

PROJECT MANUAL

FEBRUARY 9, 2026

**HVAC UPGRADES
AT
HOXSIE ELEMENTARY SCHOOL
FOR
WARWICK PUBLIC SCHOOLS
WARWICK, RHODE ISLAND**



**SACCOCCIO & ASSOCIATES, INC.
ARCHITECTS**



**1085 PARK AVENUE
CRANSTON, RHODE ISLAND**

PROJECT NO. 25040

WARWICK PUBLIC SCHOOLS BID # 260017

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DOCUMENT 00 11 16

INVITATION TO BID

Warwick Public Schools Bid No. 26-0017

Project: HVAC Upgrades at
Hoxsie Elementary School
55 Glenwood Drive, Warwick RI 02889

Owner: Warwick Public Schools
69 Draper Avenue
Warwick, Rhode Island

Architect: Saccoccio & Associates, Inc.
1085 Park Avenue
Cranston, Rhode Island 02910-3144
Tel:(401) 942-7970

Completion
Time:

- Expected award of Contract and delivery of a Notice to Proceed is approximately Mid-March 2026.
- Ordering of products, coordination and preparatory work is to commence within seven days after receipt of the Notice to Proceed.
- Construction at the site can commence on June 18, 2026.
- Substantial completion date is August 18, 2026.
- Final Completion of all work is to be August 25, 2026.

General or trade Contractors are invited to submit a sealed lump sum bid proposal for the above referenced project in accordance with the requirements of the Bidding Documents dated February 9, 2026 and the following instructions.

The Owner will receive electronic bids until **Wednesday, March 18, 2026 by 10:00 A.M.** through Bidnetdirect.com. Bids will be opened publicly and read aloud at the Gorton Administration Building, 69 Draper Avenue, Warwick, RI, 02889 – Room 204, at this specified date and time. Interested parties are invited to attend.

Refer to "Instructions To Bidders" of the Bid Documents for additional bidding requirements.

A mandatory Pre-Bid Site Visit will be held for pre-qualified Contractors on **Wednesday, March 4, 2026 at 3:00 P.M.** No other visits to the project site will be conducted.

The deadline for submitting questions to Bidnetdirect.com is **12:00 P.M., Wednesday, March 11, 2026.**

Bid security in the amount of ten percent (10%) of the bid must accompany each bid. Bid security shall be in the form of bid bond or a certified check payable to the City of Warwick. Beneficiary of the bond shall be the City of Warwick.

A Performance Bond of one hundred percent (100%) of the contract price and a Labor and Material Payment Bond of one hundred percent (100%) of the contract price with a satisfactory surety company will be required of the successful bidder.

Bidder's attention is referred to the State requirements pertaining to conditions of employment to be observed, including Workmen's Compensation, Equal Employment Opportunity, and Minority Business Enterprises. Attention is also called to the fact that not less than the minimum wage rates as hereinafter set forth shall be paid on this project, in accordance with those prevailing wages on file with the Rhode Island Department of Labor and Training, Prevailing Wage Unit. It is the Contractor's responsibility to use the current Prevailing Wage table that is in effect on the Bid issuance date for this project which is included in this Project Manual. These wage rates are applicable for the duration of the contract. The table may also be obtained at the Rhode Island Department of Labor and Training web site www.dlt.state.ri.us.

The Owner reserves the right to waive irregularities and to reject any or all bids, whole or in part, to waive any informalities or defects in any or all bids and to make awards deemed to be in the best interest of the Owner.

DOCUMENT 00 21 13

INSTRUCTIONS TO BIDDERS

AIA Document A701, Instructions to Bidders - 2018 Edition is included, following this page, as an integral part of the Bid Document. Provisions which are not amended or supplemented remain in full force and effect.

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AIA® Document A701™ – 2018

Instructions to Bidders

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

Warwick Public Schools
HVAC Upgrades to Hoxsie Elementary School
55 Glenwood Drive, Warwick, RI 02889

THE OWNER:
(Name, legal status, address, and other information)

Warwick Public Schools
69 Draper Avenue
Warwick, R.I. 02889
Telephone Number: (401) 734-3033

THE ARCHITECT:
(Name, legal status, address, and other information)

Saccoccio & Associates, Inc.
1085 Park Avenue
Cranston, RI 02910
Telephone Number: 401-942-7970
Fax Number: 401-942-7975

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ADDITIONS AND DELETIONS:

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

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

FEDERAL, STATE, AND LOCAL LAWS MAY IMPOSE REQUIREMENTS ON PUBLIC PROCUREMENT CONTRACTS. CONSULT LOCAL AUTHORITIES OR AN ATTORNEY TO VERIFY REQUIREMENTS APPLICABLE TO THIS PROCUREMENT BEFORE COMPLETING THIS FORM.

It is intended that AIA Document G612™–2017, Owner's Instructions to the Architect, Parts A and B will be completed prior to using this document.

ARTICLE 1 DEFINITIONS

§ 1.1 Bidding Documents include the Bidding Requirements and the Proposed Contract Documents. The Bidding Requirements consist of the advertisement or invitation to bid, Instructions to Bidders, supplementary instructions to bidders, the bid form, and any other bidding forms. The Proposed Contract Documents consist of the unexecuted form of Agreement between the Owner and Contractor and that Agreement's Exhibits, Conditions of the Contract (General, Supplementary and other Conditions), Drawings, Specifications, all Addenda, and all other documents enumerated in Article 8 of these Instructions.

§ 1.2 Definitions set forth in the General Conditions of the Contract for Construction, or in other Proposed Contract Documents apply to the Bidding Documents.

§ 1.3 Addenda are written or graphic instruments issued by the Architect, which, by additions, deletions, clarifications, or corrections, modify or interpret the Bidding Documents.

§ 1.4 A Bid is a complete and properly executed proposal to do the Work for the sums stipulated therein, submitted in accordance with the Bidding Documents.

§ 1.5 The Base Bid is the sum stated in the Bid for which the Bidder offers to perform the Work described in the Bidding Documents, to which Work may be added or deleted by sums stated in Alternate Bids.

§ 1.6 An Alternate Bid (or Alternate) is an amount stated in the Bid to be added to or deducted from, or that does not change, the Base Bid if the corresponding change in the Work, as described in the Bidding Documents, is accepted.

§ 1.7 A Unit Price is an amount stated in the Bid as a price per unit of measurement for materials, equipment, or services, or a portion of the Work, as described in the Bidding Documents.

§ 1.8 A Bidder is a person or entity who submits a Bid and who meets the requirements set forth in the Bidding Documents.

§ 1.9 A Sub-bidder is a person or entity who submits a bid to a Bidder for materials, equipment, or labor for a portion of the Work.

ARTICLE 2 BIDDER'S REPRESENTATIONS

§ 2.1 By submitting a Bid, the Bidder represents that:

- .1 the Bidder has read and understands the Bidding Documents;
- .2 the Bidder understands how the Bidding Documents relate to other portions of the Project, if any, being bid concurrently or presently under construction;
- .3 the Bid complies with the Bidding Documents;
- .4 the Bidder has visited the site, become familiar with local conditions under which the Work is to be performed, and has correlated the Bidder's observations with the requirements of the Proposed Contract Documents;
- .5 the Bid is based upon the materials, equipment, and systems required by the Bidding Documents without exception; and
- .6 the Bidder has read and understands the provisions for liquidated damages, if any, set forth in the form of Agreement between the Owner and Contractor.

ARTICLE 3 BIDDING DOCUMENTS

§ 3.1 Distribution

§ 3.1.1 Bidders shall obtain complete Bidding Documents, as indicated below, from the issuing office designated in the advertisement or invitation to bid, for the deposit sum, if any, stated therein.

(Indicate how, such as by email, website, host site/platform, paper copy, or other method Bidders shall obtain Bidding Documents.)

§ 3.1.2 Any required deposit shall be refunded to Bidders who submit a bona fide Bid and return the paper Bidding Documents in good condition within ten days after receipt of Bids. The cost to replace missing or damaged paper documents will be deducted from the deposit. A Bidder receiving a Contract award may retain the paper Bidding Documents, and the Bidder's deposit will be refunded.

§ 3.1.3 Bidding Documents will not be issued directly to Sub-bidders unless specifically offered in the advertisement or invitation to bid, or in supplementary instructions to bidders.

§ 3.1.4 Bidders shall use complete Bidding Documents in preparing Bids. Neither the Owner nor Architect assumes responsibility for errors or misinterpretations resulting from the use of incomplete Bidding Documents.

§ 3.1.5 The Bidding Documents will be available for the sole purpose of obtaining Bids on the Work. No license or grant of use is conferred by distribution of the Bidding Documents.

§ 3.2 Modification or Interpretation of Bidding Documents

§ 3.2.1 The Bidder shall carefully study the Bidding Documents, shall examine the site and local conditions, and shall notify the Architect of errors, inconsistencies, or ambiguities discovered and request clarification or interpretation pursuant to Section 3.2.2.

§ 3.2.2 Requests for clarification or interpretation of the Bidding Documents shall be submitted by the Bidder in writing and shall be received by the Architect at least seven days prior to the date for receipt of Bids.
(Indicate how, such as by email, website, host site/platform, paper copy, or other method Bidders shall submit requests for clarification and interpretation.)

§ 3.2.3 Modifications and interpretations of the Bidding Documents shall be made by Addendum. Modifications and interpretations of the Bidding Documents made in any other manner shall not be binding, and Bidders shall not rely upon them.

§ 3.3 Substitutions

§ 3.3.1 The materials, products, and equipment described in the Bidding Documents establish a standard of required function, dimension, appearance, and quality to be met by any proposed substitution.

§ 3.3.2 Substitution Process

§ 3.3.2.1 Written requests for substitutions shall be received by the Architect at least ten days prior to the date for receipt of Bids. Requests shall be submitted in the same manner as that established for submitting clarifications and interpretations in Section 3.2.2.

§ 3.3.2.2 Bidders shall submit substitution requests on a Substitution Request Form if one is provided in the Bidding Documents.

§ 3.3.2.3 If a Substitution Request Form is not provided, requests shall include (1) the name of the material or equipment specified in the Bidding Documents; (2) the reason for the requested substitution; (3) a complete description of the proposed substitution including the name of the material or equipment proposed as the substitute, performance and test data, and relevant drawings; and (4) any other information necessary for an evaluation. The request shall include a statement setting forth changes in other materials, equipment, or other portions of the Work, including changes in the work of other contracts or the impact on any Project Certifications (such as LEED), that will result from incorporation of the proposed substitution.

§ 3.3.3 The burden of proof of the merit of the proposed substitution is upon the proposer. The Architect's decision of approval or disapproval of a proposed substitution shall be final.

§ 3.3.4 If the Architect approves a proposed substitution prior to receipt of Bids, such approval shall be set forth in an Addendum. Approvals made in any other manner shall not be binding, and Bidders shall not rely upon them.

§ 3.3.5 No substitutions will be considered after the Contract award unless specifically provided for in the Contract Documents.

§ 3.4 Addenda

§ 3.4.1 Addenda will be transmitted to Bidders known by the issuing office to have received complete Bidding Documents.

(Indicate how, such as by email, website, host site/platform, paper copy, or other method Addenda will be transmitted.)

§ 3.4.2 Addenda will be available where Bidding Documents are on file.

§ 3.4.3 Addenda will be issued no later than four days prior to the date for receipt of Bids, except an Addendum withdrawing the request for Bids or one which includes postponement of the date for receipt of Bids.

§ 3.4.4 Prior to submitting a Bid, each Bidder shall ascertain that the Bidder has received all Addenda issued, and the Bidder shall acknowledge their receipt in the Bid.

ARTICLE 4 BIDDING PROCEDURES

§ 4.1 Preparation of Bids

§ 4.1.1 Bids shall be submitted on the forms included with or identified in the Bidding Documents.

§ 4.1.2 All blanks on the bid form shall be legibly executed. Paper bid forms shall be executed in a non-erasable medium.

§ 4.1.3 Sums shall be expressed in both words and numbers, unless noted otherwise on the bid form. In case of discrepancy, the amount entered in words shall govern.

§ 4.1.4 Edits to entries made on paper bid forms must be initialed by the signer of the Bid.

§ 4.1.5 All requested Alternates shall be bid. If no change in the Base Bid is required, enter "No Change" or as required by the bid form.

§ 4.1.6 Where two or more Bids for designated portions of the Work have been requested, the Bidder may, without forfeiture of the bid security, state the Bidder's refusal to accept award of less than the combination of Bids stipulated by the Bidder. The Bidder shall neither make additional stipulations on the bid form nor qualify the Bid in any other manner.

§ 4.1.7 Each copy of the Bid shall state the legal name and legal status of the Bidder. As part of the documentation submitted with the Bid, the Bidder shall provide evidence of its legal authority to perform the Work in the jurisdiction where the Project is located. Each copy of the Bid shall be signed by the person or persons legally authorized to bind the Bidder to a contract. A Bid by a corporation shall further name the state of incorporation and have the corporate seal affixed. A Bid submitted by an agent shall have a current power of attorney attached, certifying the agent's authority to bind the Bidder.

§ 4.1.8 A Bidder shall incur all costs associated with the preparation of its Bid.

§ 4.2 Bid Security

§ 4.2.1 Each Bid shall be accompanied by the following bid security:

(Insert the form and amount of bid security.)

§ 4.2.2 The Bidder pledges to enter into a Contract with the Owner on the terms stated in the Bid and shall, if required, furnish bonds covering the faithful performance of the Contract and payment of all obligations arising thereunder. Should the Bidder refuse to enter into such Contract or fail to furnish such bonds if required, the amount

of the bid security shall be forfeited to the Owner as liquidated damages, not as a penalty. In the event the Owner fails to comply with Section 6.2, the amount of the bid security shall not be forfeited to the Owner.

§ 4.2.3 If a surety bond is required as bid security, it shall be written on AIA Document A310™, Bid Bond, unless otherwise provided in the Bidding Documents. The attorney-in-fact who executes the bond on behalf of the surety shall affix to the bond a certified and current copy of an acceptable power of attorney. The Bidder shall provide surety bonds from a company or companies lawfully authorized to issue surety bonds in the jurisdiction where the Project is located.

§ 4.2.4 The Owner will have the right to retain the bid security of Bidders to whom an award is being considered until (a) the Contract has been executed and bonds, if required, have been furnished; (b) the specified time has elapsed so that Bids may be withdrawn; or (c) all Bids have been rejected. However, if no Contract has been awarded or a Bidder has not been notified of the acceptance of its Bid, a Bidder may, beginning days after the opening of Bids, withdraw its Bid and request the return of its bid security.

§ 4.3 Submission of Bids

§ 4.3.1 A Bidder shall submit its Bid as indicated below:

(Indicate how, such as by website, host site/platform, paper copy, or other method Bidders shall submit their Bid.)

§ 4.3.2 Paper copies of the Bid, the bid security, and any other documents required to be submitted with the Bid shall be enclosed in a sealed opaque envelope. The envelope shall be addressed to the party receiving the Bids and shall be identified with the Project name, the Bidder's name and address, and, if applicable, the designated portion of the Work for which the Bid is submitted. If the Bid is sent by mail, the sealed envelope shall be enclosed in a separate mailing envelope with the notation "SEALED BID ENCLOSED" on the face thereof.

§ 4.3.3 Bids shall be submitted by the date and time and at the place indicated in the invitation to bid. Bids submitted after the date and time for receipt of Bids, or at an incorrect place, will not be accepted.

§ 4.3.4 The Bidder shall assume full responsibility for timely delivery at the location designated for receipt of Bids.

§ 4.3.5 A Bid submitted by any method other than as provided in this Section 4.3 will not be accepted.

§ 4.4 Modification or Withdrawal of Bid

§ 4.4.1 Prior to the date and time designated for receipt of Bids, a Bidder may submit a new Bid to replace a Bid previously submitted, or withdraw its Bid entirely, by notice to the party designated to receive the Bids. Such notice shall be received and duly recorded by the receiving party on or before the date and time set for receipt of Bids. The receiving party shall verify that replaced or withdrawn Bids are removed from the other submitted Bids and not considered. Notice of submission of a replacement Bid or withdrawal of a Bid shall be worded so as not to reveal the amount of the original Bid.

§ 4.4.2 Withdrawn Bids may be resubmitted up to the date and time designated for the receipt of Bids in the same format as that established in Section 4.3, provided they fully conform with these Instructions to Bidders. Bid security shall be in an amount sufficient for the Bid as resubmitted.

§ 4.4.3 After the date and time designated for receipt of Bids, a Bidder who discovers that it made a clerical error in its Bid shall notify the Architect of such error within two days, or pursuant to a timeframe specified by the law of the jurisdiction where the Project is located, requesting withdrawal of its Bid. Upon providing evidence of such error to the reasonable satisfaction of the Architect, the Bid shall be withdrawn and not resubmitted. If a Bid is withdrawn pursuant to this Section 4.4.3, the bid security will be attended to as follows:

(State the terms and conditions, such as Bid rank, for returning or retaining the bid security.)

ARTICLE 5 CONSIDERATION OF BIDS

§ 5.1 Opening of Bids

If stipulated in an advertisement or invitation to bid, or when otherwise required by law, Bids properly identified and received within the specified time limits will be publicly opened and read aloud. A summary of the Bids may be made available to Bidders.

§ 5.2 Rejection of Bids

Unless otherwise prohibited by law, the Owner shall have the right to reject any or all Bids.

§ 5.3 Acceptance of Bid (Award)

§ 5.3.1 It is the intent of the Owner to award a Contract to the lowest responsive and responsible Bidder, provided the Bid has been submitted in accordance with the requirements of the Bidding Documents. Unless otherwise prohibited by law, the Owner shall have the right to waive informalities and irregularities in a Bid received and to accept the Bid which, in the Owner's judgment, is in the Owner's best interests.

§ 5.3.2 Unless otherwise prohibited by law, the Owner shall have the right to accept Alternates in any order or combination, unless otherwise specifically provided in the Bidding Documents, and to determine the lowest responsive and responsible Bidder on the basis of the sum of the Base Bid and Alternates accepted.

ARTICLE 6 POST-BID INFORMATION

§ 6.1 Contractor's Qualification Statement

Bidders to whom award of a Contract is under consideration shall submit to the Architect, upon request and within the timeframe specified by the Architect, a properly executed AIA Document A305™, Contractor's Qualification Statement, unless such a Statement has been previously required and submitted for this Bid.

§ 6.2 Owner's Financial Capability

A Bidder to whom award of a Contract is under consideration may request in writing, fourteen days prior to the expiration of the time for withdrawal of Bids, that the Owner furnish to the Bidder reasonable evidence that financial arrangements have been made to fulfill the Owner's obligations under the Contract. The Owner shall then furnish such reasonable evidence to the Bidder no later than seven days prior to the expiration of the time for withdrawal of Bids. Unless such reasonable evidence is furnished within the allotted time, the Bidder will not be required to execute the Agreement between the Owner and Contractor.

§ 6.3 Submittals

§ 6.3.1 After notification of selection for the award of the Contract, the Bidder shall, as soon as practicable or as stipulated in the Bidding Documents, submit in writing to the Owner through the Architect:

- .1 a designation of the Work to be performed with the Bidder's own forces;
- .2 names of the principal products and systems proposed for the Work and the manufacturers and suppliers of each; and
- .3 names of persons or entities (including those who are to furnish materials or equipment fabricated to a special design) proposed for the principal portions of the Work.

§ 6.3.2 The Bidder will be required to establish to the satisfaction of the Architect and Owner the reliability and responsibility of the persons or entities proposed to furnish and perform the Work described in the Bidding Documents.

§ 6.3.3 Prior to the execution of the Contract, the Architect will notify the Bidder if either the Owner or Architect, after due investigation, has reasonable objection to a person or entity proposed by the Bidder. If the Owner or Architect has reasonable objection to a proposed person or entity, the Bidder may, at the Bidder's option, withdraw the Bid or submit an acceptable substitute person or entity. The Bidder may also submit any required adjustment in the Base Bid or Alternate Bid to account for the difference in cost occasioned by such substitution. The Owner may accept the adjusted bid price or disqualify the Bidder. In the event of either withdrawal or disqualification, bid security will not be forfeited.

§ 6.3.4 Persons and entities proposed by the Bidder and to whom the Owner and Architect have made no reasonable objection must be used on the Work for which they were proposed and shall not be changed except with the written consent of the Owner and Architect.

ARTICLE 7 PERFORMANCE BOND AND PAYMENT BOND

§ 7.1 Bond Requirements

§ 7.1.1 If stipulated in the Bidding Documents, the Bidder shall furnish bonds covering the faithful performance of the Contract and payment of all obligations arising thereunder.

§ 7.1.2 If the furnishing of such bonds is stipulated in the Bidding Documents, the cost shall be included in the Bid. If the furnishing of such bonds is required after receipt of bids and before execution of the Contract, the cost of such bonds shall be added to the Bid in determining the Contract Sum.

§ 7.1.3 The Bidder shall provide surety bonds from a company or companies lawfully authorized to issue surety bonds in the jurisdiction where the Project is located.

§ 7.1.4 Unless otherwise indicated below, the Penal Sum of the Payment and Performance Bonds shall be the amount of the Contract Sum.

(If Payment or Performance Bonds are to be in an amount other than 100% of the Contract Sum, indicate the dollar amount or percentage of the Contract Sum.)

§ 7.2 Time of Delivery and Form of Bonds

§ 7.2.1 The Bidder shall deliver the required bonds to the Owner not later than three days following the date of execution of the Contract. If the Work is to commence sooner in response to a letter of intent, the Bidder shall, prior to commencement of the Work, submit evidence satisfactory to the Owner that such bonds will be furnished and delivered in accordance with this Section 7.2.1.

§ 7.2.2 Unless otherwise provided, the bonds shall be written on AIA Document A312, Performance Bond and Payment Bond.

§ 7.2.3 The bonds shall be dated on or after the date of the Contract.

§ 7.2.4 The Bidder shall require the attorney-in-fact who executes the required bonds on behalf of the surety to affix to the bond a certified and current copy of the power of attorney.

ARTICLE 8 ENUMERATION OF THE PROPOSED CONTRACT DOCUMENTS

§ 8.1 Copies of the proposed Contract Documents have been made available to the Bidder and consist of the following documents:

- .1 AIA Document A101™-2017, Standard Form of Agreement Between Owner and Contractor, unless otherwise stated below.

(Insert the complete AIA Document number, including year, and Document title.)

- .2 AIA Document A101™-2017, Exhibit A, Insurance and Bonds, unless otherwise stated below.

(Insert the complete AIA Document number, including year, and Document title.)

- .3 AIA Document A201™-2017, General Conditions of the Contract for Construction, unless otherwise stated below.

(Insert the complete AIA Document number, including year, and Document title.)

- .4 AIA Document E203™-2013, Building Information Modeling and Digital Data Exhibit, dated as indicated below:

(Insert the date of the E203-2013.)

.5 Drawings

Number	Title	Date

.6 Specifications

Section	Title	Date	Pages

.7 Addenda:

Number	Date	Pages

.8 Other Exhibits:

(Check all boxes that apply and include appropriate information identifying the exhibit where required.)

☐ AIA Document E204™–2017, Sustainable Projects Exhibit, dated as indicated below:
(Insert the date of the E204-2017.)

☐ The Sustainability Plan:

Title	Date	Pages

☐ Supplementary and other Conditions of the Contract:

Document	Title	Date	Pages

.9 Other documents listed below:

(List here any additional documents that are intended to form part of the Proposed Contract Documents.)

SECTION 00 31 19

INFORMATION AVAILABLE TO BIDDERS

A. Hazardous Material:

Various suspected asbestos containing materials have been tested throughout the building and asbestos containing material has been detected.

1. The Hazardous Materials Inspection Report is included following this page.

B. Contractor Notification of Asbestos-Containing Materials/Presumed Asbestos-Containing Materials – 2026.

Documents are included following this page reporting in accordance with OSHA and State Laws a list of all Asbestos-Containing Materials/Presumed Asbestos-Containing Materials located in the vicinity of construction.

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HAZARDOUS MATERIAL TESTING REPORT

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LABORATORY REPORT

Warwick Public Schools
Attn: David Small, Director
150 Draper Avenue
Warwick, RI 02889

Date Received: 2/14/2022
Date Reported: 2/15/2022
Work Order #: 2202-02300

Site Location: Hoxie Elementary School

Enclosed please find your sample(s) analysis results for asbestos content. The six asbestos types include amosite, chrysotile, crocidolite, anthophyllite, tremolite, and actinolite.

Analysis by Polarized Light Microscopy (PLM) was performed in accordance with EPA 40 CFR Appendix E to Subpart E of Part 763 and/or EPA 600/R-93/116.

R.I. Analytical Laboratories, Inc. maintains bulk asbestos fiber NVLAP accreditation under Lab Code 101440-0. This report does not serve as a product certification, approval, and/or endorsement by NVLAP, NIST, or any federal agency.

The sample(s) submitted for analysis were accepted by R.I. Analytical unless otherwise noted in the report. If a sample is found to be inhomogeneous, individual components will be analyzed separately. If individual components cannot be separated, the sample will be homogenized and a single result will be provided. These results only pertain to the samples submitted for this Work Order # and this report shall not be reproduced except in its entirety.

Samples submitted for analysis will be retained for three months for future reference.

We certify that the following results are true and accurate to the best of our knowledge. If you have questions or need further assistance, please contact our Customer Service Department.

Approved by:



Asbestos Signatory

R.I. Analytical Laboratories, Inc.
LABORATORY REPORT

Warwick Public Schools
 Date Received: 2/14/2022
 Work Order #: 2202-02300
 Site Location: Hoxie Elementary School

METHOD: EPA 600/R-93/116

SAMPLE NO.	SAMPLE DESCRIPTION	PARAMETER	SAMPLE RESULTS / UNITS	DATE ANALYZED	ANALYST
001	X5-02A Mens Lav	PLM Fiber Analysis			
		Asbestos	Not Detected	2/14/2022	EDN
		Non-fibrous	100 %	2/14/2022	EDN
		Sample Color	Tan	2/14/2022	EDN
002	X5-03A Mens Lav	PLM Fiber Analysis			
		Asbestos	Not Detected	2/14/2022	EDN
		Non-fibrous	100 %	2/14/2022	EDN
		Sample Color	Gray	2/14/2022	EDN
003	X5-04A Women's Lav	PLM Fiber Analysis			
		Asbestos	Not Detected	2/14/2022	EDN
		Non-fibrous	100 %	2/14/2022	EDN
		Sample Color	White	2/14/2022	EDN
004	X5-05A Girl's Lav	PLM Fiber Analysis			
		Asbestos	Not Detected	2/14/2022	EDN
		Cellulose	100 %	2/14/2022	EDN
		Sample Color	Tan	2/14/2022	EDN
005	X5-06A Room 2	PLM Fiber Analysis			
		Asbestos	Not Detected	2/14/2022	EDN
		Non-fibrous	100 %	2/14/2022	EDN
		Sample Color	Multicolor	2/14/2022	EDN
006	X5-06B Room 15	PLM Fiber Analysis			
		Asbestos	Not Detected	2/14/2022	EDN
		Non-fibrous	100 %	2/14/2022	EDN
		Sample Color	Multicolor	2/14/2022	EDN

NOTE: SAMPLES MUST BE KEPT IN A SEALED CONTAINER AT ALL TIMES

Analysis Required

41 Illinois Avenue Warwick, Rhode Island 02888 131 Coolidge Street Bldg 2 Hudson, MA 01749
(401) 737-8500 Fax (401) 738-1970 (978) 568-0041 Fax (978) 568-0078

Date Collected	Time Collected	Sample ID	Sample Type
2/13/2022		X5-02A Men's Lav	grab
		X5-03A Men's Lav	grab
		X5-04A Women's Lav	grab
		X5-05A Girl's Lav	grab
		X5-06A Room 2	grab
		X5-06B Room 15	grab

Company Name:	1000	P.O. #

Address:

City / State / Zip.

Phone / Fax,

Contact:

Celligaulshet bu:

Relinquished by:

Requested by:

Date / Time 5 / 11 Received by:

Date / Time

Received by:

Received by:

Received by:

Total! Numbers of Cont.

Collected by: _____

Turn Around Time:

Normal

~~Dr. R. S. S.~~

 -- Pick-Up Only

[-] - Samples

 - Shipped on Ice

Comments: * SAMPLES ARE RETAINED WITHIN THE LAB

FOR A PERIOD OF THREE MONTHS, AFTER WHICH THEY ARE DISPOSED OF AT AN EPA APPROVED ASBESTOS LANDFILL. IF THE CLIENT WISHES TO RETAIN SAMPLES AFTER ANALYSIS, REQUESTS MUST BE MADE PRIOR TO THE THREE MONTH PERIOD.

45

LABORATORY REPORT

Warwick Public Schools
Attn: David Small, Director
150 Draper Avenue
Warwick, RI 02889

Date Received: 2/14/2022
Date Reported: 2/14/2022
Work Order #: 2202-02285

Site Location: Hoxie Elementary School

Enclosed please find your sample(s) analysis results for asbestos content. The six asbestos types include amosite, chrysotile, crocidolite, anthophyllite, tremolite, and actinolite.

Analysis by Polarized Light Microscopy (PLM) was performed in accordance with EPA 40 CFR Appendix E to Subpart E of Part 763 and/or EPA 600/R-93/116.

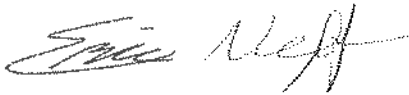
R.I. Analytical Laboratories, Inc. maintains bulk asbestos fiber NVLAP accreditation under Lab Code 101440-0. This report does not serve as a product certification, approval, and/or endorsement by NVLAP, NIST, or any federal agency.

The sample(s) submitted for analysis were accepted by R.I. Analytical unless otherwise noted in the report. If a sample is found to be inhomogeneous, individual components will be analyzed separately. If individual components cannot be separated, the sample will be homogenized and a single result will be provided. These results only pertain to the samples submitted for this Work Order # and this report shall not be reproduced except in its entirety.

Samples submitted for analysis will be retained for three months for future reference.

We certify that the following results are true and accurate to the best of our knowledge. If you have questions or need further assistance, please contact our Customer Service Department.

Approved by:



Asbestos Signatory

R.I. Analytical Laboratories, Inc.
LABORATORY REPORT

Warwick Public Schools
 Date Received: 2/14/2022
 Work Order #: 2202-02285
 Site Location: Hoxie Elementary School

METHOD: EPA 600/R-93/116

SAMPLE NO.	SAMPLE DESCRIPTION	PARAMETER	SAMPLE RESULTS / UNITS	DATE ANALYZED	ANALYST
001	07A Room 17 Lav 12x12 Beige floor tile	PLM Fiber Analysis			
		Asbestos	Not Detected	2/14/2022	EDN
		Non-fibrous	100 %	2/14/2022	EDN
		Sample Color	Beige	2/14/2022	EDN
002	08A Room 17 Lav Floor tile mastic	PLM Fiber Analysis			
		Asbestos	Not Detected	2/14/2022	EDN
		Non-fibrous	100 %	2/14/2022	EDN
		Sample Color	Black	2/14/2022	EDN
003	09A Room 17 Lav Composite cavebase and mastic	PLM Fiber Analysis			
		Asbestos	Not Detected	2/14/2022	EDN
		Non-fibrous	100 %	2/14/2022	EDN
		Sample Color	Tan	2/14/2022	EDN

NOTE: SAMPLES MUST BE KEPT IN A SEALED CONTAINER AT ALL TIMES

R. I. ANALYTICAL LABORATORIES, INC.

41 Winols Avenue Warwick, Rhode Island 02888 131 Coolidge Street Bldg 2 Hudson, MA 01749
(401) 737-8500 Fax (401) 738-1970 (978) 568-0078 Fax (978) 568-0078

Analysis Required

[illegible]

Total Numbers of Cont.

P.O. #

Collected by: R. Richiardi

RIAL: 2202-2279

Turn Around Time:

☐ Normal ☒ Rush

☐ - Pick-Up Only
☐ - Sampled

Phone / Fax:

4401-734-3407

Contract:

R. Schubert

Requested by:

Date / Time

Received by:

Relinquished by:

Date / Time: _____

for

Returnstashed by:

Date / Time

Received by:

Comments: * SAMPLES ARE RETAINED WITHIN THE LAB

FOR A PERIOD OF THREE MONTHS, AFTER WHICH THEY ARE DISPOSED OF AT AN EPA APPROVED ASBESTOS LANDFILL. IF THE CLIENT WISHES TO RETAIN SAMPLES AFTER ANALYSIS, REQUESTS MUST BE MADE PRIOR TO THE THREE MONTH PERIOD.

1501

Date Received: Mar. 15, 1995
Date Analyzed: Mar. 15, 1995

Project # WB95-2-007

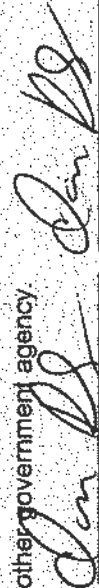
Vortex Inc.
20 Altieri Way
Unit #4
Warwick, RI 02886

The following shows results for submitted bulk samples:

Samples Submitted by: Charmia Clay

Att: Charmia Clay

Enclosed please find the results of bulk material samples, analyzed for asbestos content using EPA Method 600/R-93/116. Method for the determination of asbestos in bulk materials". Quantitation of results is completed by visual estimating techniques unless otherwise noted. Results pertain only to those bulk material samples received at V Lab. Materials that contain greater than 1% asbestos are considered asbestos containing. The EPA recognizes the following as asbestos: Chrysotile, Crocidolite, Amosite, Tremolite, Anthophyllite and Actinolite. Unless the customer requests otherwise inhomogeneous samples are homogenized using representative material from each component and analyzed as a single sample. This report must not be used by the client to claim product endorsement by NVLAP or any other government agency if you have any questions please do not hesitate to call.


Analyst
Donald Pellegrino
Lab Director
Donald Pellegrino

Project Location: Hoxsie Elementary School
55 Glenwood Drive
Vortex Project 95014

KEY FOR ABBREVIATIONS:

Chrysotile (CHR), Amosite (AMO), Tremolite (TRE), Anthophyllite (ANT), Actinolite (ACT)
Fiber Glass (FBG), Synthetic Fibers (SYN), Cellulose (CEL), Hair (HAR), Other (OTH)
Non-fibrous material (NON)

CLIENT SAMPLE IDENTIFICATION	V Lab sample#	Homogeneous Application	COLOR	POS/NEG	% Asbestos					% Non-Asbestos				
					CHR	AMO	CRO	TRE	ANT	ACT	CEL	FBG	SYN	OTH
CONCRETE BLOCK AND MORTAR ALL PURPOSE ROOM	WB326	1	GY	NEG	TR						1			99
CONCRETE BLOCK AND MORTAR MAIN OFFICE AREA	WB327	1	GY	NEG							1			99
CONCRETE BLOCK AND MORTAR ROOM	WB328	1	GY	NEG							1			99

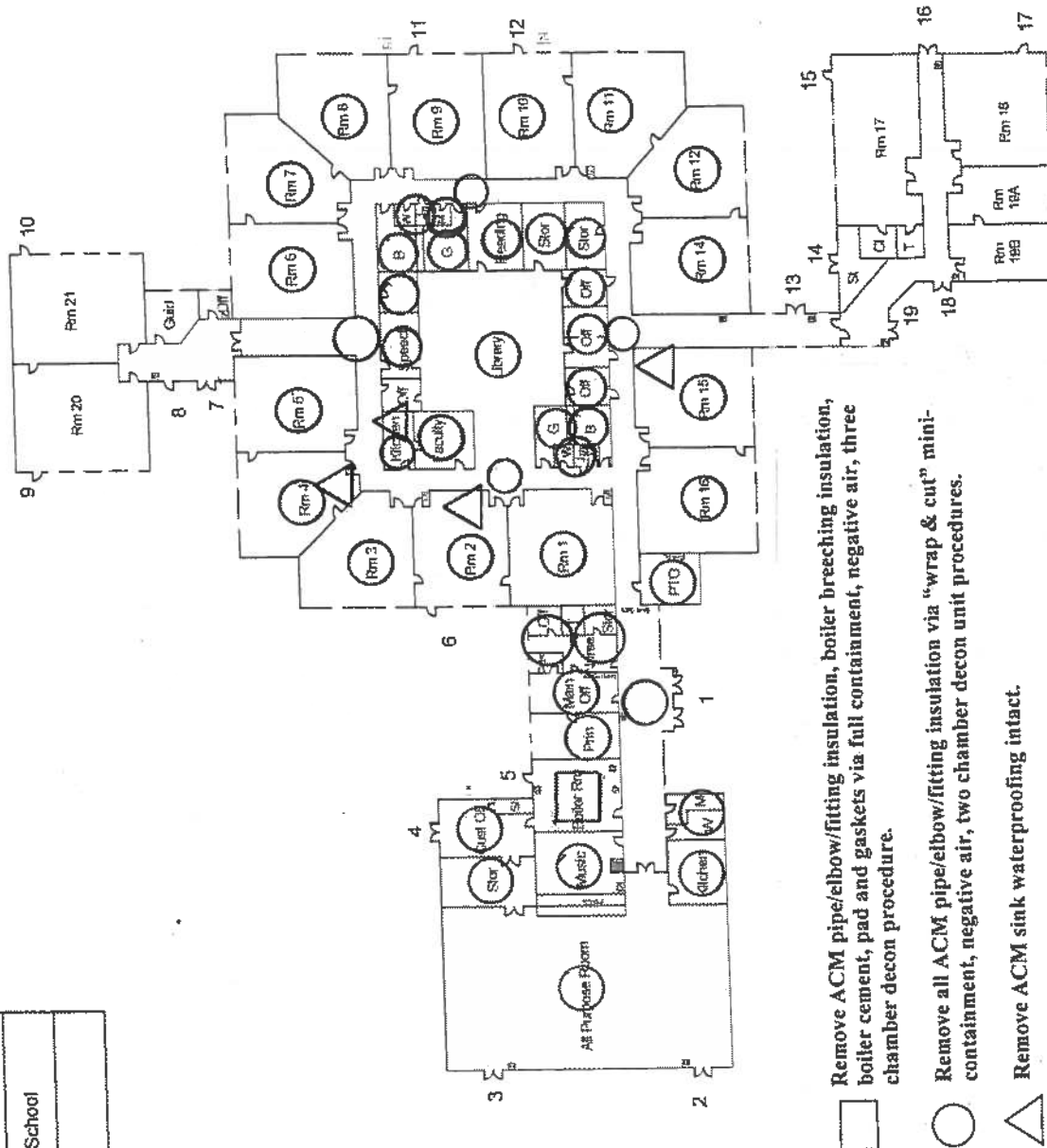
CLIENT SAMPLE IDENTIFICATION	V Lab sample#	Homogeneous Application	COLOR	POS/NEG	% Asbestos					% Non-Asbestos				
					CHR	AMO	CRO	TRE	ANT	ACT	CEL	FBG	SYN	HAR OTH
MASTIC FROM PREVIOUS	M	17		NEG	TR						10			90
TAN COVE BASE AND ADHESIVE SMALL TEACHER'S ROOM	WB357	18	TAN	NEG MASTIC POS 2% CHR							1			99
RED BRICK AND MORTAR MAIN FOYER ENTRY	WB358	19	RED	NEG							1			99
RED BRICK AND MORTAR HALLWAY 3	WB359	19	RED	NEG							1			99
RED BRICK AND MORTAR HALL WAY 5	WB360	19	RED	NEG							1			99
OLIVE GREEN 9X9 FLOOR TILE SCIENCE ROOM	WB361	20	GR	POS	3									97
MASTIC FROM PREVIOUS	M	20		POS	3						12			85
SHEETROCK WALL ROOM 9	WB363	21	W	NEG							10			90
SHEETROCK ROOM 1	WB364	21	W	NEG							10			90
SHEETROCK ROOM 7	WB362	21	W	NEG							10			90
STONE COUNTERTOP IN SCIENCE ROOM	WB365	22	BK	POS	22	3								75
LT TAN 9X9 FLOOR TILE AND MASTIC MAIN ENTRY HALL	WB366	23	TAN	POS MASTIC POS 2% CHR	3									97
PIPE FITTING INSULATION BOILER ROOM	WB367	24	GY	NEG	TR							50		50
PIPE FITTING INSULATION NEAR VALVE BOILER ROOM	WB368	24	GY	POS	5							45		50
PIPE FITTING INSULATION HALLWAY	WB369	24	DNA											
PIPE FITTING INSULATION ROOM	WB370	24	DNA											
BREECHING INSULATION BOILER ROOM	WB371	25	GY	POS	3	TR					2	50		45
BREECHING INSULATION BOILER ROOM	WB372	25	DNA											

[illegible]

Lab

School Name:	Warwick Public Schools
Building Name:	Hoxsie Elementary School
Address:	55 Glenwood Drive Warwick, RI 02889

Floor 1



- ☐ Remove ACM pipe/elbow/fitting insulation, boiler breaching insulation, boiler cement, pad and gaskets via full containment, negative air, three chamber decon procedure.
- ☐ Remove all ACM pipe/elbow/fitting insulation via "wrap & cut" mini-containment, negative air, two chamber decon unit procedures.
- Remove ACM sink waterproofing intact.

Warwick Public Schools
Hoxsie Elementary School 2026 Project
Health and Safety, COVID-19, Asbestos, Confined Space, Lead Paint, Dust Control

Health and Safety, COVID-19, Asbestos, Confined Space, Lead Paint, Dust Control: The General Contractor must strictly adhere to and meet these contract specifications along with OSHA, NIOSH, RI Dept. of Health Rules and Regulations for Asbestos Control 216-RICR-50-15-1, EPA AHERA 40 CFR Part 763 Asbestos-Containing Materials in Schools; Final Rule and Notice, EPA Toxic Substances Control Act, EPA Renovation, Repair and Painting (RRP) regulations, RI Dept. of Health Rules and Regulations for Lead Poisoning Prevention R23-24.6-PB, OSHA 29 CFR 1910.1053, as well as any other federal, state, and local regulations. Where there exists overlap of these regulations, the most stringent one applies.

All contractors performing work on Warwick Public Schools property shall adhere to COVID-19 current safety protocols established by Warwick Public Schools, Rhode Island Dept. of Health, and Federal agencies when working inside Warwick Public School buildings.

All contractors performing work in confined spaces shall strictly adhere to and meet these contract specifications along with OSHA Confined Space Regulations, as well as any other federal, state, and local regulations. Where there exists overlap of these regulations, the most stringent one applies.

Presumed ACM electrical wire covering impacted by construction which does not exceed Spot Repair quantities defined by the Rhode Island Dept. of Health shall be handled by individuals with a current RI Department of Health Asbestos Competent Person license.

Warwick Public Schools
Dept. of Buildings & Grounds, 150 Draper Avenue, Warwick, RI 02889
Asbestos-Containing Materials/Presumed Asbestos-Containing Materials
Contractor Notification 2026

Hoxsie Elementary School
55 Glenwood Drive, Warwick, RI 02889

asbestos boiler breeching insulation;
asbestos pipe fitting/elbow insulation – above suspended ceilings, boiler room,
custodian room, utility rooms;
asbestos floor tile/cove base/cove base mastic – rooms 1-15;
Trace asbestos roof flashing

presumed asbestos countertops;
presumed asbestos room partitions;
presumed asbestos blackboard/bulletin board mastic;
presumed asbestos transite panels on exterior soffits.

Construction Project Contractor Notification of Trace (<1% Asbestos) Materials in Proposed Work Areas

Per EPA/RIDOH regulations these materials are classified as non-asbestos materials.
Per OSHA regulations contractor impacting these materials shall be notified. Per OSHA regulations, workers shall utilize appropriate engineering controls and worker protection.

1. Hoxsie Elementary School: Roof — Trace Asbestos Roof Flashing.

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DOCUMENT 00 41 13

BID FORM

Warwick Public Schools Bid No. 26-0017

Date: _____

Project: HVAC Upgrades at
Hoxsie Elementary School
55 Glenwood Drive, Warwick RI 02889

Bid to: Warwick Public Schools
69 Draper Avenue
Warwick, Rhode Island 02889

Architect: Saccoccio & Associates, Inc.
1085 Park Avenue
Cranston, Rhode Island 02910-3144
Tel:(401) 942-7970

Submitted by:

Company Name: _____

Address: _____

Telephone: _____

Fax: _____

Contact: _____

License Number: _____
(If Applicable)

1. BID

Having examined the Place of The Work and all matters referred to in the Instructions to Bidders, and in the Bidding Documents prepared by Saccoccio & Associates, Inc., Architect for the above mentioned project, we, the undersigned, hereby offer to enter into a Contract to perform the Work for the Sum noted below:

1. Base Bid Amount

_____ (\$ _____.)
(written, and numerically)

We have included the Bid Security Deposit.

2. ALLOWANCES

We have included the specified Allowances, from Section 01 21 00 in Division 1 of the Specifications, in the above Bid Sum as follows:

Signage Six hundred dollars (\$ 600.00)

3. ALTERNATES

We propose to modify the above Bid Sum by the following amount(s) as identified by (a) numbered Alternate(s) specified in Division 1 of the Specifications, and as may be selected by the Owner:

Alternate No. 1: HVAC Alternate Design

Deduct: _____ (\$ _____)
(written, and numerically)

Alternate No. 2: Electric Transformer Pad (Containment Deleted)

Deduct: _____ (\$ _____)
(written, and numerically)

Alternate No. 3: Interior of Boiler Asbestos Abatement:

Add: _____ (\$ _____)
(written, and numerically)

4. UNIT PRICES

We propose the following Unit Prices for specific portions of the Work as listed. These Unit Prices shall be for additions to or subtractions from the Base Bid work and shall be performed under the Contract during the entire life of the Contract.

<u>Item Description</u>	<u>Unit Quantity</u>	<u>Unit Value</u>
a. Remove existing ACM elbow or tee pipe fitting insulation and encapsulate surfaces.	One	\$ _____
b. Remove existing 6" CMU portion of wall as required to access piping chase, provide & install new 6" CMU and paint to match the surrounding area.	9 Square Feet	\$ _____

5. ACCEPTANCE

This offer shall be open to acceptance and is irrevocable for sixty (60) calendar days from the bid closing date. If the Owner accepts this bid within the time stated above, we will:

- Execute the Agreement subject to compliance with the Invitation to Bid.
- Furnish the required bonds in compliance with amended provisions of the Instructions to Bidders.
- Commence work within seven (7) days after the signing of the Contract.

6. BID SECURITY DEPOSIT

If this bid is accepted within the time stated, and we fail to commence the Work, or we fail to provide the required Bonds, the Bid Security Deposit shall be forfeited as damages to the Owner by reason of our failure, limited in amount to the lesser of the face value of the security deposit or the difference between this bid and the bid upon which a Contract is signed.

In the event our bid is not accepted within the time stated above, the required Bid Security Deposit shall be returned to the undersigned, in accordance with the provisions of the Instructions to Bidders; unless a mutually satisfactory arrangement is made for its retention and validity for an extended period of time.

7. CONTRACT TIME

If this Bid is accepted, we will follow the schedule noted below:

- Expected award of Contract and delivery of a Notice to Proceed is approximately Mid-March 2026.
- Ordering of products, coordination and preparatory work is to commence within seven days after receipt of the Notice to Proceed.
- Construction at the site can commence on June 26, 2026.
- Substantial completion date is August 18, 2026.
- Final Completion of all work is to be August 25, 2026.

8. ADDENDA

The following Addenda (if any) have been received. The modifications to the Bid Documents noted in the Addenda have been considered and all costs are included in the Bid Sum.

Addendum No. 1, dated _____

Addendum No. 2, dated _____

Addendum No. 3, dated _____

9. BID FORM SIGNATURE(S)

(Bidder's name)

Title: _____

Corporate Seal:

10. CERTIFICATION OF SITE REVIEW SIGNATURE

By signing below, the Owner of the Bidding firm certifies that he/she has visited all the sites included in this project and has observed the existing roof conditions. No compensation for extra work on behalf of the Contractor will be considered for inconsistencies or obstructions that would have been determined by visual observation prior to bidding.

(Owner's signature)

END OF DOCUMENT

DOCUMENT 00 43 13

BID BOND

AIA Document A310 - Bid Bond, 2010 Edition - Electronic Format, is included, following this page, as an integral part of the Bid documents, for use in fulfilling Bid Security requirements in lieu of submitting a certified check.

END OF DOCUMENT

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AIA® Document A310™ – 2010

Bid Bond

CONTRACTOR:

(Name, legal status and address)

SURETY:

(Name, legal status and principal place of business)

OWNER:

(Name, legal status and address)

Warwick Public Schools
69 Draper Avenue
Warwick, R.I. 02889

BOND AMOUNT: \$**PROJECT:**

(Name, location or address, and Project number, if any)

Warwick Public Schools
HVAC Upgrades to Hoxsie Elementary School
55 Glenwood Drive, Warwick, RI 02889

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.

Any singular reference to Contractor, Surety, Owner or other party shall be considered plural where applicable.

The Contractor and Surety are bound to the Owner in the amount set forth above, for the payment of which the Contractor and Surety bind themselves, their heirs, executors, administrators, successors and assigns, jointly and severally, as provided herein. The conditions of this Bond are such that if the Owner accepts the bid of the Contractor within the time specified in the bid documents, or within such time period as may be agreed to by the Owner and Contractor, and the Contractor either (1) enters into a contract with the Owner in accordance with the terms of such bid, and gives such bond or bonds as may be specified in the bidding or Contract Documents, with a surety admitted in the jurisdiction of the Project and otherwise acceptable to the Owner, for the faithful performance of such Contract and for the prompt payment of labor and material furnished in the prosecution thereof; or (2) pays to the Owner the difference, not to exceed the amount of this Bond, between the amount specified in said bid and such larger amount for which the Owner may in good faith contract with another party to perform the work covered by said bid, then this obligation shall be null and void, otherwise to remain in full force and effect. The Surety hereby waives any notice of an agreement between the Owner and Contractor to extend the time in which the Owner may accept the bid. Waiver of notice by the Surety shall not apply to any extension exceeding sixty (60) days in the aggregate beyond the time for acceptance of bids specified in the bid documents, and the Owner and Contractor shall obtain the Surety's consent for an extension beyond sixty (60) days.

If this Bond is issued in connection with a subcontractor's bid to a Contractor, the term Contractor in this Bond shall be deemed to be Subcontractor and the term Owner shall be deemed to be Contractor.

When this Bond has been furnished to comply with a statutory or other legal requirement in the location of the Project, any provision in this Bond conflicting with said statutory or

Init.

legal requirement shall be deemed deleted herefrom and provisions conforming to such statutory or other legal requirement shall be deemed incorporated herein. When so furnished, the intent is that this Bond shall be construed as a statutory bond and not as a common law bond.

Signed and sealed this day of ,

	_____ (Contractor as Principal)	_____ (Seal)
_____ (Witness)	_____ (Title)	
	_____ (Surety)	_____ (Seal)
_____ (Witness)	_____ (Title)	

DOCUMENT 00 45 13

CONTRACTOR'S QUALIFICATION STATEMENT

AIA Document A305, Contractor's Qualification Statement - Electronic Format, 1986 Edition, is included, following this page, as an integral part of the Bid documents, for use in evaluating the qualifications of Contractors.

The numerical low bidder will be required to complete and submit this form for evaluation.

END OF DOCUMENT

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AIA® Document A305™ – 1986

Contractor's Qualification Statement

The Undersigned certifies under oath that the information provided herein is true and sufficiently complete so as not to be misleading.

SUBMITTED TO:

ADDRESS:

SUBMITTED BY:

NAME:

ADDRESS:

PRINCIPAL OFFICE:

- ☐ Corporation
- ☐ Partnership
- ☐ Individual
- ☐ Joint Venture
- ☐ Other

NAME OF PROJECT: *(if applicable)*

Warwick Public Schools
HVAC Upgrades to Hoxsie Elementary School
55 Glenwood Drive, Warwick, RI 02889

TYPE OF WORK: *(file separate form for each Classification of Work)*

- ☐ General Construction
- ☐ HVAC
- ☐ Electrical
- ☐ Plumbing
- ☐ Other: *(Specify)*

§ 1 ORGANIZATION

§ 1.1 How many years has your organization been in business as a Contractor?

§ 1.2 How many years has your organization been in business under its present business name?

§ 1.2.1 Under what other or former names has your organization operated?

§ 1.3 If your organization is a corporation, answer the following:

§ 1.3.1 Date of incorporation:

§ 1.3.2 State of incorporation:

§ 1.3.3 President's name:

§ 1.3.4 Vice-president's name(s)

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.

This form is approved and recommended by the American Institute of Architects (AIA) and The Associated General Contractors of America (AGC) for use in evaluating the qualifications of contractors. No endorsement of the submitting party or verification of the information is made by AIA or AGC.

§ 1.3.5 Secretary's name:

§ 1.3.6 Treasurer's name:

§ 1.4 If your organization is a partnership, answer the following:

§ 1.4.1 Date of organization:

§ 1.4.2 Type of partnership (if applicable):

§ 1.4.3 Name(s) of general partner(s)

§ 1.5 If your organization is individually owned, answer the following:

§ 1.5.1 Date of organization:

§ 1.5.2 Name of owner:

§ 1.6 If the form of your organization is other than those listed above, describe it and name the principals:

§ 2 LICENSING

§ 2.1 List jurisdictions and trade categories in which your organization is legally qualified to do business, and indicate registration or license numbers, if applicable.

§ 2.2 List jurisdictions in which your organization's partnership or trade name is filed.

§ 3 EXPERIENCE

§ 3.1 List the categories of work that your organization normally performs with its own forces.

§ 3.2 Claims and Suits. (If the answer to any of the questions below is yes, please attach details.)

§ 3.2.1 Has your organization ever failed to complete any work awarded to it?

§ 3.2.2 Are there any judgments, claims, arbitration proceedings or suits pending or outstanding against your organization or its officers?

§ 3.2.3 Has your organization filed any law suits or requested arbitration with regard to construction contracts within the last five years?

§ 3.3 Within the last five years, has any officer or principal of your organization ever been an officer or principal of another organization when it failed to complete a construction contract? (If the answer is yes, please attach details.)

§ 3.4 On a separate sheet, list major construction projects your organization has in progress, giving the name of project, owner, architect, contract amount, percent complete and scheduled completion date.

§ 3.4.1 State total worth of work in progress and under contract:

§ 3.5 On a separate sheet, list the major projects your organization has completed in the past five years, giving the name of project, owner, architect, contract amount, date of completion and percentage of the cost of the work performed with your own forces.

§ 3.5.1 State average annual amount of construction work performed during the past five years:

§ 3.6 On a separate sheet, list the construction experience and present commitments of the key individuals of your organization.

§ 4 REFERENCES

§ 4.1 Trade References:

§ 4.2 Bank References:

§ 4.3 Surety:

§ 4.3.1 Name of bonding company:

§ 4.3.2 Name and address of agent:

§ 5 FINANCING

§ 5.1 Financial Statement.

§ 5.1.1 Attach a financial statement, preferably audited, including your organization's latest balance sheet and income statement showing the following items:

Current Assets (e.g., cash, joint venture accounts, accounts receivable, notes receivable, accrued income, deposits, materials inventory and prepaid expenses);

Net Fixed Assets;

Other Assets;

Current Liabilities (e.g., accounts payable, notes payable, accrued expenses, provision for income taxes, advances, accrued salaries and accrued payroll taxes);

Other Liabilities (e.g., capital, capital stock, authorized and outstanding shares par values, earned surplus and retained earnings).

§ 5.1.2 Name and address of firm preparing attached financial statement, and date thereof:

§ 5.1.3 Is the attached financial statement for the identical organization named on page one?

§ 5.1.4 If not, explain the relationship and financial responsibility of the organization whose financial statement is provided (e.g., parent-subsiidiary).

§ 5.2 Will the organization whose financial statement is attached act as guarantor of the contract for construction?

§ 6 SIGNATURE

§ 6.1 Dated at this day of

Name of Organization:

By:

Title:

§ 6.2

M being duly sworn deposes and says that the information provided herein is true and sufficiently complete so as not to be misleading.

Subscribed and sworn before me this day of

Notary Public:

My Commission Expires:

DOCUMENT 00 52 13

AGREEMENT FORM

AIA Document A101 Standard Form of Agreement Between Owner and Contractor where the basis of payment is a Stipulated Sum - 2017 Edition, and as amended, forms the basis of Contract between the Owner and Contractor, and is included, following this page, as an integral part of the Bid documents. Provisions that are not amended or supplemented remain in full force and effect.

END OF DOCUMENT

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AIA Document A101™ – 2017

Standard Form of Agreement Between Owner and Contractor where the basis of payment is a Stipulated Sum

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

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

Warwick Public Schools
69 Draper Avenue
Warwick, R.I. 02889
Telephone Number: (401) 734-3033

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

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

Warwick Public Schools
HVAC Upgrades to Hoxsie Elementary School
55 Glenwood Drive, Warwick, RI 02889

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

Saccoccio & Associates, Inc.
1085 Park Avenue
Cranston, RI 02910
Telephone Number: 401-942-7970
Fax Number: 401-942-7975

The Owner and Contractor agree as follows.

ADDITIONS AND DELETIONS:

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

The parties should complete A101™–2017, Exhibit A, Insurance and Bonds, contemporaneously with this Agreement. AIA Document A201™–2017, General Conditions of the Contract for Construction, is adopted in this document by reference. Do not use with other general conditions unless this document is modified.

TABLE OF ARTICLES

- 1 THE CONTRACT DOCUMENTS
- 2 THE WORK OF THIS CONTRACT
- 3 DATE OF COMMENCEMENT AND SUBSTANTIAL COMPLETION
- 4 CONTRACT SUM
- 5 PAYMENTS
- 6 DISPUTE RESOLUTION
- 7 TERMINATION OR SUSPENSION
- 8 MISCELLANEOUS PROVISIONS
- 9 ENUMERATION OF CONTRACT DOCUMENTS

EXHIBIT A INSURANCE AND BONDS

ARTICLE 1 THE CONTRACT DOCUMENTS

The Contract Documents consist of this Agreement, Conditions of the Contract (General, Supplementary, and other Conditions), Drawings, Specifications, Addenda issued prior to execution of this Agreement, other documents listed in this Agreement, and Modifications issued after execution of this Agreement, all of which form the Contract, and are as fully a part of the Contract as if attached to this Agreement or repeated herein. The Contract represents the entire and integrated agreement between the parties hereto and supersedes prior negotiations, representations, or agreements, either written or oral. An enumeration of the Contract Documents, other than a Modification, appears in Article 9.

ARTICLE 2 THE WORK OF THIS CONTRACT

The Contractor shall fully execute the Work described in the Contract Documents, except as specifically indicated in the Contract Documents to be the responsibility of others.

ARTICLE 3 DATE OF COMMENCEMENT AND SUBSTANTIAL COMPLETION

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

☐ The date of this Agreement.

☒ A date set forth in a notice to proceed issued by the Owner.

☐ Established as follows:

(Insert a date or a means to determine the date of commencement of the Work.)

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

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

§ 3.3 Substantial Completion

§ 3.3.1 Subject to adjustments of the Contract Time as provided in the Contract Documents, the Contractor shall achieve Substantial Completion of the entire Work:

(Check one of the following boxes and complete the necessary information.)

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

[] By the following date:

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

Portion of Work

Substantial Completion Date

§ 3.3.3 If the Contractor fails to achieve Substantial Completion as provided in this Section 3.3, liquidated damages, if any, shall be assessed as set forth in Section 4.5.

ARTICLE 4 CONTRACT SUM

§ 4.1 The Owner shall pay the Contractor the Contract Sum in current funds for the Contractor's performance of the Contract. The Contract Sum shall be (\$), subject to additions and deductions as provided in the Contract Documents.

§ 4.2 Alternates

§ 4.2.1 Alternates, if any, included in the Contract Sum:

Item

Price

§ 4.2.2 Subject to the conditions noted below, the following alternates may be accepted by the Owner following execution of this Agreement. Upon acceptance, the Owner shall issue a Modification to this Agreement.
(Insert below each alternate and the conditions that must be met for the Owner to accept the alternate.)

Item

Price

Conditions for Acceptance

§ 4.3 Allowances, if any, included in the Contract Sum:
(Identify each allowance.)

Item

Price

§ 4.4 Unit prices, if any:

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

Item

Units and Limitations

Price per Unit (\$0.00)

§ 4.5 Liquidated damages, if any:

(Insert terms and conditions for liquidated damages, if any.)

§ 4.6 Other:

(Insert provisions for bonus or other incentives, if any, that might result in a change to the Contract Sum.)

ARTICLE 5 PAYMENTS

§ 5.1 Progress Payments

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

§ 5.1.2 The period covered by each Application for Payment shall be one calendar month ending on the last day of the month, or as follows:

§ 5.1.3 Provided that an Application for Payment is received by the Architect not later than the First day of a month, the Owner shall make payment of the amount certified to the Contractor not later than the Fifteenth day of the following month. If an Application for Payment is received by the Architect after the application date fixed above, payment of the amount certified shall be made by the Owner not later than Forty-five (45) days after the Architect receives the Application for Payment.

(Federal, state or local laws may require payment within a certain period of time.)

§ 5.1.4 Each Application for Payment shall be based on the most recent schedule of values submitted by the Contractor in accordance with the Contract Documents. The schedule of values shall allocate the entire Contract Sum among the various portions of the Work. The schedule of values shall be prepared in such form, and supported by such data to substantiate its accuracy, as the Architect may require. This schedule of values shall be used as a basis for reviewing the Contractor's Applications for Payment.

§ 5.1.5 Applications for Payment shall show the percentage of completion of each portion of the Work as of the end of the period covered by the Application for Payment.

§ 5.1.6 In accordance with AIA Document A201™-2017, General Conditions of the Contract for Construction, and subject to other provisions of the Contract Documents, the amount of each progress payment shall be computed as follows:

§ 5.1.6.1 The amount of each progress payment shall first include:

- .1 That portion of the Contract Sum properly allocable to completed Work;
- .2 That portion of the Contract Sum properly allocable to materials and equipment delivered and suitably stored at the site for subsequent incorporation in the completed construction, or, if approved in advance by the Owner, suitably stored off the site at a location agreed upon in writing; and
- .3 That portion of Construction Change Directives that the Architect determines, in the Architect's professional judgment, to be reasonably justified.

§ 5.1.6.2 The amount of each progress payment shall then be reduced by:

- .1 The aggregate of any amounts previously paid by the Owner;
- .2 The amount, if any, for Work that remains uncorrected and for which the Architect has previously withheld a Certificate for Payment as provided in Article 9 of AIA Document A201-2017;
- .3 Any amount for which the Contractor does not intend to pay a Subcontractor or material supplier, unless the Work has been performed by others the Contractor intends to pay;
- .4 For Work performed or defects discovered since the last payment application, any amount for which the Architect may withhold payment, or nullify a Certificate of Payment in whole or in part, as provided in Article 9 of AIA Document A201-2017; and
- .5 Retainage withheld pursuant to Section 5.1.7.

§ 5.1.7 Retainage

§ 5.1.7.1 For each progress payment made prior to Substantial Completion of the Work, the Owner may withhold the following amount, as retainage, from the payment otherwise due:

(Insert a percentage or amount to be withheld as retainage from each Application for Payment. The amount of retainage may be limited by governing law.)

10 percent

§ 5.1.7.1.1 The following items are not subject to retainage:
(Insert any items not subject to the withholding of retainage, such as general conditions, insurance, etc.)

§ 5.1.7.2 Reduction or limitation of retainage, if any, shall be as follows:
(If the retainage established in Section 5.1.7.1 is to be modified prior to Substantial Completion of the entire Work, including modifications for Substantial Completion of portions of the Work as provided in Section 3.3.2, insert provisions for such modifications.)

To be requested in writing by the General Contractor to the Architect.

§ 5.1.7.3 Except as set forth in this Section 5.1.7.3, upon Substantial Completion of the Work, the Contractor may submit an Application for Payment that includes the retainage withheld from prior Applications for Payment pursuant to this Section 5.1.7. The Application for Payment submitted at Substantial Completion shall not include retainage as follows:
(Insert any other conditions for release of retainage upon Substantial Completion.)

Remaining retainage to be withheld until Punch List work is 100 percent complete.

§ 5.1.8 If final completion of the Work is materially delayed through no fault of the Contractor, the Owner shall pay the Contractor any additional amounts in accordance with Article 9 of AIA Document A201–2017.

§ 5.1.9 Except with the Owner's prior approval, the Contractor shall not make advance payments to suppliers for materials or equipment which have not been delivered and stored at the site.

§ 5.2 Final Payment

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

- .1 the Contractor has fully performed the Contract except for the Contractor's responsibility to correct Work as provided in Article 12 of AIA Document A201–2017, and to satisfy other requirements, if any, which extend beyond final payment; and
- .2 a final Certificate for Payment has been issued by the Architect.

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

§ 5.3 Interest

Payments due and unpaid under the Contract shall bear interest from the date payment is due at the rate stated below, or in the absence thereof, at the legal rate prevailing from time to time at the place where the Project is located.

(Insert rate of interest agreed upon, if any.)

%

ARTICLE 6 DISPUTE RESOLUTION

§ 6.1 Initial Decision Maker

The Architect will serve as the Initial Decision Maker pursuant to Article 15 of AIA Document A201–2017, unless the parties appoint below another individual, not a party to this Agreement, to serve as the Initial Decision Maker.

(If the parties mutually agree, insert the name, address and other contact information of the Initial Decision Maker, if other than the Architect.)

§ 6.2 Binding Dispute Resolution

For any Claim subject to, but not resolved by, mediation pursuant to Article 15 of AIA Document A201–2017, the method of binding dispute resolution shall be as follows:

(Check the appropriate box.)

☒ [X] Arbitration pursuant to Section 15.4 of AIA Document A201–2017

☐ [] Litigation in a court of competent jurisdiction

☐ [] Other *(Specify)*

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

ARTICLE 7 TERMINATION OR SUSPENSION

§ 7.1 The Contract may be terminated by the Owner or the Contractor as provided in Article 14 of AIA Document A201–2017.

§ 7.1.1 If the Contract is terminated for the Owner's convenience in accordance with Article 14 of AIA Document A201–2017, then the Owner shall pay the Contractor a termination fee as follows:

(Insert the amount of, or method for determining, the fee, if any, payable to the Contractor following a termination for the Owner's convenience.)

§ 7.2 The Work may be suspended by the Owner as provided in Article 14 of AIA Document A201–2017.

ARTICLE 8 MISCELLANEOUS PROVISIONS

§ 8.1 Where reference is made in this Agreement to a provision of AIA Document A201–2017 or another Contract Document, the reference refers to that provision as amended or supplemented by other provisions of the Contract Documents.

§ 8.2 The Owner's representative:

(Name, address, email address, and other information)

§ 8.3 The Contractor's representative:

(Name, address, email address, and other information)

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

§ 8.5 Insurance and Bonds

§ 8.5.1 The Owner and the Contractor shall purchase and maintain insurance as set forth in AIA Document A101™-2017, Standard Form of Agreement Between Owner and Contractor where the basis of payment is a Stipulated Sum, Exhibit A, Insurance and Bonds, and elsewhere in the Contract Documents.

§ 8.5.2 The Contractor shall provide bonds as set forth in AIA Document A101™-2017 Exhibit A, and elsewhere in the Contract Documents.

§ 8.6 Notice in electronic format, pursuant to Article 1 of AIA Document A201-2017, may be given in accordance with AIA Document E203™-2013, Building Information Modeling and Digital Data Exhibit, if completed, or as otherwise set forth below:

(If other than in accordance with AIA Document E203-2013, insert requirements for delivering notice in electronic format such as name, title, and email address of the recipient and whether and how the system will be required to generate a read receipt for the transmission.)

§ 8.7 Other provisions:

ARTICLE 9 ENUMERATION OF CONTRACT DOCUMENTS

§ 9.1 This Agreement is comprised of the following documents:

- .1 AIA Document A101™-2017, Standard Form of Agreement Between Owner and Contractor
- .2 AIA Document A101™-2017, Exhibit A, Insurance and Bonds
- .3 AIA Document A201™-2017, General Conditions of the Contract for Construction
- .4 AIA Document E203™-2013, Building Information Modeling and Digital Data Exhibit, dated as indicated below:
(Insert the date of the E203-2013 incorporated into this Agreement.)

.5 Drawings

Number	Title	Date

.6 Specifications

Section	Title	Date	Pages

.7 Addenda, if any:

Number	Date	Pages

Portions of Addenda relating to bidding or proposal requirements are not part of the Contract Documents unless the bidding or proposal requirements are also enumerated in this Article 9.

.8 Other Exhibits:

(Check all boxes that apply and include appropriate information identifying the exhibit where required.)

Init.

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User Notes:

(3B9ADA42)

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

☐ The Sustainability Plan:

Title	Date	Pages

☐ Supplementary and other Conditions of the Contract:

Document	Title	Date	Pages

.9 Other documents, if any, listed below:

(List here any additional documents that are intended to form part of the Contract Documents. AIA Document A201™-2017 provides that the advertisement or invitation to bid, Instructions to Bidders, sample forms, the Contractor's bid or proposal, portions of Addenda relating to bidding or proposal requirements, and other information furnished by the Owner in anticipation of receiving bids or proposals, are not part of the Contract Documents unless enumerated in this Agreement. Any such documents should be listed here only if intended to be part of the Contract Documents.)

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

OWNER (Signature)

CONTRACTOR (Signature)

(Printed name and title)

(Printed name and title)

Init.

DOCUMENT 00 61 13

PERFORMANCE BOND; PAYMENT BOND

1. PERFORMANCE BOND

AIA Document A312 - Performance Bond - 2010 Edition is included, following this page, as an integral part of the Bid documents, and issues of this form, signed and executed by the successful Bidder and Surety, will be bound into the executed Contract copies of the Project Manual.

2. PAYMENT BOND

AIA Document A312 - Payment Bond - 2010 Edition is included, following this page, as an integral part of the Bid Documents, and issues of this form, signed and executed by the successful Bidder and Surety, will be bound into the executed Contract copies of the Project Manual

END OF DOCUMENT

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AIA® Document A312™ – 2010

Performance Bond

CONTRACTOR:

(Name, legal status and address)

SURETY:

(Name, legal status and principal place of business)

OWNER:

(Name, legal status and address)

Warwick Public Schools
69 Draper Avenue
Warwick, R.I. 02889

CONSTRUCTION CONTRACT

Date:

Amount: \$

Description:

(Name and location)

Warwick Public Schools

HVAC Upgrades to Hoxsie Elementary School

55 Glenwood Drive, Warwick, RI 02889

BOND

Date:

(Not earlier than Construction Contract Date)

Amount: \$

Modifications to this Bond:

None

See Section 16

CONTRACTOR AS PRINCIPAL

Company: *(Corporate Seal)*

Signature: _____

Name and

Title: _____

(Any additional signatures appear on the last page of this Performance Bond.)

SURETY

Company: _____

Signature: _____

Name and

Title: _____

(FOR INFORMATION ONLY — Name, address and telephone)

AGENT or BROKER:

OWNER'S REPRESENTATIVE:

(Architect, Engineer or other party:)

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.

Any singular reference to Contractor, Surety, Owner or other party shall be considered plural where applicable.

§ 1 The Contractor and Surety, jointly and severally, bind themselves, their heirs, executors, administrators, successors and assigns to the Owner for the performance of the Construction Contract, which is incorporated herein by reference.

§ 2 If the Contractor performs the Construction Contract, the Surety and the Contractor shall have no obligation under this Bond, except when applicable to participate in a conference as provided in Section 3.

§ 3 If there is no Owner Default under the Construction Contract, the Surety's obligation under this Bond shall arise after

- .1 the Owner first provides notice to the Contractor and the Surety that the Owner is considering declaring a Contractor Default. Such notice shall indicate whether the Owner is requesting a conference among the Owner, Contractor and Surety to discuss the Contractor's performance. If the Owner does not request a conference, the Surety may, within five (5) business days after receipt of the Owner's notice, request such a conference. If the Surety timely requests a conference, the Owner shall attend. Unless the Owner agrees otherwise, any conference requested under this Section 3.1 shall be held within ten (10) business days of the Surety's receipt of the Owner's notice. If the Owner, the Contractor and the Surety agree, the Contractor shall be allowed a reasonable time to perform the Construction Contract, but such an agreement shall not waive the Owner's right, if any, subsequently to declare a Contractor Default;
- .2 the Owner declares a Contractor Default, terminates the Construction Contract and notifies the Surety; and
- .3 the Owner has agreed to pay the Balance of the Contract Price in accordance with the terms of the Construction Contract to the Surety or to a contractor selected to perform the Construction Contract.

§ 4 Failure on the part of the Owner to comply with the notice requirement in Section 3.1 shall not constitute a failure to comply with a condition precedent to the Surety's obligations, or release the Surety from its obligations, except to the extent the Surety demonstrates actual prejudice.

§ 5 When the Owner has satisfied the conditions of Section 3, the Surety shall promptly and at the Surety's expense take one of the following actions:

§ 5.1 Arrange for the Contractor, with the consent of the Owner, to perform and complete the Construction Contract;

§ 5.2 Undertake to perform and complete the Construction Contract itself, through its agents or independent contractors;

§ 5.3 Obtain bids or negotiated proposals from qualified contractors acceptable to the Owner for a contract for performance and completion of the Construction Contract, arrange for a contract to be prepared for execution by the Owner and a contractor selected with the Owner's concurrence, to be secured with performance and payment bonds executed by a qualified surety equivalent to the bonds issued on the Construction Contract, and pay to the Owner the amount of damages as described in Section 7 in excess of the Balance of the Contract Price incurred by the Owner as a result of the Contractor Default; or

§ 5.4 Waive its right to perform and complete, arrange for completion, or obtain a new contractor and with reasonable promptness under the circumstances:

- .1 After investigation, determine the amount for which it may be liable to the Owner and, as soon as practicable after the amount is determined, make payment to the Owner; or
- .2 Deny liability in whole or in part and notify the Owner, citing the reasons for denial.

§ 6 If the Surety does not proceed as provided in Section 5 with reasonable promptness, the Surety shall be deemed to be in default on this Bond seven days after receipt of an additional written notice from the Owner to the Surety demanding that the Surety perform its obligations under this Bond, and the Owner shall be entitled to enforce any remedy available to the Owner. If the Surety proceeds as provided in Section 5.4, and the Owner refuses the payment or the Surety has denied liability, in whole or in part, without further notice the Owner shall be entitled to enforce any remedy available to the Owner.

§ 7 If the Surety elects to act under Section 5.1, 5.2 or 5.3, then the responsibilities of the Surety to the Owner shall not be greater than those of the Contractor under the Construction Contract, and the responsibilities of the Owner to the Surety shall not be greater than those of the Owner under the Construction Contract. Subject to the commitment by the Owner to pay the Balance of the Contract Price, the Surety is obligated, without duplication, for

- .1 the responsibilities of the Contractor for correction of defective work and completion of the Construction Contract;
- .2 additional legal, design professional and delay costs resulting from the Contractor's Default, and resulting from the actions or failure to act of the Surety under Section 5; and
- .3 liquidated damages, or if no liquidated damages are specified in the Construction Contract, actual damages caused by delayed performance or non-performance of the Contractor.

§ 8 If the Surety elects to act under Section 5.1, 5.3 or 5.4, the Surety's liability is limited to the amount of this Bond.

§ 9 The Surety shall not be liable to the Owner or others for obligations of the Contractor that are unrelated to the Construction Contract, and the Balance of the Contract Price shall not be reduced or set off on account of any such unrelated obligations. No right of action shall accrue on this Bond to any person or entity other than the Owner or its heirs, executors, administrators, successors and assigns.

§ 10 The Surety hereby waives notice of any change, including changes of time, to the Construction Contract or to related subcontracts, purchase orders and other obligations.

§ 11 Any proceeding, legal or equitable, under this Bond may be instituted in any court of competent jurisdiction in the location in which the work or part of the work is located and shall be instituted within two years after a declaration of Contractor Default or within two years after the Contractor ceased working or within two years after the Surety refuses or fails to perform its obligations under this Bond, whichever occurs first. If the provisions of this Paragraph are void or prohibited by law, the minimum period of limitation available to sureties as a defense in the jurisdiction of the suit shall be applicable.

§ 12 Notice to the Surety, the Owner or the Contractor shall be mailed or delivered to the address shown on the page on which their signature appears.

§ 13 When this Bond has been furnished to comply with a statutory or other legal requirement in the location where the construction was to be performed, any provision in this Bond conflicting with said statutory or legal requirement shall be deemed deleted herefrom and provisions conforming to such statutory or other legal requirement shall be deemed incorporated herein. When so furnished, the intent is that this Bond shall be construed as a statutory bond and not as a common law bond.

§ 14 Definitions

§ 14.1 Balance of the Contract Price. The total amount payable by the Owner to the Contractor under the Construction Contract after all proper adjustments have been made, including allowance to the Contractor of any amounts received or to be received by the Owner in settlement of insurance or other claims for damages to which the Contractor is entitled, reduced by all valid and proper payments made to or on behalf of the Contractor under the Construction Contract.

§ 14.2 Construction Contract. The agreement between the Owner and Contractor identified on the cover page, including all Contract Documents and changes made to the agreement and the Contract Documents.

§ 14.3 Contractor Default. Failure of the Contractor, which has not been remedied or waived, to perform or otherwise to comply with a material term of the Construction Contract.

§ 14.4 Owner Default. Failure of the Owner, which has not been remedied or waived, to pay the Contractor as required under the Construction Contract or to perform and complete or comply with the other material terms of the Construction Contract.

§ 14.5 Contract Documents. All the documents that comprise the agreement between the Owner and Contractor.

§ 15 If this Bond is issued for an agreement between a Contractor and subcontractor, the term Contractor in this Bond shall be deemed to be Subcontractor and the term Owner shall be deemed to be Contractor.

§ 16 Modifications to this bond are as follows:

(Space is provided below for additional signatures of added parties, other than those appearing on the cover page.)

CONTRACTOR AS PRINCIPAL

Company: _____
Signature: _____
(Corporate Seal)

Name and Title: _____
Address: _____

SURETY

Company: _____
Signature: _____
(Corporate Seal)

Name and Title: _____
Address: _____



AIA Document A312™ – 2010

Payment Bond

CONTRACTOR:

(Name, legal status and address)

SURETY:

(Name, legal status and principal place of business)

OWNER:

(Name, legal status and address)

Warwick Public Schools
69 Draper Avenue
Warwick, R.I. 02889

CONSTRUCTION CONTRACT

Date:

Amount: \$

Description:

(Name and location)

Warwick Public Schools

HVAC Upgrades to Hoxsie Elementary School
55 Glenwood Drive, Warwick, RI 02889

BOND

Date:

(Not earlier than Construction Contract Date)

Amount: \$

Modifications to this Bond:

None

See Section 18

CONTRACTOR AS PRINCIPAL

Company: *(Corporate Seal)*

Signature:

SURETY

Company: *(Corporate Seal)*

Signature:

Name and

Title:

(Any additional signatures appear on the last page of this Payment Bond.)

Name and

Title:

(FOR INFORMATION ONLY — Name, address and telephone)

AGENT or BROKER:

OWNER'S REPRESENTATIVE:

(Architect, Engineer or other party:)

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.

Any singular reference to Contractor, Surety, Owner or other party shall be considered plural where applicable.

§ 1 The Contractor and Surety, jointly and severally, bind themselves, their heirs, executors, administrators, successors and assigns to the Owner to pay for labor, materials and equipment furnished for use in the performance of the Construction Contract, which is incorporated herein by reference, subject to the following terms.

§ 2 If the Contractor promptly makes payment of all sums due to Claimants, and defends, indemnifies and holds harmless the Owner from claims, demands, liens or suits by any person or entity seeking payment for labor, materials or equipment furnished for use in the performance of the Construction Contract, then the Surety and the Contractor shall have no obligation under this Bond.

§ 3 If there is no Owner Default under the Construction Contract, the Surety's obligation to the Owner under this Bond shall arise after the Owner has promptly notified the Contractor and the Surety (at the address described in Section 13) of claims, demands, liens or suits against the Owner or the Owner's property by any person or entity seeking payment for labor, materials or equipment furnished for use in the performance of the Construction Contract and tendered defense of such claims, demands, liens or suits to the Contractor and the Surety.

§ 4 When the Owner has satisfied the conditions in Section 3, the Surety shall promptly and at the Surety's expense defend, indemnify and hold harmless the Owner against a duly tendered claim, demand, lien or suit.

§ 5 The Surety's obligations to a Claimant under this Bond shall arise after the following:

§ 5.1 Claimants, who do not have a direct contract with the Contractor,

- .1 have furnished a written notice of non-payment to the Contractor, stating with substantial accuracy the amount claimed and the name of the party to whom the materials were, or equipment was, furnished or supplied or for whom the labor was done or performed, within ninety (90) days after having last performed labor or last furnished materials or equipment included in the Claim; and
- .2 have sent a Claim to the Surety (at the address described in Section 13).

§ 5.2 Claimants, who are employed by or have a direct contract with the Contractor, have sent a Claim to the Surety (at the address described in Section 13).

§ 6 If a notice of non-payment required by Section 5.1.1 is given by the Owner to the Contractor, that is sufficient to satisfy a Claimant's obligation to furnish a written notice of non-payment under Section 5.1.1.

§ 7 When a Claimant has satisfied the conditions of Sections 5.1 or 5.2, whichever is applicable, the Surety shall promptly and at the Surety's expense take the following actions:

§ 7.1 Send an answer to the Claimant, with a copy to the Owner, within sixty (60) days after receipt of the Claim, stating the amounts that are undisputed and the basis for challenging any amounts that are disputed; and

§ 7.2 Pay or arrange for payment of any undisputed amounts.

§ 7.3 The Surety's failure to discharge its obligations under Section 7.1 or Section 7.2 shall not be deemed to constitute a waiver of defenses the Surety or Contractor may have or acquire as to a Claim, except as to undisputed amounts for which the Surety and Claimant have reached agreement. If, however, the Surety fails to discharge its obligations under Section 7.1 or Section 7.2, the Surety shall indemnify the Claimant for the reasonable attorney's fees the Claimant incurs thereafter to recover any sums found to be due and owing to the Claimant.

§ 8 The Surety's total obligation shall not exceed the amount of this Bond, plus the amount of reasonable attorney's fees provided under Section 7.3, and the amount of this Bond shall be credited for any payments made in good faith by the Surety.

§ 9 Amounts owed by the Owner to the Contractor under the Construction Contract shall be used for the performance of the Construction Contract and to satisfy claims, if any, under any construction performance bond. By the Contractor furnishing and the Owner accepting this Bond, they agree that all funds earned by the Contractor in the performance of the Construction Contract are dedicated to satisfy obligations of the Contractor and Surety under this Bond, subject to the Owner's priority to use the funds for the completion of the work.

§ 10 The Surety shall not be liable to the Owner, Claimants or others for obligations of the Contractor that are unrelated to the Construction Contract. The Owner shall not be liable for the payment of any costs or expenses of any Claimant under this Bond, and shall have under this Bond no obligation to make payments to, or give notice on behalf of, Claimants or otherwise have any obligations to Claimants under this Bond.

§ 11 The Surety hereby waives notice of any change, including changes of time, to the Construction Contract or to related subcontracts, purchase orders and other obligations.

§ 12 No suit or action shall be commenced by a Claimant under this Bond other than in a court of competent jurisdiction in the state in which the project that is the subject of the Construction Contract is located or after the expiration of one year from the date (1) on which the Claimant sent a Claim to the Surety pursuant to Section 5.1.2 or 5.2, or (2) on which the last labor or service was performed by anyone or the last materials or equipment were furnished by anyone under the Construction Contract, whichever of (1) or (2) first occurs. If the provisions of this Paragraph are void or prohibited by law, the minimum period of limitation available to sureties as a defense in the jurisdiction of the suit shall be applicable.

§ 13 Notice and Claims to the Surety, the Owner or the Contractor shall be mailed or delivered to the address shown on the page on which their signature appears. Actual receipt of notice or Claims, however accomplished, shall be sufficient compliance as of the date received.

§ 14 When this Bond has been furnished to comply with a statutory or other legal requirement in the location where the construction was to be performed, any provision in this Bond conflicting with said statutory or legal requirement shall be deemed deleted herefrom and provisions conforming to such statutory or other legal requirement shall be deemed incorporated herein. When so furnished, the intent is that this Bond shall be construed as a statutory bond and not as a common law bond.

§ 15 Upon request by any person or entity appearing to be a potential beneficiary of this Bond, the Contractor and Owner shall promptly furnish a copy of this Bond or shall permit a copy to be made.

§ 16 Definitions

§ 16.1 Claim. A written statement by the Claimant including at a minimum:

- .1 the name of the Claimant;
- .2 the name of the person for whom the labor was done, or materials or equipment furnished;
- .3 a copy of the agreement or purchase order pursuant to which labor, materials or equipment was furnished for use in the performance of the Construction Contract;
- .4 a brief description of the labor, materials or equipment furnished;
- .5 the date on which the Claimant last performed labor or last furnished materials or equipment for use in the performance of the Construction Contract;
- .6 the total amount earned by the Claimant for labor, materials or equipment furnished as of the date of the Claim;
- .7 the total amount of previous payments received by the Claimant; and
- .8 the total amount due and unpaid to the Claimant for labor, materials or equipment furnished as of the date of the Claim.

§ 16.2 Claimant. An individual or entity having a direct contract with the Contractor or with a subcontractor of the Contractor to furnish labor, materials or equipment for use in the performance of the Construction Contract. The term Claimant also includes any individual or entity that has rightfully asserted a claim under an applicable mechanic's lien or similar statute against the real property upon which the Project is located. The intent of this Bond shall be to include without limitation in the terms "labor, materials or equipment" that part of water, gas, power, light, heat, oil, gasoline, telephone service or rental equipment used in the Construction Contract, architectural and engineering services required for performance of the work of the Contractor and the Contractor's subcontractors, and all other items for which a mechanic's lien may be asserted in the jurisdiction where the labor, materials or equipment were furnished.

§ 16.3 Construction Contract. The agreement between the Owner and Contractor identified on the cover page, including all Contract Documents and all changes made to the agreement and the Contract Documents.

§ 16.4 Owner Default. Failure of the Owner, which has not been remedied or waived, to pay the Contractor as required under the Construction Contract or to perform and complete or comply with the other material terms of the Construction Contract.

§ 16.5 Contract Documents. All the documents that comprise the agreement between the Owner and Contractor.

§ 17 If this Bond is issued for an agreement between a Contractor and subcontractor, the term Contractor in this Bond shall be deemed to be Subcontractor and the term Owner shall be deemed to be Contractor.

§ 18 Modifications to this bond are as follows:

(Space is provided below for additional signatures of added parties, other than those appearing on the cover page.)

CONTRACTOR AS PRINCIPAL

Company: _____ (Corporate Seal)

Signature: _____

Name and Title: _____

Address: _____

SURETY

Company: _____ (Corporate Seal)

Signature: _____

Name and Title: _____

Address: _____

DOCUMENT 00 65 19.16

WAIVER OF LIEN FORM

The Waiver of Lien Form is included, following this page, as an integral part of the Contract documents. A copy with completed information must be submitted with the second and each succeeding Application for Payment.

WAIVER OF LIEN FORM
Material or Labor

Construction Project Title: _____

General Contractor: _____

Subcontractor/Supplier: _____

General Contractor's previous Application No: _____

General Contractor's previous Application Date: _____

Schedule of Values Line Item No.: _____

DESCRIPTION OF WORK Heading: _____

Total payment Received to Date:

\$ _____

The undersigned Representative of the above Subcontractor/Supplier has been contracted by the above General Contractor to furnish materials, or labor, or both, as included in the approved Schedule of Values under the Line Item No., and DESCRIPTION OF WORK heading indicated above, for the Construction Project listed above.

The undersigned acknowledges receipt of payment, under this Line Item No., and DESCRIPTION OF WORK heading, and hereby waives and releases any and all lien, or claim or right to lien, on the Construction Project listed above, and premises, under the statutes of the State of Rhode Island, relating to Mechanics Liens, on account of materials, or labor, or both, furnished, or which may be furnished, by the undersigned to, or on account of, the above numbered and dated Application and Certificate for Payment.

Signed this month of _____ day of _____, 20__.

(signature)

(company/firm name)

END OF DOCUMENT

DOCUMENT 00 65 19.18

**AFFIDAVIT OF GENERAL CONTRACTOR THAT ALL SUBCONTRACTORS,
SUPPLIERS AND LABORERS HAVE BEEN PAID AND HOLD HARMLESS CLAUSE**

The affidavit is included, following this page, as an integral part of the bid documents, for submittal with all applications for payment.

DOCUMENT 00815

AFFIDAVIT OF GENERAL CONTRACTOR
THAT ALL SUBCONTRACTORS, SUPPLIERS AND LABORERS
HAVE BEEN PAID: AND HOLD HARMLESS CLAUSE

To: ????????????

The undersigned hereby deposes, says and makes affidavit under oath that he/she is _____ of _____ and further certifies that as of today's date all monies previously advanced pursuant to requisitions of the Contractor in connection with the Project known as HVAC Upgrades to Hoxsie Elementary School have been paid to or are being held for and will be paid to the subcontractors, laborers, or suppliers: that there are no further amounts owing to the knowledge of the undersigned other than as set forth in the current requisition, a copy of which is attached hereto, and that only materials, fixtures, and equipment to which undersigned has absolute title have been used in the project. Further, the undersigned HEREBY HOLDS HARMLESS THE CITY OF WARWICK, AND ALL COMMITTEES, BOARDS, DEPARTMENTS AND AGENCIES THEREUNDER, AND AGREES TO INDEMNIFY SAME FOR ANY ACTION OR SUIT BROUGHT BY ANY SUBCONTRACTOR, LABORER, OR SUPPLIER FOR THE PAYMENT OF ANY SUMS DUE RELATIVE TO THE AFORESAID PROJECT. Said Hold Harmless Clause and Indemnification shall cause the undersigned to shield the City of Warwick and all committees, boards, departments and agencies from all attachments, chattel mortgages, and all liens, whatsoever, sought by subcontractors, laborers and/or suppliers for collection of monies allegedly due said parties for work performed on the aforesaid Project.

On the _____ day of _____, 20____, before me
appeared _____, where upon oath said
property executed the foregoing Affidavit as their free act and deed.

NOTARY

My commission expires:

DOCUMENT 00 72 13

GENERAL CONDITIONS

AIA Document A201, General Conditions of the Contract for Construction - 2017 Edition, is included, following this page, as an integral part of the Bidding and Contract Documents. Provisions which are not amended or supplement remain in full force and effect.

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AIA® Document A201™ – 2017

General Conditions of the Contract for Construction

for the following PROJECT:

(Name and location or address)

Warwick Public Schools
HVAC Upgrades to Hoxsie Elementary School
55 Glenwood Drive, Warwick, RI 02889

THE OWNER:

(Name, legal status and address)

Warwick Public Schools
69 Draper Avenue
Warwick, Rhode Island 02889

THE ARCHITECT:

(Name, legal status and address)

Saccoccio & Associates, Architects
1085 Park Avenue, Cranston, Rhode Island 02910
Tel: 401-942-7970
www.sa-architects.com

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- 13 MISCELLANEOUS PROVISIONS**

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.

For guidance in modifying this document to include supplementary conditions, see AIA Document A503™, *Guide for Supplementary Conditions*.

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	1.1.1, 2.4, 3.9, 7, 8.2.2, 12.1, 12.2, 13.4.2, 14.3.1

ARTICLE 1 GENERAL PROVISIONS

§ 1.1 Basic Definitions

§ 1.1.1 The Contract Documents

The Contract Documents consist of the Agreement between the Owner and Contractor (hereinafter, 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 include the advertisement or invitation to bid, Instructions to Bidders, sample forms, information furnished by the Owner in anticipation of receiving bids or proposals, the Contractor's bid or proposal, and Addenda relating to those documents.

In the event of any conflict among the Contract Documents, the Documents shall be construed according to the following priorities:

§ 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. The Initial Decision Maker shall not show partiality to the Owner or Contractor and shall not be liable for results of interpretations or decisions rendered in good faith.

§ 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

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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. All Work mentioned or indicated in the Contract Documents shall be performed by the Contractor as part of this Contract unless it is specifically indicated in the Contract Documents that such Work is to be done by others. Should the Drawings or the Specifications disagree in themselves or with each other, the Contractor shall provide the better quality or greater quantity of Work unless otherwise directed by written addendum to the Contract.

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

§ 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. The Contractor and all Subcontractors shall refer to all of the Drawings, including those showing primarily the Work of the mechanical, electrical and other specialized trades; and to all of the Sections of the Specifications, and shall perform all Work reasonably inferable therefrom as being necessary to produce the indicated results.

§ 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.

§ 1.2.4 All indications or notations which apply to one of a number of similar situations, materials or processes shall be deemed to apply to all such situations, materials or processes wherever they appear in the Work, except where a contrary result is clearly indicated by the Contract Documents.

§ 1.2.5 Where codes, standards, requirements and publications of public and private bodies are referred to in the Specifications, references shall be understood to be to the latest revision prior to the date of receiving bids, except where otherwise indicated.

§ 1.2.6 Where no explicit quality or standards for materials or workmanship are established for Work, such Work is to be of good quality for the intended use and consistent with the quality of the surrounding Work and of the construction of the Project generally.

§ 1.2.7 All manufactured articles, materials, and equipment shall be applied, installed, connected, erected, used, cleaned, and conditioned in accordance with the manufacturer's written or printed directions and instructions unless otherwise indicated in the Contract Documents.

§ 1.2.8 All drawings are diagrammatic and indicate general arrangement of systems and equipment, except when specifically dimensioned or detailed. For exact locations of building elements, refer to dimensioned drawings. Field measurements take precedence over dimensioned drawings. Intention is to show size, capacity, approximate location, direction and general relationship of one work phase to another, but not exact detail or arrangement. Installation of all systems and equipment is subject to clarification as indicated in reviewed shop drawings and field coordination drawings.

Dimensions indicated on contract drawings are limiting dimensions. Do not use equipment exceeding dimensions indicated or equipment or arrangements that reduce required clearances or exceed specified maximum dimensions.

§ 1.2.9 The Mechanical, Plumbing, Electrical and Fire Protection Drawings are diagrammatic only, and are not intended to show the alignment, physical locations or configurations of such Work. Such Work shall be installed without additional cost to the Owner to clear all obstructions, permit proper clearances for the Work of other trades, and present an orderly appearance where exposed. Prior to beginning such Work, the Contractor shall prepare coordination drawings showing the exact alignment, physical location and configuration of the Mechanical, Plumbing, Electrical and Fire Protection installations and demonstrating to the Contractor's satisfaction that the installations will comply with the preceding sentence. A copy of the drawings shall be submitted to the Architect, and the Contractor shall revise and resubmit the drawings if so directed by the Architect.

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§ 1.2.10 Exact locations of fixtures and outlets shall be obtained from the Architect as provided in subparagraph 3.2.5 before the Work is roughed in; Work installed without such information from the Architect shall be relocated at the Contractor's expense.

§ 1.2.11 Test boring or soil test information included with the Contract Documents or otherwise made available to the Contractor was obtained by the Owner for use by the Architects in the design of the Project or Work. The Owner does not hold out such information to the Contractor as a completely accurate indication of subsurface conditions, and no claim for extra cost or extension of time resulting from a reliance by the Contractor on such information shall be allowed except as provided in subparagraph 3.7.4.

§ 1.2.12 Where the Work is to fit with existing conditions or work to be performed by others, the Contractor shall fully and completely join the Work with such conditions or work, unless otherwise specified. Owner provided drawings showing existing conditions or construction are based on available documents and are not guaranteed to show actual existing conditions.

§ 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 All Drawings, Specifications and copies thereof furnished by the Owner are and shall remain the Owner's property. They are to be used only with respect to this Project and are not to be used on any other project without the prior written consent of the Owner. With the exception of one contract set for each party to the Contract, such documents are to be returned or suitably accounted for to the Owner at the completion of the Work. Submission or distribution to meet official regulatory requirements or for other purposes in connection with the Project is not to be construed as publication in derogation of any reserved rights.

§ 1.5.2 The Contractor, Subcontractors, Sub-subcontractors, and suppliers are authorized to use and reproduce the Instruments of Service provided to them, subject to any protocols established pursuant to Sections 1.7 and 1.8, solely and exclusively for execution of the Work. All copies made under this authorization shall bear the copyright notice, if any, shown on the Instruments of Service. The Contractor, Subcontractors, Sub-subcontractors, and suppliers may not use the Instruments of Service on other projects or for additions to the Project outside the scope of the Work without the specific written consent of the Owner, Architect, and the Architect's consultants.

§ 1.6 Notice

§ 1.6.1 Except as otherwise provided in Section 1.6.2, where the Contract Documents require one party to notify or give notice to the other party, such notice shall be provided in writing to the designated representative of the party to whom the notice is addressed and shall be deemed to have been duly served if delivered in person, by mail, by courier, or by electronic transmission if a method for electronic transmission is set forth in the Agreement.

§ 1.6.2 Notice of Claims as provided in Section 15.1.3 shall be provided in writing and shall be deemed to have been duly served only if delivered to the designated representative of the party to whom the notice is addressed by certified or registered mail, or by courier providing proof of delivery.

§ 1.7 Digital Data Use and Transmission

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

§ 1.8 Building Information Models Use and Reliance

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

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.

(Paragraph Deleted)

§ 2.2 Evidence of the Owner's Financial Arrangements

§ 2.2.1 Not Used.

§ 2.2.2 Following commencement of the Work and upon written request by the Contractor, the Owner shall furnish to the Contractor reasonable evidence that the Owner has made financial arrangements to fulfill the Owner's obligations under the Contract only if (1) the Owner fails to make payments to the Contractor as the Contract Documents require; (2) the Contractor identifies in writing a reasonable concern regarding the Owner's ability to make payment when due; or (3) a change in the Work materially changes the Contract Sum. If the Owner fails to provide such evidence, as required, within fourteen days of the Contractor's request, the Contractor may immediately stop the Work and, in that event, shall notify the Owner that the Work has stopped. However, if the request is made because a change in the Work materially changes the Contract Sum under (3) above, the Contractor may immediately stop only that portion of the Work affected by the change until reasonable evidence is provided. If the Work is stopped under this Section 2.2.2, the Contract Time shall be extended appropriately and the Contract Sum shall be increased by the amount of the Contractor's reasonable costs of shutdown, delay and start-up, plus interest as provided in the Contract Documents.

§ 2.2.3 After the Owner furnishes evidence of financial arrangements under this Section 2.2, the Owner shall not materially vary such financial arrangements without prior notice to the Contractor.

§ 2.2.4 Where the Owner has designated information furnished under this Section 2.2 as "confidential," the Contractor shall keep the information confidential and shall not disclose it to any other person. However, the Contractor may disclose "confidential" information, after seven (7) days' notice to the Owner, where disclosure is required by law, including a subpoena or other form of compulsory legal process issued by a court or governmental entity, or by court or arbitrator(s) order. The Contractor may also disclose "confidential" information to its employees, consultants, sureties, Subcontractors and their employees, Sub-subcontractors, and others who need to know the content of such information solely and exclusively for the Project and who agree to maintain the confidentiality of such information.

§ 2.3 Information and Services Required of the Owner

§ 2.3.1 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.

§ 2.3.2 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.

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

§ 2.3.4 The Owner shall furnish available 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 except to the extent that the Contractor's review thereof reveals, or in the exercise of reasonable diligence should have revealed, any inaccuracy or incompleteness therein. The Owner makes no warranty as to the accuracy or completeness of such information. The Contractor shall exercise proper precautions relating to the safe performance of the Work.

§ 2.3.5 Information or services required of the Owner by the Contract Documents shall be furnished by the Owner with reasonable promptness after receipt from the Contractor of a written request for such information or services.

§ 2.3.6 Unless otherwise provided in the Contract Documents, the Contractor will be furnished, free of charge, 5 copies of Drawings and Project Manuals. All additional hard copies will be furnished upon request at the cost of reproduction.

§ 2.4 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. The Contractor shall resume the Work after such stoppage promptly upon written notice to do so from the Owner. The Contractor shall remain responsible for maintaining the progress of the Work and shall not be entitled to any increase in the Contract Sum or Contract Time. The Contractor shall be responsible for all costs incurred by the Owner attributable to such an order to stop the Work.

§ 2.5 Owner's Right to Carry Out the Work

If the Contractor defaults or neglects to carry out the Work in accordance with the Contract Documents and fails within a ten-day period after receipt of notice from the Owner to commence and continue correction of such default or neglect with diligence and promptness, the Owner may, without prejudice to other remedies the Owner may have, correct such default or neglect. Such action by the Owner and amounts charged to the Contractor are both subject to prior approval of the Architect and the Architect may, pursuant to Section 9.5.1, withhold or nullify a Certificate for Payment in whole or in part, to the extent reasonably necessary to reimburse the Owner for the reasonable cost of correcting such deficiencies, including Owner's expenses and compensation for the Architect's and Owner's Project Manager's additional services made necessary by such default, neglect, or failure. If current and future payments are not sufficient to cover such amounts, the Contractor shall pay the difference to the Owner. If the Contractor disagrees with the actions of the Owner or the Architect, or the amounts claimed as costs to the Owner, the Contractor may file a Claim pursuant to Article 15.

The rights of the Owner hereunder are in addition to any other rights set forth in the Contract Documents or available at law or in equity.

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 its 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 familiar with local conditions under which the Work is to be performed, and correlated personal observations with requirements of the Contract Documents. The Contractor shall not be entitled to any change in the Contract Time or Contract Sum on account of its failure, or that of any Subcontractor, to comply with the foregoing requirements.

§ 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 2.3.4, 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. 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. If the Contractor performs any construction activity that it knows or should know involves a recognized error, inconsistency or omission in the Contract Documents without such notice to the Architect, the Contractor shall assume appropriate responsibility for such performance and shall bear responsibility for the costs of any required correction.

§ 3.2.3 The Contractor is 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. 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 submit 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, subject to Section 15.1.7, as would have been avoided if the Contractor had performed such obligations. **§ 3.2.5** Any claim by the Contractor, in submitting their bid, they did not include all items as shown in the Contract Documents, will be given no consideration for an adjustment of any kind.

§ 3.2.6 The Contractor shall give the Architect timely notice of any additional Drawings, Specifications, or instructions required to define the Work in greater detail, or to permit the proper progress of the Work.

§ 3.2.7 The Contractor shall not proceed with any Work not clearly and consistently defined in detail in the Contract Documents, but shall request additional drawings or instructions from the Architect as provided in subparagraph 3.2.5. If the Contractor proceeds with such Work without obtaining further Drawings, Specifications or instructions, the Contractor shall correct Work incorrectly done at the Contractor's own expense.

§ 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 which shall not be less than such state of skill and attention generally rendered by the contracting profession for projects similar to the Project in scope difficulty and location.

The Contractor shall adequately staff the Project to properly and thoroughly manage, schedule and supervise all construction activities.

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 Contractor unless the Contract Documents give other specific instructions concerning these matters. Where the contract documents refer to particular construction means, methods, techniques, sequences or procedures or indicate or imply that such are to be used in the Work, such mention is intended only to indicate that the operations of the Contractor shall be such as to produce at least the quality of work implied by the operations described, by the actual determination of whether or not the described operations may be safely and suitably employed on the Work shall be the responsibility of the Contractor, who should notify the Architect in writing of the actual means, methods, techniques, sequences or procedures which will be employed on the Work, if these differ from those mentioned in the Contract Documents.

All loss, damage, or liability, or cost of correcting defective work arising from the employment of any construction means, methods, techniques, sequences, or procedures shall be corrected at Contractor's expense, notwithstanding that such construction means, methods, techniques, sequences, or procedures are referred to, indicated or implied by

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the Contract Documents, unless the Contractor has given timely notice to the Owner and Architect in writing that such means, methods, techniques, sequences or procedures are not safe or suitable, and the Owner has then instructed the Contractor in writing to proceed at the Owner's risk.

§ 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. This obligation shall also extend to the presence on the Site of suppliers of materials or equipment, their employees, contractors, and agents engaged in the Work.

§ 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.

§ 3.4.2 Except in the case of minor changes in the Work approved by the Architect in accordance with Section 3.12.8 or ordered by the Architect in accordance with Section 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, and the Contractor shall ensure that all workers to be employed on the Project have successfully completed a course in construction safety and health approved by the United States Occupational Safety and Health Administration (OSHA) of at least 10 hours. The Contractor shall be responsible for maintaining all safety precautions at and around the Project site. On the Owner's request, the Contractor shall permanently remove from the Project site any employee of the Contractor or any Subcontractor who fails to comply with the requirements of the Contract Documents or whose presence or behavior is deemed by the Owner to be adverse to the success of the Project or the Owner's interests.

§ 3.5 Warranty

§ 3.5.1 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 and, promptly after written notification of non-conformance, shall be repaired or replaced by the Contractor with Work conforming to such requirements.

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. If required by the Architect, the Contractor shall furnish satisfactory evidence as to the kind and quality of materials and equipment.

§ 3.5.2 All material, equipment, or other special warranties required by the Contract Documents shall be issued in the name of the Owner, or shall be transferable to the Owner, and shall commence in accordance with Section 9.8.4.

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3.5.3

The Contractor shall be responsible for determining that all materials furnished for the Work meet all requirements of the Contract Documents. The Architect may require the Contractor to produce reasonable evidence that a material meets such requirements, such as certified reports of past tests by qualified testing laboratories, reports of studies by qualified experts, or other evidence which, in the opinion of the Architect, would lead to a reasonable certainty that any material used, or proposed to be used, in the Work meets the requirements of the Contract Documents. All such data shall be furnished at the Contractor's expense. This provision shall not require the Contractor to pay for periodic testing of different batches of the same material, unless such testing is specifically required by the Contract Documents to be performed at the Contractor's expense.

§3.5.4 The Contractor shall guarantee all Work for a period of one year after Date of Substantial Completion, or by the terms of any special guarantee required by the Contract Documents. The Contractor shall, upon written notice from the Owner, promptly correct defective Work or Work not in accordance with the Contract Documents.

§ 3.6 Taxes

The Owner is exempt from Rhode Island sales tax on products permanently incorporated in Work of the Project.

§ 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.

The Construction Documents are being submitted by the Owner to the Fire Marshal and the Building Inspection Department for review. The Owner will pay the costs for this review.

The Contractor will include all permit costs in their Bid. Contact the Local Building Inspector's Office to determine the permit costs.

§ 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. If any of the Work is required to be inspected or approved by any public authority, the Contractor shall cause such inspection or approval to be performed and shall comply with any instructions or corrections ordered by the public authority.

§ 3.7.3 If the Contractor performs Work it knows or should know 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.

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(Paragraph Deleted)

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. 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.

§ 3.8 Allowances

§ 3.8.1 The Contractor shall include in the Contract Sum all allowances stated in the Contract Documents.

(Paragraphs Deleted)

§ 3.9 Superintendent

§ 3.9.1 The Contractor shall employ, in accordance with the Contract Documents, a competent superintendent and necessary assistants who shall be in attendance at the Project site at all times during performance of the Work until the date of Substantial Completion, and for such time thereafter as the Architect may determine to be necessary for the expeditious completion of the Work. The Contractor shall remove the superintendent if requested in writing by the Owner, and shall replace him/her with a competent person reasonably acceptable to Owner.

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 notify the Owner and Architect of the name and qualifications of a proposed superintendent. Within 14 days of receipt of the information, the Architect may notify the Contractor, stating whether the Owner or the Architect (1) has reasonable objection to the proposed

superintendent or (2) requires additional time for review. Failure of the Architect to provide notice 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.

§ 3.9.4 The Contractor shall coordinate and supervise the Work performed by Subcontractors to the end that the Work is carried out without conflict between trades and so that no trade, at any time, causes delay to the general progress of the Work. The Contractor and all Subcontractors shall at all times afford each trade, any separate contractor, or the Owner, every reasonable opportunity for the installation of Work and the storage of materials.

§ 3.10 Contractor's Construction and Submittal Schedules

§ 3.10.1 The Contractor, within twenty (20) calendar days after being awarded the Contract, shall submit for the Owner's and Architect's information a Contractor's construction schedule for the Work. The schedule shall contain detail appropriate for the Project, including (1) the date of commencement of the Work, interim schedule milestone dates, and the date of Substantial Completion; (2) an apportionment of the Work by construction activity; and (3) the time required for completion of each portion of the Work. The schedule shall provide for the orderly progression of the Work to completion and shall not exceed time limits current under the Contract Documents. The schedule shall be revised at appropriate intervals as required by the conditions of the Work and Projector as requested by the Architect.

The construction schedule shall be in such form and contain such information as the Architect and Owner require.

The construction schedule shall be resource loaded for the Contractor and all subcontractors, with each resource identified by name, description, unit of measure, and calendar assignment. For each class of work included in the Contractor's schedule of values, the construction schedule shall show the percentage of completion to be obtained and the total dollar value of the work to be completed as of the first of each month until Substantial Completion. All calculations shall be on the basis of work in place, but not including the value of materials delivered but not in place.

§ 3.10.2 The Contractor, promptly after being awarded the Contract and thereafter as necessary to maintain a current submittal schedule, shall submit a submittal schedule for the Architect's approval. The Architect's approval shall not be unreasonably 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, or fails to provide submittals in accordance with the approved 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.

The Contractor's compliance with the construction schedule is a material obligation of the Contract.

§ 3.10.4 The Contractor shall monitor the progress of the Work for conformance with the requirements of the construction schedule and shall promptly advise the Owner of any delays or potential delays. The construction schedule shall be updated every month (or more frequently if requested by the Owner) to reflect actual conditions (such updates are sometimes referred to in these General Conditions as "progress reports"). In the event any progress report indicates delays in achievement of any milestone date set forth in such schedule, the Contractor shall propose in written form an affirmative plan (the "Recovery Schedule") to correct the delay, including overtime and/or additional labor, if necessary, which Recovery Schedule shall indicate the date by which the progress of the Work will comply with the construction schedule, and shall be subject to the approval of the Owner and the Architect. In no event shall any progress report or Recovery Schedule constitute an adjustment in the construction schedule, Contract Time or any milestone date unless any such adjustment is agreed to by the Owner and authorized pursuant to a Change Order.

§ 3.10.5 In the event (i) that the performance of the Work, as of a milestone date, has not progressed or reached the level of completion required by the construction schedule, and (ii) the progress of the Work is not brought back into compliance with the construction schedule on the date proposed by the Recovery Schedule, or the Contractor otherwise fails to comply with the Recovery Schedule, the Owner shall have the right to order the Contractor to take

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corrective measures to expedite the progress of the Work, including, without limitation, (1) supplying additional manpower, equipment, and facilities, (2) working additional shifts or overtime, (3) working additional days, and (4) other similar measures (hereinafter referred to collectively as "Corrective Measures"). Such Corrective Measures shall continue until the progress of the Work complies with the stage of completion required by the Contract Documents.

§ 3.10.6 The Contractor shall not be entitled to an adjustment in the Contract Sum in connection with Corrective Measures required by the Owner under or pursuant to Section 3.10.5. The Owner may exercise the rights furnished the Owner under or pursuant to Section 3.10.5 as frequently as reasonably necessary to ensure that the Contractor's performance of the Work complies with the milestone dates set forth in the construction schedule.

§ 3.11 Documents and Samples at the Site

The Contractor shall make available, at the Project site, the Contract Documents, including Change Orders, Construction Change Directives, and other Modifications, in good order and marked currently to indicate field changes and selections made during construction, and the approved Shop Drawings, Product Data, Samples, and similar required submittals. These shall be in electronic form or paper copy, available to the Architect and Owner, and delivered to the Architect for submittal to the Owner upon completion of the Work as a record of the Work as constructed.

§ 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 how 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. By approving and submitting Shop Drawings, Product Data, Samples, and similar submittals the Contractor thereby represents that the Contractor has determined and verified all dimensions, quantities, field dimensions, relations to existing work, coordination with work to be installed later, coordination with information on previously accepted Shop Drawings, Product Data, Samples, or similar submittals and verification of compliance with all the requirements of the Contract Documents. The accuracy of all such information is the responsibility of the Contractor. In reviewing Shop Drawings, Product Data, Samples, and similar submittals the Architect shall be entitled to rely upon the Contractor's representation that such information is correct and accurate.

§ 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. The accuracy of all such information is the responsibility of the Contractor. In reviewing Shop Drawings, Product Data, Samples, and similar submittals the Architect shall be entitled to rely upon the Contractor's representation that such information is correct and accurate.

§ 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 the requirements of the Contract Documents by the Architect's approval of Shop Drawings, Product Data, Samples, or similar submittals, unless the Contractor has specifically notified the Architect 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 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.

§ 3.12.10.1 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 be entitled to rely upon the adequacy and accuracy of the performance and design criteria provided in the Contract Documents. The Contractor shall cause such services or certifications to be provided by an appropriately 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 and accuracy of the services, certifications, and approvals performed or provided by such design professionals. Pursuant to this Section 3.12.10, the Architect will review and 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.

§ 3.12.10.2 If the Contract Documents require the Contractor's design professional to certify that the Work has been performed in accordance with the design criteria, the Contractor shall furnish such certifications to the Architect at the time and in the form specified by the Architect.

§ 3.12.11 When professional certification of materials, systems or equipment is required by the Contract Documents, the Owner shall be entitled to rely upon such certifications, and neither the Owner nor the Architect shall be expected to make an independent examination with respect to the performance of such materials, systems or equipment.

§ 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, lawful orders of public authorities, and the Contract Documents and shall not unreasonably encumber the site with materials or equipment.

The right of possession of the premises and the improvements made thereon by the Contractor shall remain at all times with the Owner. The Contractor's right to entry and use thereof arises solely from the permission granted by the Owner under the Contract Documents. The Owner shall not be liable to the Contractor, the Subcontractors, their employees, or anyone else with respect to the conditions of the premises, except only for a condition caused directly and solely by the negligence of

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the
Owner.

§ 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, or patching shall be restored to the condition existing prior to the cutting, fitting, or 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 construction by the Owner or a Separate Contractor except with written consent of the Owner and of the Separate Contractor. Consent shall not be unreasonably withheld. The Contractor shall not unreasonably withhold, from the Owner or a Separate Contractor, its 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 and rubbish caused by operations under the Contract. At completion of the Work, the Contractor shall remove waste materials, rubbish, the Contractor's tools, construction equipment, machinery, and surplus materials from and about the Project site.

§ 3.15.2 If the Contractor fails to clean up as provided in the Contract Documents, the Owner may do so and the Owner shall be entitled to reimbursement from the Contractor and may deduct all costs thereof from any payment due the Contractor.

§ 3.16 Access to Work

The Contractor shall provide the Owner, Owner's representatives, and Architect with 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 defense or loss when a particular design, process, or product of a particular manufacturer or manufacturers is required by the Contract Documents, or where the copyright violations are contained in Drawings, Specifications, or other documents prepared by the Owner or Architect. However, if an infringement of a copyright or patent is discovered by, or made known to, the Contractor, the Contractor shall be responsible for the loss unless the information is promptly furnished to the Architect.

§ 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, including claims, damage, loss or expense attributable to bodily injury, sickness, disease or death, or to injury to or destruction of tangible property, including the Work, caused in whole or in part by the negligent or wrongful 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, including those of indemnity, which would otherwise exist as to a party or person described in this section.

§ 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.

§ 3.18.3 The obligations of the Contractor under this paragraph 3.18 shall not extend to the liability of the Architect, the Architect's consultants, and agents or employees of any of them arising out of (1) the preparation of maps,

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Drawings, opinions, reports, surveys, Change Orders, designs or Specifications, or (2) directions or instructions given by the Architect, the Architect's consultants and agents or employees of any of them, provided such instructions or directions are the primary cause of the injury or damage.

§ 3.18.4 The Owner and the Architect have acknowledged that nothing in the Architect's engagement implies any undertaking by the Architect for the benefit of or which may be enforced by the Contractor, its Subcontractors, or the surety of any of them; it being understood that the Architect's obligations are to the Owner and that, in performing such obligations, the Architect may increase the burdens and expense of the Contractor, its Subcontractors or the surety of any of them. Neither the Contractor, any Subcontractor, nor the surety of any of them shall bring any civil suit or other legal action against the Architect arising out of or in connection with the Project.

ARTICLE 4 ARCHITECT

§ 4.1 General

§ 4.1.1 The Architect is the person or entity retained by the Owner pursuant to Section 2.3.2 and identified as such in the Agreement.

§ 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 and Architect. Consent of the Owner shall not be unreasonably withheld.

§ 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.

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

§ 4.2.4 Communications

The Owner and Contractor shall include the Architect in all communications that relate to or affect the Architect's services or professional responsibilities. The Owner shall promptly notify the Architect of the substance of any direct communications between the Owner and the Contractor otherwise relating to the Project. Communications by and with the Architect's consultants shall be through the Architect. Communications by and with Subcontractors and suppliers shall be through the Contractor. Communications by and with Separate Contractors shall be through the Owner. The Contract Documents may specify other communication protocols.

§ 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 13.4.2 and 13.4.3, whether or not the 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, suppliers, their agents or employees, or other persons or entities performing portions of the Work.

§ 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 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 order 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 Not Used

§ 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.

§ 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 the 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, the Contractor, as soon as practicable after award of the Contract, shall notify the Owner and Architect of the persons or entities proposed for each principal portion of the Work, including those who are to furnish materials or equipment fabricated to a special design. Within 14 days of receipt of the information, the Architect may notify the Contractor whether the Owner or the Architect (1) has reasonable objection to any such proposed person or entity or (2) requires additional time for review.

§ 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 and legally permissible 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. No increase in the Contract Sum or Contract Time shall be allowed for such change.

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

§ 5.3 Subcontractual Relations

By appropriate written agreement, 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 that the Contractor, by these Contract 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 Article 14 and only for those subcontract agreements that the Owner accepts by notifying the Subcontractor and Contractor;
- .2 assignment is subject to the prior rights of the surety, if any, obligated under bond relating to the

Contract; and

(Paragraph Deleted)

- .3 the Owner may further assign the subcontract to a successor contractor or other entity.

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

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§ 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 any Separate Contractors and the Owner in reviewing their construction schedules. The Contractor shall make any revisions to its 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 The Owner reserves the right to enter any part of the Project site at any time to inspect the Work or to perform other work with its own forces or separate contractors, or to address any emergency situation. Such access is not to be construed to mean partial occupancy by the Owner and no claim for increase in the Contract Time or Sum will be considered unless such Owner's contractors have delayed or damaged the Contractor's Work. The Contractor shall permit the Owner to place and install as much furniture, equipment and other material during the progress of the Work as is possible before completion of the various parts of the Work and agrees that such placing and installation of equipment shall not in any way evidence the completion or acceptance of the Work or any portion of it.

§ 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 notify the Architect of apparent discrepancies or defects in the construction or operations by the Owner or Separate Contractor that would render it unsuitable for proper execution and results of the Contractor's Work. Failure of the Contractor to notify the Architect of apparent discrepancies or defects prior to proceeding with the Work 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. The Contractor shall not be responsible for discrepancies or defects in the construction or operations by the Owner or Separate Contractor that are not apparent.

§ 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.

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

(Paragraph Deleted)

§ 6.3 Owner's Right to Clean Up

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

ARTICLE 7 CHANGES IN THE WORK

§ 7.1 General

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

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

§ 7.1.3 Changes in the Work shall be performed under applicable provisions of the Contract Documents. The Contractor shall proceed promptly with changes in the Work, 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.

§ 7.2.2 Upon request of the Owner or the Architect, the Contractor shall without cost to the Owner submit to the Architect, in such form as the Architect may require, an accurate written estimate of the cost of any proposed extra Work or change. The estimate shall indicate the quantity and unit cost of each item of material, and the number of hours of work and hourly rate for each class of labor, as well as a description and the amounts of all other costs chargeable under the terms of this Article. Unit labor costs for the installation of each item of material shall be shown if required by the Architect. The Contractor shall promptly revise and resubmit each estimate if the Architect determines that it is not in compliance with the requirements of this Article, or that it contains errors of fact or mathematical errors. If required by the Architect, in order to establish the exact cost of new Work added or of previously required Work omitted, the Contractor shall obtain and furnish to the Architect bona fide proposals from recognized suppliers for furnishing any material included in such Work. Such estimates shall be furnished promptly so as to occasion no delay in the Work, and shall be furnished at the Contractor's expense. The Contractor shall state in the estimate any extension of time required for the completion of the Work if the change or extra work is ordered.

§ 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, and if the Contract Documents include a unit price for the work that is the subject of such directive, such unit price shall be the basis of the adjustment to the Contract Sum, unless the Owner, in its sole discretion, chooses another method. If, however, the Contract Documents do not include a unit price for such work, the adjustment shall be based on one of the following methods, as selected by the Owner:

- .1 Mutual acceptance of a lump sum properly itemized and supported by sufficient substantiating data to permit evaluation;
- .2 Unit prices 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 7.3.4.

§ 7.3.4 If the proposed method of adjustment in the Contract Sum is based on unit prices that are stated in the Contract Documents, such unit prices shall be the basis of any adjustment to the Contract Sum, unless the Owner has chosen another method pursuant to subparagraph 7.3.3. If the proposed method of adjustment is not based on such unit prices and the Contractor objects to the proposed method of adjustment, the Contractor must notify the Architect of such objection in writing within five (5) calendar days from Contractor's receipt of the Construction Change Directive. Failure to so object will irrevocably

waive any such objections and claims on account of such method of adjustment, and the Construction Change Directive shall be deemed and shall constitute a Change Order. If the Contractor does so object, the adjustment to the Contract Sum shall be determined by the Architect 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 allowance for overhead and profit in accordance with the Clauses 7.3.11.1 through 7.3.11.6 below.

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 7.3.4 shall be limited to the following:

- .1 Costs of labor, including applicable payroll taxes, fringe benefits required by agreement or custom, workers' compensation insurance, and other employee costs approved by the Architect;
- .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 and permit fees directly related to the change; and
- .5 Costs of supervision and field office personnel directly attributable to the change.

§ 7.3.5 If the Contractor disagrees with the adjustment in the Contract Time, the Contractor may make a Claim in accordance with applicable provisions of Article 15.

§ 7.3.6 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.

§ 7.3.7 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 deemed a Change Order.

§ 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 all changes for any given trade.

§ 7.3.9 Pending final determination of the total cost of a Construction Change Directive to the Owner amounts for such changes in the Work shall not be included in Applications for Payment. Such amounts shall only be included in an Application for Payment after the adjustment for the Construction Change Directive has been included in a Change Order signed by the Owner and the Contractor. 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.

§ 7.3.11 The allowance for the combined overhead and profit is to be as listed below.

- .1 For the Contractor, for Work performed by the Contractor's own forces, 10 percent of the cost.
- .2 For the Contractor, for Work performed by the Contractor's Subcontractor, 6 percent of the amount due the Subcontractor.
- .3 For each Subcontractor involved, for Work performed by that Subcontractor's own forces, 10 percent of the cost.
- .4 Cost to which overhead and profit is to be applied shall be determined in accordance with Subparagraph 7.3.4.

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- .5 Overhead and profit is to include the Contractor's project management and supervisory costs, all administrative expenses and personnel, change estimate preparation, mobilization, setup & break-down, meetings, all safety related costs, cleanup costs and storage costs pertaining to the changes in the work.
- .6 The fee increase to any permit required by the additional work is allowed to be added to the Change Order costs. However, the Contractor is required to submit proof that the additional fee was paid to the presiding authority.
- .7 In order to facilitate checking of quotations for extras or credits, all proposals, except those so minor that their propriety can be seen by inspection, shall be accompanied by a 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 shall be itemized also. In no case will a change involving over \$500.00 be approved without such itemization.

§ 7.4 Minor Changes in the Work

The Architect may order minor changes in the Work that are consistent with the intent of the Contract Documents and do not involve an adjustment in the Contract Sum or an extension of the Contract Time. The Architect's order for minor changes shall be in writing. If the Contractor believes that the proposed minor change in the Work will affect the Contract Sum or Contract Time, the Contractor shall notify the Architect and shall not proceed to implement the change in the Work. If the Contractor performs the Work set forth in the Architect's order for a minor change without prior notice to the Architect that such change will affect the Contract Sum or Contract Time, the Contractor waives any adjustment to the Contract Sum or extension of the Contract Time.

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, commence the Work prior to the effective date of insurance required to be furnished by the Contractor and Owner.

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

§ 8.2.4 Unless specifically required by law, no payment under this Contract shall be due until the construction schedule, required by Section 3.10, and conforming to the requirements of the General Requirements has been accepted by the Architect.

§ 8.2.5 If the Architect in reviewing any Application for Payment determines that the amount of completed Work in place as certified by the Architect is less than 90% of the Work in place required by the Contractor's construction schedule or schedule of values provided for in Section 9.2, or that there have been delays to critical paths and the Contract completion date will not be met, or that, in the Owner's sole discretion, there is reasonable concern that the Work will not be Substantially Complete by the date required in the Contract Documents, the Contractor shall be required to submit a recovery schedule with a written description of the steps the Contractor intends to take to put the Project back on schedule. At the Owner's option, the Contractor shall take some or all of the following actions at no additional cost to the Owner:

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- 1 Increase the number of workers on the site, in such quantities and trades as will substantially eliminate the backlog of work;
- 2 Increase the number of working hours per shift, shifts per day, working days per week, amount of construction equipment, or any combination of the foregoing, sufficiently to substantially eliminate backlog of work; or
- 3 Reschedule activities so that the completion dates initially scheduled will be met.

§ 8.2.6 If the Architect has determined that the Contractor should be permitted to extend the time for completion as provided in paragraph 8.3, the calendar dates in the Progress Schedule shall be adjusted accordingly to retain their same relationship to the adjusted date of Substantial Completion, and the dollar value of Work to be completed as of the first of each month shall be adjusted prorata.

§ 8.2.7 If the Contractor fails to submit any Application for Payment in any month, the Architect shall, for the purpose of this evaluation of progress, certify separately to the actual value of the Work in place completed as of the first of the month to the best of the Architect's knowledge.

§ 8.2.8 Nothing herein shall limit the Owner's right to liquidated or other damages for delays by the Contractor or to any other remedy which the Owner may possess under other provisions of the Contract Documents or by law.

§ 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 (1) an act or neglect of the Owner or Architect, of an employee of either, or of a Separate Contractor; (2) by changes ordered in the Work; (3) by labor disputes, fire, unusual delay in deliveries, unavoidable casualties, adverse weather conditions documented in accordance with Section 15.1.6.2, or other causes beyond the Contractor's control; (4) by delay authorized by the Owner or (5) by other causes that the Contractor asserts, and the Architect determines, justify delay, then the Contract Time shall be extended for such reasonable time as the Architect may determine, and this shall be the Contractor's sole remedy for such delay. Under no circumstances will the Contractor be entitled to an increase in the Contract Sum, or to any other damages, on account of or in connection with any delay, regardless of the cause of such delay, and Contractor agrees not to make any claim for such damages, including, but not limited, claims for damages on account of having to perform out-of-sequence work, claims for damages on account of loss of production, and claims for damages on account of hindrances or interference with the work.

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

§ 8.3.3 No extension of time shall be granted because of seasonal or abnormal variations in temperature, humidity or precipitation, which conditions shall be wholly at the risk of the Contractor, whether occurring within the time originally scheduled for completion or within the period of any extension granted. There shall be no increase in the Contract Sum on account of any additional costs of operations or conditions resulting therefrom.

§ 8.3.4 The Contractor hereby agrees that the Contractor shall have no claim for damages of any kind against the Owner or the Architect on account of any delay in the commencement of the Work and/or any hindrance, delay or suspension of any portion of the Work, whether such delay is caused by the Owner, the Architect, or otherwise. The Contractor acknowledges that the Contractor's sole remedy for any such delay and/or suspension will be an extension of time as provided in this Article.

§ 8.4 Liquidated Damages

§ 8.4.1 It is expressly understood and agreed, by and between the Contractor and Owner, that the time for the completion of the Work described herein is a reasonable time for the completion of same, taking into consideration the average climatic range and usual industrial and/or residential conditions prevailing in this locality. If the said Contractor shall neglect, fail or refuse to complete the Work within the times herein specified, or any proper extension thereof granted by the Owner, then the Contractor does hereby agree, as a part consideration for the awarding of this Contract, to pay to the Owner the amount stipulated in these Contract Documents, not as a penalty but as liquidated damages for such breach of contract, for each and every calendar day that the Contractor shall be in default after the time stipulated for completing the Work. The said amount is fixed and agreed upon by and between the Contractor and the Owner because of the impracticability and difficulty of fixing and ascertaining the actual damages the Owner would in such event sustain, and said amount is agreed to be the amount of damages which the Owner would sustain and said amount shall be deducted by the Owner from periodic payments.

ARTICLE 9 PAYMENTS AND COMPLETION

§ 9.1 Contract Sum

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

§ 9.1.2 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, in the opinion of the Architect, application of such unit prices to quantities of Work proposed will cause substantial inequity to the Owner, the applicable unit prices shall be equitably adjusted.

§ 9.2 Schedule of Values

Where the Contract is based on a stipulated sum or Guaranteed Maximum Price, the Contractor shall submit a schedule of values to the Architect before the first Application for Payment, allocating the entire Contract Sum to the various portions of the Work. The schedule of values shall be prepared in the form, and supported by the data to substantiate its accuracy, required by the Architect. This schedule, unless objected to by the Architect, shall be used as a basis for reviewing the Contractor's Applications for Payment. Any changes to the schedule of values shall be submitted to the Architect and supported by such data to substantiate its accuracy as the Architect may require, and unless objected to by the Architect, shall be used as a basis for reviewing the Contractor's subsequent Applications for Payment, and shall be revised if later found by the Architect to be inaccurate. In addition, the Contractor shall submit to the Architect, at least 14 days before the first Application for Payment, a Cash Flow Schedule that shows the percentage completion to be obtained and the total dollar value of Work to be completed as of the first of each month until Substantial Completion. All calculations in the Cash Flow Schedule shall be on the basis of Work in place and shall exclude the value of materials delivered but not in place.

§ 9.2.1 The Cash Flow Schedule shall be based on an orderly progression of the Work allowing adequate time for each operation (including adequate time for submission and review of submittals) and leading to a reasonable certainty of Substantial Completion by the date established in the Agreement. The Cash Flow Schedule will be reviewed by the Architect for compliance with the requirements of the Contract Documents. Unless specifically required by law, no payment under this Contract shall be due until the Cash Flow Schedule has been reviewed and approved by the Architect. The Architect's review of the Cash Flow Schedule shall not impose any duty on the Architect or the Owner with respect to the timing, planning, scheduling or execution of the Work. In particular if the Contractor proposes a Cash Flow Schedule indicating a date of Substantial Completion which is earlier than the Contract Time the Contractor shall not be entitled to additional payment or compensation of any kind if for any reason the full Contract Time is required to achieve Substantial Completion of the Work.

§ 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. The application shall be notarized, if required, and supported by all data substantiating the Contractor's right to payment that the Owner or Architect require, such as copies of requisitions, and releases and waivers of liens from Subcontractors and suppliers, and shall reflect retainage if provided for in the Contract Documents. The form of Application for Payment shall be a notarized AIA Document G702, Application and Certification for Payment, supported by AIA Document G703, Continuation Sheet.

§ 9.3.1.1 Each Application for Payment or periodic estimate requesting payment shall be accompanied at the owner's option by (i) a waiver of liens from each Subcontractor or (ii) a certificate from each Subcontractor stating that the Subcontractor has been paid all amounts due the Subcontractor on the basis of the previous periodic payment to the Contractor, or else stating the amount not so paid and the reason for the discrepancy. In the event of any such discrepancy, the Contractor shall furnish the Contractor's own written explanation to the Owner through the Architect. Such waiver or certificate shall be in a form acceptable to the Owner.

§ 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 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. The Owner may deduct the amount of such costs from payments due the Contractor.

§ 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 encumbrances, in favor of the Contractor; Subcontractors, suppliers, or other persons or entities that provided labor, materials, and equipment relating to the Work.

§ 9.4 Certificates for Payment

§ 9.4.1 Subject to the Contractor's compliance with Section 9.3 and the provisions of Section 9.6, the Architect will, within seven days after receipt of the Contractor's Application for Payment, either (1) issue to the Owner a Certificate for Payment in the full amount of the Application for Payment, with a copy to the Contractor; or (2) issue to the Owner a Certificate for Payment for such amount as the Architect determines is properly due, and notify the Contractor and Owner of the Architect's reasons for withholding certification in part as provided in Section 9.5.1; or (3) withhold certification of the entire Application for Payment, and notify the Contractor and Owner of the Architect's reason for withholding certification in whole 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 in the Application for Payment, that, to the best of the Architect's knowledge, information, and belief, the Work has progressed to the point indicated, the quality of the Work is in accordance with the Contract Documents, and that the Contractor is entitled to payment in the amount certified. The foregoing representations are subject to an evaluation of the Work for conformance with the Contract Documents upon Substantial Completion, to results of subsequent tests and inspections, to correction of minor deviations from the Contract Documents prior to completion, and to specific qualifications expressed by the Architect. However, the issuance of a Certificate for Payment will not be a representation that the Architect has (1) made exhaustive or continuous on-site inspections to check the quality or quantity of the Work; (2) reviewed construction means, methods, techniques, sequences, or procedures; (3) reviewed copies of requisitions received from Subcontractors and suppliers and other data requested by the Owner to substantiate the Contractor's right to payment; or (4) made examination to ascertain how or for what purpose the Contractor has used money previously paid on account of the Contract Sum.

§ 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 suppliers for labor, materials or equipment;
- 4 reasonable evidence that the Work cannot be completed for the unpaid balance of the Contract Sum;
- 5 damage to the Owner or a Separate Contractor;

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- .6 reasonable evidence that the Work will not be completed within the Contract Time, and that the retainage currently held by the Owner 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.
- .8 failure of the Contractor or mechanical or electrical trade subcontractors to comply with requirements of the General Requirements for maintaining record drawings. The Contractor shall check record drawings each month. Written confirmation that the record drawings are current will be required by the Architect before approval of the Contractor's monthly payment requisition;
- .9 failure of the Contractor to provide required warranties under Section 9.3, claims for direct payment, or reasonable evidence indicating probable filing of such claims;
- .10 costs incurred by the Owner under Section 10.2.5;
- .11 failure of the Contractor to submit prerequisite documentation required by the General Requirements; or
- .12 liquidated damages due the Owner pursuant to Section 8.4.

§ 9.5.2 When either party disputes the Architect's decision regarding a Certificate for Payment under Section 9.5.1, in whole or in part, that party may submit a Claim in accordance with Article 15.

§ 9.5.3 Not Used

§ 9.5.4 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 supplier 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 Contractor shall reflect such payment on its next Application 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. The Owner reserves the right to withhold payment to the Contractor, in whole or in part, for any or all of the reasons cited in Clauses 9.5.1.1 through 9.5.1.12.

§ 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 suppliers amounts paid by the Owner to the Contractor for subcontracted Work. The Owner shall have the right to contact Subcontractors and suppliers 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 or supplier, except as may otherwise be required by law.

§ 9.6.5 Not Used

§ 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

Provided the Owner has fulfilled its payment obligations under the Contract Documents, the Contractor shall defend and indemnify the Owner from all loss, liability, damage or expense, including reasonable attorney's fees and

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litigation expenses, arising out of any lien claim or other claim for payment by any Subcontractor or supplier of any tier. Upon receipt of notice of a lien claim or other claim for payment, the Owner shall notify the Contractor. If approved by the applicable court, when required, the Contractor may substitute a surety bond for the property against which the lien or other claim for payment has been asserted.

§ 9.7 Not Used

(Paragraph Deleted)

§ 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.

In addition, Substantial Completion for the entire Project shall be achieved only when:

- .1 the Owner has beneficial occupancy and use of the entire Project for all its intended uses;
- .2 all Project systems included in the Work are operational and acceptable to the Owner;
- .3 all governmental inspections for the Project have been successfully completed, all governmental approvals and related paperwork have been delivered to the Owner, and final and unconditional certificates of occupancy for the entire Project have been delivered to the Owner;
- .4 the only remaining Work to be performed is minor in nature and the remaining Work may reasonably be performed without having a material adverse effect on or materially interfering with the Owner's occupancy and use of the Project and
- .5 all prerequisites to Substantial Completion defined in the Contract Documents have been completed.

§ 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 together with the estimated value of completing or correcting such items (the "Punchlist") and (2) the permits and certificates referenced in Section 13.5. The Architect shall have the right to modify and supplement the Punchlist, including the estimated value of completion or correction.

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.

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

§ 9.8.5 The Certificate of Substantial Completion shall be submitted to the Owner and Contractor by the Architect. The certificate shall state the date of substantial completion, shall state any consequent responsibilities of the Contractor and the Owner in accordance with the Contract Documents. The Contractor shall complete and correct any incomplete and defective work within the number of calendar days stipulated in these Contract Documents.

§ 9.8.6 Services provided by the Architect to conduct more than three (3) inspections of completed Work or any inspections beyond thirty (30) calendar days after the date of substantial completion of any portion of the Work as stated in the Agreement shall be paid by the Contractor to the Owner. The Owner may deduct the cost of such services and inspections from payments due the Contractor.

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§ 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. Such partial occupancy or use may commence whether or not the portion is substantially complete, provided the Owner has accepted in writing the responsibilities assigned to it and the Contractor for payments, retainage, if any, security, maintenance, heat, utilities, damage to the Work and insurance. 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. 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 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. When the Architect finds the Work acceptable under the Contract Documents and the Contract fully performed, the Architect will promptly issue a final Certificate for Payment stating that to the best of the Architect's knowledge, information and belief, and on the basis of the Architect's on-site visits and inspections, the Work has been completed in accordance with the Contract Documents and that the entire balance found to be due the Contractor and noted in the final Certificate is due and payable. The Architect's final Certificate for Payment will constitute a further representation that conditions listed in Section 9.10.2 as precedent to the Contractor's being entitled to final payment have been fulfilled. By Final Completion, the Contractor shall have completed its performance of all Punchlist items, completed all balancing of mechanical and other applicable systems and all seasonal system adjustments that are reasonably necessary to proper functioning of the completed Project, delivered to the Owner all operations and maintenance manuals and completed related training for such manuals, and delivered to the Owner all required warranties and guarantees.

§ 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, (3) a written statement that the Contractor knows of no 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, (5) documentation of any special warranties, such as manufacturers' warranties or specific Subcontractor warranties, and (6) if required by the Owner, other data establishing payment or satisfaction of obligations, such as receipts and 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 the Contractor fails to furnish such releases or waivers as the Owner reasonably requires to satisfy the Owner that there are no outstanding liens, the Owner may require the Contractor, as a condition of final payment and at the Contractor's expense, to furnish a bond satisfactory to the Owner to indemnify the Owner against any such liens.
(Paragraphs Deleted)

§ 9.10.3 Acceptance of final payment by the Contractor, a Subcontractor, or a supplier, shall constitute a waiver of claims by that payee for payment for Work performed and of all other claims of which the payee knew or should have known at the time of final payment, 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, a Subcontractor, or a Sub-subcontractor;
- .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; and
- .4 work or property of the Owner, its tenants, or other parties at or near the Project site with the Owner's permission.

§ 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 implement, 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 the owners and users of adjacent sites and utilities of the safeguards.

§ 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, 10.2.1.3 and 10.2.1.4 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. The foregoing obligations of the Contractor are in addition to the Contractor's obligations under Section 3.18. Where the damage or loss presents an immediate danger to the public, the Owner, in its sole discretion and at the Contractor's expense, may promptly remedy such damage or loss without prior notice to the Contractor.

§ 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, notice of the 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.

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10.2.9 The Contractor shall provide and maintain in good operating condition suitable and adequate fire protection equipment and services, and shall comply with all reasonable recommendations regarding fire protection made by the representatives of the fire insurance company carrying insurance on the Work or by the local fire chief or fire

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marshal. The area within the site limits shall be kept orderly and clean, and all combustible rubbish shall be promptly removed from the site.

§ 10.2.10 The Contractor shall at all times protect excavations, trenches, buildings and materials from rain water, groundwater, backup or leakage of sewers, drains and other piping, and from water of any other origin and shall remove promptly any accumulation of water. The Contractor shall provide and operate all pumps, piping and other equipment necessary to this end.

§ 10.2.11 The Contractor shall remove snow and ice which might result in damage or delay.

§ 10.2.12 During the progress of the Work and at all times prior to the date of Substantial Completion or occupancy of the Work by the Owner, whichever is earlier, the Contractor shall provide temporary heat, ventilation, and enclosure, adequate to permit the Work to proceed in a timely fashion, and to prevent damage to completed Work or Work in progress, or to materials stored on the premises. The use of the permanent heating and/or ventilation systems for temporary heat and/or ventilation shall be subject to the prior written approval of the Owner and Architect.

§ 10.2.13 The Contractor shall install weather protection and furnish adequate heat in the protected area from November 1 to March 31 as necessary.

§ 10.3 Hazardous Materials and Substances

§ 10.3.1 The Contractor is responsible for compliance with any requirements included in the Contract Documents regarding hazardous materials or substances. The Contractor shall not cause or permit any introduction onto, under, or near the Owner's property of any hazardous materials or substances as defined by any applicable law, and shall not cause or permit any release, discharge, transportation, storage, or disposal of such materials or substances onto, under, or near the Owner's property or areas near the Owner's property. If the Contractor encounters or recognizes on the site any material known or reasonably believed to be hazardous, including but not limited to asbestos or polychlorinated biphenyl (PCB), the Contractor shall immediately stop Work in the area affected and report the condition to the Owner and Architect in writing. The Contractor and the Owner shall cooperate in implementing measures to remove or contain said material and the Contractor shall comply with all directions of the Architect in the implementation of such removal or containment.

§ 10.3.2 The Contractor shall reimburse the Owner for the cost and expense the Owner incurs (1) for remediation of hazardous materials or substances the Contractor brings to the site and negligently handles, or (2) where the Contractor fails to perform its obligations under Article 10 or for any violation of applicable law related to the Contractor's noncompliance with the provisions of this Article 10.

§ 10.3.3 The parties anticipate that certain hazardous substances and/or materials may be discovered at the site. When such conditions are set forth in the Contract Documents, the Contractor acknowledges that such conditions have been considered in establishing the Contract Time and Contract Sum. No extension of the Contract Time or increase in the Contract Sum shall be claimed or allowed with respect to any hazardous substances or materials located at the site which were disclosed in the Contract Documents. The Contractor shall strictly comply with all laws, regulations, rules, orders, ordinances and the like related to the excavation, storage, removal and disposal of any such hazardous substances or materials.

§ 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 include all major divisions of coverage, and shall be on a comprehensive general basis including Premises and Operations (including X-C-U), Owner's and Contractor's Protective, Products and Completed Operations, and Owned, Non-owned, and Hired Motor Vehicles. Such insurance shall be written for not less than any limits of liability required by law or those set forth in the Contract Documents, whichever is greater.

(Paragraph Deleted)

All insurance shall be written on an occurrence basis, unless the Owner approves in writing coverage on a claims-made basis. Coverages, whether written on an occurrence or claims-made basis, shall be maintained without interruption from date of commencement of the Work until date of final payment and any further period during which coverage is required to be maintained after final payment by the Contract Documents. The Owner shall be named an Additional Insured on all policies.

Coverage for such liability insurance shall be provided by a company or companies reasonably acceptable to the Owner and authorized to do business in Massachusetts. Contractor shall furnish to Owner written confirmation as to the insurance carrier's most current financial ratings prior to commencing work.

§ 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.

These certificates shall set forth evidence of all coverage required by Sections 11.1.1 and 11.1.2. The Contractor shall furnish to the Owner copies of any endorsements that are subsequently issued amending limits of coverage.

§ 11.1.3.1 The Contractor shall be responsible for having acceptable insurance coverage provided by or on behalf of all Subcontractors, with such insurance to be similar to that required of the Contractor under the Agreement and these General Conditions. The Contractor shall not allow any Subcontractor to commence Work on the Project prior to the Contractor's receipt of certificates of insurance that are acceptable in form and limits to the Owner; the Owner shall have no obligation to pay the Contractor for any Work performed by a Subcontractor who has not supplied acceptable insurance certificates prior to starting its Work.

The Owner shall be named an additional insured on all such certificates.

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§ 11.1.3.2 All insurance policies shall contain provisions or endorsements necessary to assure coverage of claims by one insured against another. All required insurance policies are to be endorsed to state that the Contractor's policies shall be primary to all other insurance available to the Owner and other specified additional insureds for liability arising out of or resulting from the Contractor's operations under the Contract, 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.

§ 11.1.4 The Contractor shall cause the commercial liability coverage required by the Contract Documents to include (1) the Owner, the Owner's Project Manager, 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.

§ 11.1.5 In no case shall the limits of liability be less than the following:

.1 General Liability of at least \$1,000,000 Bodily Injury and Property Damage Liability, Combined Single Limit with a \$3,000,000 Annual Aggregate Limit. Products and Completed Operations is to be maintained for up to 3 years after the completion of the project.

(Paragraph Deleted)

.2 Automobile Liability (applicable for any contractor who has an automobile operating exposure) of at least \$1,000,000 Bodily Injury and Property Damage per accident.

.3 Workers' Compensation Insurance as required by law.

.4 Builders' Risk Property Coverage for the full insurable value (completed value) including existing structure of the building under construction if applicable. It is to include "All Risk" insurance for physical loss or damage including theft.

.5 Property Coverage for materials and supplies being transported by the contractor, as the Town's Property Contract provides coverage for personal property within 1000 feet of the premises.

.6 Umbrella Liability of at least \$2,000,000/occurrence, \$2,000,000/aggregate.

§ 11.2 OWNER'S LIABILITY INSURANCE The Contractor shall procure and pay for an Owner's policy of Owner's protective liability insurance insuring the Owner and its officers, employees and agents against claims which may arise from operations under the Contract or relating thereto.

§ 11.3 PROPERTY INSURANCE

§ 11.3.1 The Contractor shall purchase and maintain property insurance upon the entire Work at the site to the full insurable value thereof. Coverage for such liability insurance shall be provided by a company or companies reasonably acceptable to the Owner. Contractor shall furnish to Owner written confirmation as to the insurance carrier's most current financial ratings prior to commencing work. Such insurance shall include the interests of the Owner, the

Contractor, Subcontractors and Sub-subcontractors in

the work and shall insure against the perils of fire and extended coverage and shall include "all risks" insurance for physical loss or

damage including without duplication, theft, vandalism and malicious mischief. This insurance shall also cover portions of

the Work stored off the site or in transit. If this insurance is written with stipulated amounts deductible, the Owner shall not be responsible for any difference between the payments made by the insurance carrier and the claim. The policy shall contain a provision that coverages afforded under policies will not be canceled or allowed to expire until at least 30 days' written notice has been given to the Owner. The Owner shall be named insured within the policy.

§ 11.3.2 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.

§ 11.3.3 The Owner shall have the power to adjust and settle with its insurers any loss for which it has obtained insurance.

Upon the occurrence of an insured loss, the Owner and the Contractor shall cooperate with each other and with each other's insurer in the submission of claims and related information and the distribution of any insurance proceeds. If after such a loss no other special agreement is made, replacement of damaged work shall be covered by an appropriate change order.

§ 11.4 PERFORMANCE BOND AND PAYMENT BOND

§ 11.4.1 Contractor shall furnish bonds covering faithful performance of the Contract and payment of obligations arising thereunder, each in the amount of 100% of the Contract Price, and each by a surety company qualified to do business under the laws of the State of Rhode Island and acceptable to the Owner. The attorney-in-fact who signs the bonds on behalf of the surety, must affix to each bond a certified and current copy of the power of attorney. The Performance and Payment Bonds shall be written in a form satisfactory to the Owner.

§ 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.

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, the Contractor shall be entitled to an equitable adjustment to the Contract Sum and Contract Time as may be appropriate. If such Work is not in accordance with the Contract Documents, the costs of uncovering the Work, and the cost of correction, shall be at the Contractor's expense.

§ 12.2 Correction of Work

§ 12.2.1 Before Substantial Completion

The Contractor shall promptly correct Work rejected by the Architect or failing to conform to the requirements of the Contract Documents, discovered before 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. The Contractor shall bear the cost of any loss or damages to the Owner resulting from such failure or defect.

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§ 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 any applicable special warranty required by the Contract Documents, any of the Work is found to be not in accordance with the requirements of the Contract Documents, the Contractor shall correct it promptly after receipt of notice from the Owner to do so, unless the Owner has previously given the Contractor a written acceptance of such condition. The Owner shall give such notice promptly after discovery of the condition. 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 2.5. If the correction or repair of any of the Work is required to avoid impacts to the maintenance, operation or safety of any portion of the Project site or the Owner's property, the Owner reserves the right to undertake the repairs prior to notifying the Contractor or without waiting for the Contractor to respond, without waiving the Owner's rights under the warranties and the Owner's right to correct work under Section 2.5.

§ 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 of the Owner or Separate Contractors, whether completed or partially completed, 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.

§ 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 laws of the State of Rhode Island. 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. Neither party to the Contract shall assign the Contract as a whole without written consent of the other. If either party attempts to make an assignment without such consent, that party shall nevertheless remain legally responsible for all obligations under the Contract.

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§ 13.3 Rights and Remedies

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§ 13.3.1 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.

§ 13.3.2 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 thereunder, except as may be specifically agreed upon in writing.

§ 13.4 Tests and Inspections

§ 13.4.1 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 tests, inspections, or approvals that do not become requirements until after bids are received or negotiations concluded. The Owner shall directly arrange and pay for tests, inspections, or approvals where building codes or applicable laws or regulations so require.

§ 13.4.2 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 13.4.1, 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 13.4.3, shall be at the Owner's expense.

§ 13.4.3 If procedures for testing, inspection, or approval under Sections 13.4.1 and 13.4.2 reveal failure of the portions of the Work to comply with requirements established by the Contract Documents, all costs made necessary by such failure, including those of repeated procedures and compensation for the Architect's services and expenses, shall be at the Contractor's expense.

§ 13.4.4 The Contractor shall obtain and deliver promptly to the Architect any occupancy permit and any certificates of final inspection of any part of the Contractor's work and operating permits for any mechanical apparatus, such as elevators, escalators, boilers, air compressors, etc., which may be required by law to permit full use and occupancy of the premises by the Owner. Receipt of such permits or certificates by the Architect shall be a condition precedent to Substantial Completion of the Work.

§ 13.4.5 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.

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

§ 13.5 Interest

Payments due and unpaid under the Contract Documents shall bear interest from the date payment is due at the rate the parties 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.

§ 13.6 It is expressly agreed that the obligations of the Contractor hereunder arise out of contractual duties, and that the failure of the Contractor to comply with the requirements of the Contract Documents shall constitute a breach of contract, not a tort, for the purpose of applicable statutes of limitation and repose. Any cause of action which the Owner may have on account of such failure shall be deemed to accrue only when the Owner has obtained actual knowledge of such failure, not before.

§ 13.7 LIMITATION OF LIABILITY

§ 13.7.1 The Owner shall be liable, if ever, only to the extent of its interest in the Project; and no officer, director, partner, agent or employee of the Owner shall ever be personally or individually liable with respect to this Contract

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or the Work. Each Subcontract shall include the foregoing limitation, which shall be effective if the Owner ever succeeds to the Contractor's rights and obligations under a Subcontract.

§ 13.8 DEFENSE OF SUITS

§ 13.8.1 The Contractor shall be responsible for, shall defend and pay all costs, attorneys' fees and liabilities both direct and indirect as a result of suits arising out of this Contract.

§ 13.8.2 Neither final acceptance nor occupation of the premises by the Owner shall relieve the Contractor of responsibility for all claims for labor, materials, and equipment arising out of this Contract.

§ 13.8.3 The Contractor shall indemnify and hold harmless the Owner and the Architect and their agents and employees from and against all claims, damages, losses, and expenses including attorneys' fees arising out of or resulting from the performance of the work.

§ 13.9 EQUAL EMPLOYMENT OPPORTUNITY REQUIREMENTS

§ 13.9.1 The Contractor shall maintain policies of employment as follows:

§ 13.9.1.1 The Contractor and the Contractor's Subcontractors shall not discriminate against any employee or applicant for employment because of race, religion, color, sex or national origin. The Contractor shall take affirmative action to insure that applicants are employed, and that employees are treated during employment without regard to their race, religion, color, sex or national origin. Such action shall include, but not be limited to, the following: employment, upgrading, demotion or transfer; recruitment or recruitment advertising; layout or termination; rates of pay or other forms of compensation; and selection for training, including apprenticeship. The Contractor agrees to post in conspicuous places, available to employees and applicants for employment, notices setting forth the policies of non-discrimination.

§ 13.9.1.2 The Contractor and the Contractor's Subcontractors shall, in all solicitations or advertisements for employees placed by them or on their behalf, state that all qualified applicants will receive consideration for employment without regard to race, religion, color, sex or national origin.

§ 13.9.1.3 The Contractor shall be a signatory to the requirements of the Rhode Island Equal Employment Office.

§ 13.10 PREVAILING WAGES SCALES ON PUBLIC WORKS PROJECTS

§ 13.10.1. In accordance with Chapter 290 of the General laws of Rhode Island, 1938, as amended, the Department of Labor determined the customary and prevailing rate of wages paid to craftspersons, teamsters, and laborers in the constructing of public works by the State, and by cities and towns, and by persons contracting therewith for such construction. Violators are subject to a fine of not more than One Hundred Dollars (\$100.00) for each offense.

§ 13.10.2 The wage rates as ascertained by the Department of Labor are uniform for the State of Rhode Island and as of the date of advertisement of Contract applying to the life of this Contract. Information concerning wage rates prevailing in the construction industry in Rhode Island may be obtained from the Division of Professional Regulation, Department of Labor and Training, 1511 Pontiac Avenue, Cranston, Rhode Island, 02920 or their website www.dlt.state.ri.us.

Under no condition shall the wages paid to be less than those designated in the general classification. This clause does not relieve the Contractor or his Subcontractors from respecting any other union regulations to which he ordinarily subscribes.

§ 13.10.3 Bulletin No. 3, State Labor Laws, issued by the Rhode Island Department of Labor, pertaining to Public Works Projects (General Laws of Rhode Island, Revision of 1956, Chapter 37-12 as amended, and Chapter 77, Public Laws of 1965), is hereby made as part of this Project. These laws include, but are not limited to:

1. weekly payment of employees;
2. provisions applicable to public works contracts;
3. payment of prevailing wage rates;
4. posting of prevailing wage rates; and

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5. overtime compensation.

§ 13.11 MINORITY BUSINESS REQUIREMENTS

In accordance with RI Gen. Law § 37-14.1-1, it is the policy of the State of Rhode Island to support the fullest possible participation of firms owned and controlled by minorities (MBEs) and women (WBEs). Pursuant to §§ 37-14.1-2 and 37-14.1-6, MBEs and WBEs shall be included in all state purchasing, including, but not limited to, the procurement of goods, services, construction projects, or contracts funded in whole or in part with state funds, or funds which, in accordance with a federal grant or otherwise, the state expends or administers. MBEs and WBEs shall be awarded a minimum of ten percent (10%) of the dollar value of the entire procurement or project. MBE participation credit shall only be granted for firms duly certified as MBEs or WBEs by the State of Rhode Island, Department of Administration, Office of Diversity, Equity and Opportunity, MBE Compliance Office (MBECO). The current directory of firms certified as MBEs and WBEs may be accessed at <http://odeo.ri.gov/offices/mbeco/mbe-wbe.php> or by contacting Dorinda Keene at the MBECO at (401) 574-8670 or via email at

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Dorinda.Keene@doa.ri.gov.

ARTICLE 14 TERMINATION OR SUSPENSION OF THE CONTRACT

§ 14.1 Termination by the Contractor

§ 14.1.1 Provided that the Contractor is not in breach of any of its obligations under the Contract, 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, a Subcontractor, a Sub-subcontractor, their agents or employees, or any other persons or entities performing portions of the Work

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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.

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§ 14.1.2 Not Used

§ 14.1.3 If one of the above reasons 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 properly executed and for all materials or equipment not incorporated in the Work, but delivered and suitably stored at the site. The payment for materials or equipment stored at the site shall be conditioned upon submission by the Contractor of bills of sale or such other evidence as is satisfactory to the Owner to establish the Owner's title to such material or equipment or otherwise protect the Owner's interest.

§ 14.2 Termination by the Owner for Cause

§ 14.2.1 The Owner may terminate the Contract if the Contractor

- .1 refuses or fails to supply enough properly skilled workers or proper materials;
- .2 fails to make payment to Subcontractors or suppliers in accordance with the respective agreements between the Contractor and the Subcontractors or suppliers;
- .3 disregards applicable laws, statutes, ordinances, codes, rules and regulations, or lawful orders of a public authority;
- .4 becomes the subject of a voluntary petition in bankruptcy or any voluntary proceeding related to insolvency, receivership, liquidation or comparable proceeding or any assignment for the benefit of creditors or becomes the subject of an involuntary petition in bankruptcy or any involuntary proceeding related to insolvency, receivership, liquidation or comparable proceeding or any assignment for the benefit of creditors;
- .5 submits three successive Applications for Payment, each of which indicate that the actual Work completed is less than 90 percent of the values estimated in the construction schedule (submitted by the Contractor pursuant to Section 3.10.1) to be completed by the respective dates; or

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- .6 otherwise is guilty of substantial breach of a provision of the Contract Documents.

§ 14.2.2 When any of the reasons described in Section 14.2.1 exist, and upon certification by the Architect that sufficient cause exists to justify such action, the Owner 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' 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.

§ 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 all costs and losses incurred by the Owner on account of the Contractor's failure to comply with the Contract Documents and compensation for the Architect's and Owner's Project Manager'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 Owner shall be entitled to hold all amounts due the Contractor at the date of termination until all of the Owner's damages have been established, and to apply such amounts to such damages.

§ 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 under Section 14.3.1, subject to compliance with the conditions of Section 8.3. 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 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 the event that the Contract is terminated for the Owner's convenience, the Contractor shall be reimbursed in accordance with the Contract Documents for all Work properly performed up to the termination date, and for all materials or equipment not incorporated in the Work, but delivered and suitably stored at the site.

Payment for materials or equipment stored at the site shall be conditioned upon submission by the Contractor of bills of sale or such other evidence as is satisfactory to the Owner to establish the Owner's title to such material or equipment or otherwise protect the Owner's interest. The Contractor shall not be entitled to payment for overhead and profit on the Work not executed.

ARTICLE 15 CLAIMS AND DISPUTES

§ 15.1 Claims

§ 15.1.1 Definition

The word "Claim" shall mean a written demand by the Contractor for an increase in the Contract Time or the Contract Sum. The Contractor is responsible for substantiating its Claims. The word "Claim" shall not include claims by the Owner. The Owner may withhold from the

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Contractor the value of any claims against the Contractor in accordance with Massachusetts General Laws, including, but not limited to, Sections 39G and 39K of Chapter 30.

§ 15.1.2 Notice of Claims

Contractor must initiate Claims within fourteen (14) calendar days after occurrence of the event giving rise to such Claim by written notice to the Architect and the Owner. Such written notice must (1) be signed by the Contractor; (2) conspicuously identify on its face that the notice serves as a notice of claim; (3) explain in sufficient detail the basis of the Claim; (4) identify the date of the event giving rise to such Claim; and (5) state the exact dollar amount of the increase in the

Contract Sum being requested, if any, and the number of days extension to the Contract Time sought, if any.

§ 15.1.3 Not Used

§ 15.1.4 Continuing Contract Performance

§ 15.1.4.1 Pending final resolution of a Claim, except as otherwise agreed in writing or as provided in 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.

§ 15.1.4.2 The Contract Sum and Contract Time shall be adjusted in accordance with the Initial Decision Maker's decision, subject to the right of either party to proceed in accordance with this Article 15. The Architect will issue Certificates for Payment in accordance with the decision of the Initial Decision Maker.

§ 15.1.5 Claims for Additional Cost

If the Contractor wishes to make a Claim for an increase in the Contract Sum, notice as provided in Section 15.1.3 shall be given before proceeding to execute the portion of the Work that is the subject of the Claim. Prior notice is not required for Claims relating to an emergency endangering life or property arising under Section 10.4.

§ 15.1.6 Claims for Additional Time

§ 15.1.6.1 If the Contractor wishes to make a Claim for an increase in the Contract Time, notice as provided in Section 15.1.3 shall be given. The Contractor's Claim shall include an estimate of probable effect of delay on progress of the Work. In the case of a continuing delay, only one Claim is necessary.

§ 15.1.6.2 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.

§ 15.1.7 Waiver of 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 15.1.7 shall be deemed to preclude assessment of liquidated damages, when applicable, in accordance with the requirements of the Contract Documents.

§ 15.2 Initial Decision

§ 15.2.1 Claims, excluding those where the condition giving rise to the Claim is first discovered after expiration of the period for correction of the Work set forth in Section 12.2.2 or arising under Sections 10.3, 10.4, and 11.5, 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. If an initial decision has not been rendered within 30 days after the Claim has been referred to the Initial Decision Maker, the party asserting the Claim may demand mediation and binding dispute resolution without a 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.

§ 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 the 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 receipt of an initial decision, demand in writing that the other party file for mediation. If such a demand is made and the party receiving the demand fails to file for mediation within 30 days after receipt thereof, 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 15.1.7, shall be subject to mediation as a condition precedent to binding dispute resolution.

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

§ 15.3.3 Either party may, within 30 days from the date that mediation has been concluded without resolution of the dispute or 60 days after mediation has been demanded without resolution of the dispute, demand in writing that the other party file for binding dispute resolution. If such a demand is made and the party receiving the demand fails to file for binding dispute resolution within 60 days after receipt thereof, then both parties waive their rights to binding dispute resolution proceedings with respect to the initial decision.

§ 15.3.4 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. The Arbitration shall be conducted in the place where the Project is located, unless another location is mutually agreed upon. 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 Subject to the rules of the American Arbitration Association or other applicable arbitration rules, either party 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 Subject to the rules of the American Arbitration Association or other applicable arbitration rules, either party 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 those of the Owner and Contractor under this Agreement.

DOCUMENT 00 73 46

PREVAILING WAGE RATES

The State of Rhode Island Department of Labor, Division of Professional Regulation General Decision Modification document, current as of the bid issuance date for this Project, is an integral part of the Bid Documents for use in fulfilling prevailing wage rate requirements. A copy is included below.

Additional information concerning prevailing wage rates may be obtained from the Rhode Island Division of Professional Regulation, Department of Labor and Training, 1511 Pontiac Avenue, Cranston, Rhode Island, 02920.

General Decision Number: RI20260001 01/30/2026

Superseded General Decision Number: RI20250001

State: Rhode Island

Construction Types: Building, Heavy (Heavy and Marine) and Highway

Counties: Rhode Island Statewide.

BUILDING CONSTRUCTION PROJECTS (does not include residential construction consisting of single family homes and apartments up to and including 4 stories) HEAVY, HIGHWAY AND MARINE CONSTRUCTION PROJECTS

Modification Number	Publication Date
0	01/02/2026
1	01/23/2026
2	01/30/2026

ASBE0006-006 09/01/2024

	Rates	Fringes
HAZARDOUS MATERIAL HANDLER (Includes preparation, wetting, stripping, removal scrapping, vacuuming, bagging & disposing of all insulation materials, whether they contain asbestos or not, from mechanical systems).....	\$ 49.91	36.63

ASBE0006-008 09/01/2024		

Rates	Fringes

Asbestos Worker/Insulator

Includes application of
all insulating materials,
protective coverings,
coatings & finishes to all
types of mechanical systems.

\$ 49.91 36.63

BOIL0029-001 01/01/2025

Rates Fringes

BOILERMAKER.....\$ 50.62 28.82

BRRI0003-001 06/01/2022

Rates Fringes

Bricklayer, Stonemason,
Pointer, Caulker & Cleaner.....\$ 46.86 29.14

BRRI0003-002 09/01/2022

Rates Fringes

Marble Setter, Terrazzo
Worker & Tile Setter.....\$ 46.54 30.34

BRRI0003-003 09/01/2022

Rates Fringes

Marble, Tile & Terrazzo
Finisher.....\$ 38.78 29.61

CARP0330-001 06/02/2025

Rates Fringes

CARPENTER (Includes Soft

Floor Layer).....\$ 47.88 30.50

Diver Tender.....\$ 48.68 30.50

DIVER.....\$ 60.83 30.50

Piledriver.....\$ 41.53 29.35

WELDER.....\$ 48.68 30.50

FOOTNOTES:

When not diving or tending the diver, the diver and diver
tender shall receive the piledriver rate. Diver tenders

shall receive \$1.00 per hour above the pile driver rate when tending the diver.

Work on free-standing stacks, concrete silos & public utility electrical power houses, which are over 35 ft. in height when constructed: \$.50 per hour additional.

Work on exterior concrete shear wall gang forms, 45 ft. or more above ground elevation or on setback: \$.50 per hour additional.

The designated piledriver, known as the ""monkey"": \$1.00 per hour additional.

CARP1121-002 04/21/2025

	Rates	Fringes
MILLWRIGHT.....	\$ 45.72	31.50

ELEC0099-002 06/01/2025

	Rates	Fringes
ELECTRICIAN.....	\$ 56.11	44.10%
Teledata System Installer.....	\$ 42.09	10.45%+15.31

FOOTNOTES:

Work of a hazardous nature, or where the work height is 30 ft. or more from the floor, except when working OSHA-approved lifts: 20% per hour additional.

Work in tunnels below ground level in combined sewer outfall: 20% per hour additional.

ELEV0039-001 01/01/2025

	Rates	Fringes
ELEVATOR MECHANIC.....	\$ 64.52	38.435+a+b

FOOTNOTES:

a. PAID HOLIDAYS: New Years Day; Memorial Day; Independence Day; Labor Day; Veterans' Day; Thanksgiving Day; the Friday after Thanksgiving Day; and Christmas Day.

b. Employer contributes 8% basic hourly rate for 5 years or more of service of 6% basic hourly rate for 6 months to 5 years of service as vacation pay credit.

ENGI0057-001 12/01/2025

	Rates	Fringes
Operating Engineer: (power plants, sewer treatment plants, pumping stations, tunnels, caissons, piers, docks, bridges, wind turbines, subterranean & other marine and heavy construction work)		
GROUP 1.....	\$ 51.30	29.95
GROUP 2.....	\$ 49.30	29.95
GROUP 3.....	\$ 44.92	29.95
GROUP 4.....	\$ 42.07	29.95
GROUP 5.....	\$ 48.35	29.95
GROUP 6.....	\$ 39.15	29.95
GROUP 7.....	\$ 33.15	29.95
GROUP 8.....	\$ 45.00	29.95
GROUP 9.....	\$ 48.92	29.95

a. BOOM LENGTHS, INCLUDING JIBS:

150 feet and over + \$ 2.00
180 feet and over + \$ 3.00
210 feet and over + \$ 4.00
240 feet and over + \$ 5.00
270 feet and over + \$ 7.00
300 feet and over + \$ 8.00
350 feet and over + \$ 9.00
400 feet and over + \$10.00

a. PAID HOLIDAYS:

New Year's Day, President's Day, Memorial Day, July Fourth, Victory Day, Labor Day, Columbus Day, Veterans Day, Thanksgiving Day, Christmas Day. a: Any employee who works 3 days in the week in which a holiday falls shall be paid for the holiday.

a. FOOTNOTES:

Hazmat work: \$2.00 per hour additional.
Tunnel/Shaft work: \$5.00 per hour additional.

POWER EQUIPMENT OPERATORS CLASSIFICATIONS

GROUP 1: Cranes, lighters, boom trucks and derricks

GROUP 2: Digging machine, Ross Carrier, locomotive, hoist, elevator, bidwell-type machine, shot & water blasting machine, paver, spreader, graders, front end loader (3 yds. and over), vibratory hammer & vacuum truck, roadheaders, forklifts, econobile type equipment, tunnel boring machines, concrete pump and on site concrete plants.

GROUP 3: Oilers on cranes.

GROUP 4: Oiler on crawler backhoe.

GROUP 5: Bulldozer, bobcats, skid steer loader, tractor, scraper, combination loader backhoe, roller, front end loader (less than 3 yds.), street and mobile-powered sweeper (3-yd. capacity), 8-ft. sweeper minimum 65 HP).

GROUP 6: Well-point installation crew.

GROUP 7: Utility Engineers and Signal Persons

GROUP 8: Heater, concrete mixer, stone crusher, welding machine, generator and light plant, gas and electric driven pump and air compressor.

GROUP 9: Boat & tug operator.

ENGI0057-003 12/01/2025

BUILDING CONSTRUCTION

	Rates	Fringes
Power Equipment Operator		
GROUP 1.....	\$ 50.57	29.95
GROUP 2.....	\$ 48.57	29.95
GROUP 3.....	\$ 48.35	29.95
GROUP 4.....	\$ 44.35	29.95
GROUP 5.....	\$ 41.50	29.95
GROUP 6.....	\$ 47.65	29.95
GROUP 7.....	\$ 47.22	29.95
GROUP 8.....	\$ 44.54	29.95

a. BOOM LENGTHS, INCLUDING JIBS:

150 ft. and over: + \$ 2.00

180 ft. and over: + \$ 3.00
210 ft. and over: + \$ 4.00
240 ft. and over: + \$ 5.00
270 ft. and over: + \$ 7.00
300 ft. and over: + \$ 8.00
350 ft. and over: + \$ 9.00
400 ft. and over: + \$10.00

a. PAID HOLIDAYS: New Year's Day, President's Day, Memorial Day, July Fourth, Victory Day, Labor Day, Columbus Day, Veterans Day, Thanksgiving Day & Christmas Day. a: Any employee who works 3 days in the week in which a holiday falls shall be paid for the holiday.

a. FOOTNOTE: Hazmat work: \$2.00 per hour additional.
Tunnel/Shaft work: \$5.00 per hour additional.

POWER EQUIPMENT OPERATORS CLASSIFICATIONS

GROUP 1: Cranes, lighters, boom trucks and derricks.

GROUP 2: Digging machine, Ross carrier, locomotive, hoist, elevator, bidwell-type machine, shot & water blasting machine, paver, spreader, front end loader (3 yds. and over), vibratory hammer and vacuum truck

GROUP 3: Telehandler equipment, forklift, concrete pump & on-site concrete plant

GROUP 4: Fireman & oiler on cranes

GROUP 5: Oiler on crawler backhoe

GROUP 6: Bulldozer, skid steer loaders, bobcats, tractor, grader, scraper, combination loader backhoe, roller, front end loader (less than 3 yds.), street and mobile powered sweeper (3 yds. capacity), 8-ft. sweeper (minimum 65 hp)

GROUP 7: Well point installation crew

GROUP 8: Heater, concrete mixer, stone crusher, welding machine, generator for light plant, gas and electric driven pump & air compressor

ENGI0057-005 12/01/2025

Rates

Fringes

Power Equipment Operator

(highway construction projects; water and sewerline projects which are incidental to highway construction projects; and bridge projects that do not span water)

GROUP 1.....	\$ 46.45	29.95
GROUP 2.....	\$ 44.45	29.95
GROUP 3.....	\$ 39.15	29.95
GROUP 4.....	\$ 25.75	29.95
GROUP 5.....	\$ 33.15	29.95
GROUP 6.....	\$ 39.73	29.95
GROUP 7.....	\$ 43.43	29.95
GROUP 8.....	\$ 38.70	29.95

a. FOOTNOTE: a. Any employee who works three days in the week in which a holiday falls shall be paid for the holiday.

b. PAID HOLIDAYS: New Year's Day, President's Day, Memorial Day, July Fourth, Victory Day, Labor Day, Columbus Day, Veterans Day, Thanksgiving Day & Christmas Day.

POWER EQUIPMENT OPERATOR CLASSIFICATIONS

GROUP 1: Cranes, pile drivers, lighters, boom trucks, hoists, derricks

GROUP 2: Digging machines, excavators, locomotives, John Henry's, directional drilling machines, cold planers, reclaimers, pavers, spreaders, graders, front-end loaders (3yds & over), vacuum truck, drill/boring machine operators, vermeer saw, water blaster, hydraulic-demolition robot, Ross Carriers, concrete pump operators, asphalt/material transfer machines, rotating telehandlers, SPMT type equipment

GROUP 3: Wellpoint installation and drill/boring machine assistants

GROUP 4: Utility engineers

GROUP 5: Signal persons

GROUP 6: Oilers on cranes and deckhands

GROUP 7: Combination loader / backhoes, front-end loaders (less than 3 yds.), forklift, bulldozers, scrapers, boats, rollers, skid steer loaders (regardless of attachments), street sweepers, mechanics, welders, operators in materials yards, shops and garages

GROUP 8: Gas and electric drive heaters, concrete mixers,
light plants, welding machines, pumps and compressors

IRON0037-001 09/16/2025

	Rates	Fringes
IRONWORKER.....	\$ 43.03	33.53

LABO0271-001 12/03/2023

BUILDING CONSTRUCTION

	Rates	Fringes
LABORER		
GROUP 1.....	\$ 37.00	26.90
GROUP 2.....	\$ 37.00	26.90
GROUP 3.....	\$ 37.00	26.90
GROUP 4.....	\$ 37.00	26.90
GROUP 5.....	\$ 39.00	26.90

LABORERS CLASSIFICATIONS

GROUP 1: Laborer, Carpenter Tender, Mason Tender, Cement Finisher Tender, Scaffold Erector, Wrecking Laborer, Asbestos Removal [Non-Mechanical Systems]

GROUP 2: Asphalt Raker, Adzemen, Pipe Trench Bracer, Demolition Burner, Chain Saw Operator, Fence & Guard Rail Erector, Setter of Metal Forms for Roadways, Mortar Mixer, Pipelayer, Riprap & Dry Stonewall Builder, Highway Stone Spreader, Pneumatic Tool Operator, Wagon Drill Operator, Tree Trimmer, Barco-Type Jumping Tamper, Mechanical Grinder Operator

GROUP 3: Pre-Cast Floor & Roof Plank Erectors

GROUP 4: Air Track Operator, Hydraulic & Similar Self-Powered Drill, Block Paver, Rammer, Curb Setter, Powderman & Blaster

GROUP 5: Toxic Waste Remover

LABORERS CLASSIFICATIONS

GROUP 1: Laborer, Carpenter Tender, Mason Tender, Cement Finisher Tender, Scaffold Erector, Wrecking Laborer, Asbestos Removal [Non-Mechanical Systems]

GROUP 2: Asphalt Raker, Adzemen, Pipe Trench Bracer,

Demolition Burner, Chain Saw Operator, Fence & Guard Rail Erector, Setter of Metal Forms for Roadways, Mortar Mixer, Pipelayer, Riprap & Dry Stonewall Builder, Highway Stone Spreader, Pneumatic Tool Operator, Wagon Drill Operator, Tree Trimmer, Barco-Type Jumping Tamper, Mechanical Grinder Operator

GROUP 3: Pre-Cast Floor & Roof Plank Erectors

GROUP 4: Air Track Operator, Hydraulic & Similar Self-Powered Drill, Block Paver, Rammer, Curb Setter, Powderman & Blaster

GROUP 5: Toxic Waste Remover

LABO0271-002 11/27/2022

HEAVY AND HIGHWAY CONSTRUCTION

	Rates	Fringes
LABORER		
COMPRESSED AIR		
Group 1.....	\$ 55.40	24.15
Group 2.....	\$ 52.93	24.15
Group 3.....	\$ 42.45	24.15
FREE AIR		
Group 1.....	\$ 46.00	24.15
Group 2.....	\$ 45.00	24.15
Group 3.....	\$ 42.45	24.15
LABORER		
Group 1.....	\$ 33.05	24.05
Group 2.....	\$ 35.75	24.85
Group 3.....	\$ 36.50	24.85
Group 4.....	\$ 29.00	24.85
Group 5.....	\$ 37.50	24.85
OPEN AIR CAISSON, UNDERPINNING WORK AND BORING CREW		
Bottom Man.....	\$ 41.50	24.15
Top Man & Laborer.....	\$ 35.60	24.15
TEST BORING		
Driller.....	\$ 41.95	24.15
Laborer.....	\$ 41.95	24.15
LABORER CLASSIFICATIONS		

GROUP 1: Laborer; Carpenter tender; Cement finisher tender; Wrecking laborer; Asbestos removers [non-mechanical systems]; Plant laborer; Driller in quarries

GROUP 2: Adzeperson; Asphalt raker; Barcotype jumping tamper; Chain saw operators; Concrete and power buggy operator; Concrete saw operator; Demolition burner; Fence and guard rail erector; Highway stone spreader; Laser beam operator; Mechanical grinder operator; Mason tender; Mortar mixer; Pneumatic tool operator; Riprap and dry stonewall builder; Scaffold erector; Setter of metal forms for roadways; Wagon drill operator; Wood chipper operator; Pipelayer; Pipe trench bracer

GROUP 3: Air track drill operator; Hydraulic and similar powered drills; Brick paver; Block paver; Rammer and curb setter; Powderperson and blaster

GROUP 4: Flagger & signaler

GROUP 5: Toxic waste remover

LABORER - COMPRESSED AIR CLASSIFICATIONS

GROUP 1: Mucking machine operator, tunnel laborer, brake person, track person, miner, grout person, lock tender, gauge tender, miner: motor person & all others in compressed air

GROUP 2: Change house attendant, powder watchperson, top person on iron

GROUP 3: Hazardous waste work within the ""HOT"" zone

LABORER - FREE AIR CLASSIFICATIONS

GROUP 1: Grout person - pumps, brake person, track person, form mover & stripper (wood & steel), shaft laborer, laborer topside, outside motorperson, miner, conveyor operator, miner welder, heading motorperson, erecting operator, mucking machine operator, nozzle person, rodperson, safety miner, shaft & tunnel, steel & rodperson, mole nipper, concrete worker, form erector (wood, steel and all accessories), cement finisher (this type of work only), top signal person, bottom person (when heading is 50' from shaft), burner, shield operator and TBM operator

GROUP 2: Change house attendant, powder watchperson

GROUP 3: Hazardous waste work within the ""HOT"" zone

LABORER CLASSIFICATIONS

GROUP 1: Laborer; Carpenter tender; Cement finisher tender; Wrecking laborer; Asbestos removers [non-mechanical

systems]; Plant laborer; Driller in quarries

GROUP 2: Adzeperson; Asphalt raker; Barcotype jumping tamper; Chain saw operators; Concrete and power buggy operator; Concrete saw operator; Demolition burner; Fence and guard rail erector; Highway stone spreader; Laser beam operator; Mechanical grinder operator; Mason tender; Mortar mixer; Pneumatic tool operator; Riprap and dry stonewall builder; Scaffold erector; Setter of metal forms for roadways; Wagon drill operator; Wood chipper operator; Pipelayer; Pipe trench bracer

GROUP 3: Air track drill operator; Hydraulic and similar powered drills; Brick paver; Block paver; Rammer and curb setter; Powderperson and blaster

GROUP 4: Flagger & signaler

GROUP 5: Toxic waste remover

LABORER - COMPRESSED AIR CLASSIFICATIONS

GROUP 1: Mucking machine operator, tunnel laborer, brake person, track person, miner, grout person, lock tender, gauge tender, miner: motor person & all others in compressed air

GROUP 2: Change house attendant, powder watchperson, top person on iron

GROUP 3: Hazardous waste work within the ""HOT"" zone

LABORER - FREE AIR CLASSIFICATIONS

GROUP 1: Grout person - pumps, brake person, track person, form mover & stripper (wood & steel), shaft laborer, laborer topside, outside motorperson, miner, conveyor operator, miner welder, heading motorperson, erecting operator, mucking machine operator, nozzle person, rodperson, safety miner, shaft & tunnel, steel & rodperson, mole nipper, concrete worker, form erector (wood, steel and all accessories), cement finisher (this type of work only), top signal person, bottom person (when heading is 50' from shaft), burner, shield operator and TBM operator

GROUP 2: Change house attendant, powder watchperson

GROUP 3: Hazardous waste work within the ""HOT"" zone

PAIN0011-005 06/01/2025

	Rates	Fringes
PAINTER		
Brush and Roller.....	\$ 39.57	26.60
Epoxy, Tanks, Towers, Swing Stage & Structural Steel.....	\$ 41.57	26.60
Spray, Sand & Water Blasting.....	\$ 42.57	26.60
Taper.....	\$ 38.82	25.80
Wall Coverer.....	\$ 38.57	25.80

PAIN0011-006 06/01/2024

	Rates	Fringes
GLAZIER.....	\$ 41.63	26.15

FOOTNOTES:

SWING STAGE: \$1.00 per hour additional.

PAID HOLIDAYS: Labor Day & Christmas Day.

PAIN0011-011 06/01/2024

	Rates	Fringes
Painter (Bridge Work).....	\$ 57.85	26.40

PAIN0035-008 06/01/2011

	Rates	Fringes
Sign Painter.....	\$ 24.79	13.72

PLAS0040-001 01/01/2025

BUILDING CONSTRUCTION

	Rates	Fringes
CEMENT MASON/CONCRETE FINISHER...	\$ 44.75	29.10

FOOTNOTE: Cement Mason: Work on free swinging scaffolds under
3 planks width and which is 20 or more feet above ground

and any offset structure: \$.30 per hour additional.

PLAS0040-002 01/01/2025

HEAVY AND HIGHWAY CONSTRUCTION

	Rates	Fringes
CEMENT MASON/CONCRETE FINISHER...	\$ 44.75	29.10

PLAS0040-003 01/01/2025

	Rates	Fringes
PLASTERER.....	\$ 45.52	29.43

PLUM0051-002 08/25/2025

	Rates	Fringes
Plumbers and Pipefitters.....	\$ 54.34	34.50

* ROOF0033-004 12/01/2025

	Rates	Fringes
ROOFER.....	\$ 47.49	31.44

SFRI0669-001 04/01/2025

	Rates	Fringes
SPRINKLER FITTER.....	\$ 53.76	33.44

SHEE0017-002 06/01/2025

	Rates	Fringes
Sheet Metal Worker.....	\$ 44.42	41.94

TEAM0251-001 05/01/2025

HEAVY AND HIGHWAY CONSTRUCTION

	Rates	Fringes
TRUCK DRIVER		
GROUP 1.....	\$ 31.86	34.51+a+b
GROUP 2.....	\$ 32.01	34.51+a+b

GROUP 3.....	\$ 32.06	34.51+a+b
GROUP 4.....	\$ 32.11	34.51+a+b
GROUP 5.....	\$ 32.21	34.51+a+b
GROUP 6.....	\$ 32.61	34.51+a+b
GROUP 7.....	\$ 32.81	34.51+a+b
GROUP 8.....	\$ 32.31	34.51+a+b
GROUP 9.....	\$ 32.56	34.51+a+b
GROUP 10.....	\$ 32.36	34.51+a+b

FOOTNOTES:

A. Paid Holidays: New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day and Christmas Day, plus Presidents' Day, Columbus Day, Veteran's Day & V-J Day, providing the employee has worked at least one day in the calendar week in which the holiday falls.

B. Employee who has been on the payroll for 1 year or more but less than 5 years and has worked 150 Days during the last year of employment shall receive 1 week's paid vacation; 5 to 10 years - 2 weeks' paid vacation; 10 or more years - 3 week's paid vacation.

C. Employees on the seniority list shall be paid a one hundred dollar (\$100.00) bonus for every four hundred (400) hours worked, up to a maximum of five hundred dollars (\$500.00)

All drivers working on a defined hazard material job site shall be paid a premium of \$2.00 per hour over applicable rate.

TRUCK DRIVER CLASSIFICATIONS

GROUP 1: Pick-up trucks, station wagons, & panel trucks

GROUP 2: Two-axle on low beds

GROUP 3: Two-axle dump truck

GROUP 4: Three-axle dump truck

GROUP 5: Four- and five-axle equipment

GROUP 6: Low-bed or boom trailer.

GROUP 7: Trailers when used on a double hook up (pulling 2 trailers)

GROUP 8: Special earth-moving equipment, under 35 tons

GROUP 9: Special earth-moving equipment, 35 tons or over

GROUP 10: Tractor trailer

WELDERS - Receive rate prescribed for craft performing
operation to which welding is incidental.

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Note: Executive Order (EO) 13706, Establishing Paid Sick Leave for Federal Contractors applies to all contracts subject to the Davis-Bacon Act for which the contract is awarded (and any solicitation was issued) on or after January 1, 2017. If this contract is covered by the EO, the contractor must provide employees with 1 hour of paid sick leave for every 30 hours they work, up to 56 hours of paid sick leave each year. Employees must be permitted to use paid sick leave for their own illness, injury or other health-related needs, including preventive care; to assist a family member (or person who is like family to the employee) who is ill, injured, or has other health-related needs, including preventive care; or for reasons resulting from, or to assist a family member (or person who is like family to the employee) who is a victim of, domestic violence, sexual assault, or stalking. Additional information on contractor requirements and worker protections under the EO is available at <https://www.dol.gov/agencies/whd/government-contracts>.

Note: Executive Order 13658 generally applies to contracts subject to the Davis-Bacon Act that were awarded on or between January 1, 2015 and January 29, 2022, and that have not been renewed or extended on or after January 30, 2022. Executive Order 13658 does not apply to contracts subject only to the Davis-Bacon Related Acts regardless of when they were awarded. If a contract is subject to Executive Order 13658, the contractor must pay all covered workers at least \$13.30 per hour (or the applicable wage rate listed on this wage determination, if it is higher) for all hours spent performing on the contract in 2025. The applicable Executive Order minimum wage rate will be adjusted annually. Additional information on contractor requirements and worker protections under Executive Order 13658 is available at www.dol.gov/whd/govcontracts.

Unlisted classifications needed for work not included within the scope of the classifications listed may be added after award only as provided in the labor standards contract clauses

(29CFR 5.5 (a) (1) (iii)).

The body of each wage determination lists the classifications and wage rates that have been found to be prevailing for the type(s) of construction and geographic area covered by the wage determination. The classifications are listed in alphabetical order under rate identifiers indicating whether the particular rate is a union rate (current union negotiated rate), a survey rate, a weighted union average rate, a state adopted rate, or a supplemental classification rate.

Union Rate Identifiers

A four-letter identifier beginning with characters other than "SU", "UAVG", ?SA?, or ?SC? denotes that a union rate was prevailing for that classification in the survey. Example: PLUM0198-005 07/01/2024. PLUM is an identifier of the union whose collectively bargained rate prevailed in the survey for this classification, which in this example would be Plumbers. 0198 indicates the local union number or district council number where applicable, i.e., Plumbers Local 0198. The next number, 005 in the example, is an internal number used in processing the wage determination. The date, 07/01/2024 in the example, is the effective date of the most current negotiated rate.

Union prevailing wage rates are updated to reflect all changes over time that are reported to WHD in the rates in the collective bargaining agreement (CBA) governing the classification.

Union Average Rate Identifiers

The UAVG identifier indicates that no single rate prevailed for those classifications, but that 100% of the data reported for the classifications reflected union rates. EXAMPLE: UAVG-OH-0010 01/01/2024. UAVG indicates that the rate is a weighted union average rate. OH indicates the State of Ohio. The next number, 0010 in the example, is an internal number used in producing the wage determination. The date, 01/01/2024 in the example, indicates the date the wage determination was updated to reflect the most current union average rate.

A UAVG rate will be updated once a year, usually in January, to reflect a weighted average of the current rates in the collective bargaining agreements on which the rate is based.

Survey Rate Identifiers

The ""SU"" identifier indicates that either a single non-union rate prevailed (as defined in 29 CFR 1.2) for this classification in the survey or that the rate was derived by computing a weighted average rate based on all the rates reported in the survey for that classification. As a weighted average rate includes all rates reported in the survey, it may include both union and non-union rates. Example: SUFL2022-007 6/27/2024. SU indicates the rate is a single non-union prevailing rate or a weighted average of survey data for that classification. FL indicates the State of Florida. 2022 is the year of the survey on which these classifications and rates are based. The next number, 007 in the example, is an internal number used in producing the wage determination. The date, 6/27/2024 in the example, indicates the survey completion date for the classifications and rates under that identifier.

?SU? wage rates typically remain in effect until a new survey is conducted. However, the Wage and Hour Division (WHD) has the discretion to update such rates under 29 CFR 1.6(c)(1).

State Adopted Rate Identifiers

The ""SA"" identifier indicates that the classifications and prevailing wage rates set by a state (or local) government were adopted under 29 C.F.R 1.3(g)-(h). Example: SAME2023-007 01/03/2024. SA reflects that the rates are state adopted. ME refers to the State of Maine. 2023 is the year during which the state completed the survey on which the listed classifications and rates are based. The next number, 007 in the example, is an internal number used in producing the wage determination. The date, 01/03/2024 in the example, reflects the date on which the classifications and rates under the ?SA? identifier took effect under state law in the state from which the rates were adopted.

WAGE DETERMINATION APPEALS PROCESS

1) Has there been an initial decision in the matter? This can be:

- a) a survey underlying a wage determination
- b) an existing published wage determination
- c) an initial WHD letter setting forth a position on a wage determination matter
- d) an initial conformance (additional classification and rate) determination

On survey related matters, initial contact, including requests for summaries of surveys, should be directed to the WHD Branch of Wage Surveys. Requests can be submitted via email to davisbaconinfo@dol.gov or by mail to:

Branch of Wage Surveys
Wage and Hour Division
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

Regarding any other wage determination matter such as conformance decisions, requests for initial decisions should be directed to the WHD Branch of Construction Wage Determinations. Requests can be submitted via email to BCWD-Office@dol.gov or by mail to:

Branch of Construction Wage Determinations
Wage and Hour Division
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

2) If an initial decision has been issued, then any interested party (those affected by the action) that disagrees with the decision can request review and reconsideration from the Wage and Hour Administrator (See 29 CFR Part 1.8 and 29 CFR Part 7). Requests for review and reconsideration can be submitted via email to dba.reconsideration@dol.gov or by mail to:

Wage and Hour Administrator
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

The request should be accompanied by a full statement of the interested party's position and any information (wage payment data, project description, area practice material, etc.) that the requestor considers relevant to the issue.

3) If the decision of the Administrator is not favorable, an interested party may appeal directly to the Administrative Review Board (formerly the Wage Appeals Board). Write to:

Administrative Review Board
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210.

=====
END OF GENERAL DECISION"

SECTION 01 10 00

SUMMARY OF WORK

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Contract description.
- B. Contractor's use of site and premises.
- C. Owner occupancy.
- D. Hazardous Material Suspicion
- E. Definitions

1.02 CONTRACT DESCRIPTION

- A. Work of the Project includes HVAC Upgrades at the existing building listed below as described on the drawings and in this project manual.

Hoxsie Elementary School
55 Glenwood Drive, Warwick, RI 02889
- B. The work of the project also includes the removal in select areas of existing asbestos-containing material. See the asbestos testing and abatement documents for additional information.
- C. Perform the Work of the Contract under a stipulated sum Contract with the Owner in accordance with the Conditions of Contract.
- D. The Work of the Contract is identified in the Project Manual and on the Drawings.

1.03 CONTRACTOR'S USE OF SITE AND PREMISES

- A. Limit use of the site and premises to allow:
 - 1. Owner occupancy throughout construction.
- B. Construction Personnel Conduct
 - 1. The following conduct by construction personnel will not be tolerated on the Owner's property, violators may be ejected from the site.
 - a. NO SMOKING is allowed. The Contractor will erect signs noting such at all entrances.
 - b. No drugs or alcohol are allowed
 - c. No firearms or weapons are allowed.
 - d. No foul language will be tolerated.
 - e. No fighting. All involved will be subject to being removed from the site.

1.04 OWNER OCCUPANCY

- A. The Owner will occupy the site and premises during the entire period of construction.
- B. Cooperate with the Owner to minimize conflict, and to facilitate the Owner's operations if necessary.

1.05 HAZARDOUS MATERIAL SUSPICION

- A. If, during the course of construction, the Contractor suspects a material to contain asbestos, all work involving the material is to be stopped and the Architect notified immediately of the suspicion. Until the material is confirmed to be safe or tested and determined to be an asbestos containing material, the Contractor is to assume it contains asbestos and is to avoid contact. Upon notification of its composition the Architect will determine the course of action and inform the Contractor accordingly.

1.06 DEFINITIONS

- A. Basic Contract definitions are included below.
 - 1. "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.
 - 2. "Directed": A command or instruction by Architect. . Other terms including "requested," "authorized," "selected," "approved," "required," and "permitted" have the same meaning as "directed."
 - 3. "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."
 - 4. "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.
 - 5. "Furnish": Supply and deliver to Project site, ready for unloading, unpacking, assembly, installation, and similar operations.
 - 6. "Install": Operations at Project site including unloading, temporarily storing, unpacking, disposing of packaging, assembling, erecting, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, and similar operations.
 - 7. "Provide": Furnish and install, complete, in place, and ready for the intended use.
 - 8. "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.

PART 2 - PRODUCTS

Not Used.

PART 3 - EXECUTION
Not Used.

END OF SECTION

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SECTION 01 20 00

PRICE AND PAYMENT PROCEDURES

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Schedule of values.
- B. Applications for payment.
- C. Sales Tax Exemption
- D. Change procedures.
- E. Defect assessment.
- F. Unit prices.

1.02 SCHEDULE OF VALUES

- A. Submit a printed schedule on AIA Form G703 - Application and Certificate for Payment Continuation Sheet
- B. Submit Schedule of Values in duplicate, one copyrighted original and one copy, within fifteen (15) days after date of receipt of a Notice to Proceed.
- C. Format: Utilize the Table of Contents of this Project Manual. Identify each line item with number and title of the major specification Section. Identify site mobilization, bonds and insurance.
- D. Include in each line item, the amount of Allowances specified in Section 01 21 00 if occurring. For unit cost Allowances, identify quantities taken from Contract Documents multiplied by the unit cost to achieve the total for the item.
- E. Include separately from each line item, a direct proportional amount of Contractor's overhead and profit.
- F. Revise schedule to list approved Change Orders, with each Application for Payment.

1.03 APPLICATIONS FOR PAYMENT

- A. Submit each application on an original copyrighted AIA Form G702 - Application and Certificate for Payment and AIA G703 - Continuation Sheet, accompanied by three copies.
 - 1. Individually sign and notarize, and emboss with notary's official seal, the original and each of the three copies.
 - 2. Applications not including original copyrighted AIA G702, and G703 Forms, will be rejected, and returned for resubmittal.
 - 3. Applications not properly signed and notarized will be rejected, and returned for resubmittal.

- B. Content and Format: Utilize Schedule of Values for listing items in Application for Payment.
- C. Provide one copy of the updated construction schedule with each Application for Payment submission.
 - 1. Provide a statement signed by the Contractor's firm principal certifying that there are no unidentified outstanding claims for delay.
- D. Include with each monthly Application for Payment, following the first application, one copy of the Certified Monthly Payroll Record for the previous month's pay period.
- E. Payment Period: Submit at intervals stipulated in the Agreement.
- F. Submit with transmittal letter as specified for Submittals in Section 01 33 00.
- G. Beginning with the second Application for Payment, Contractor's right to payment must be substantiated by documenting, on a copy of the Waiver of Lien Form included in Document 00 65 19.16 - Waiver of Lien Form in this Project Manual, that payment monies due, less retainage not exceeding ten percent, have been paid in full to subcontractor and suppliers for work, materials, or rental of equipment billed for under specific line item numbers in the immediately preceding application.
- H. Substantiating Data: When the Architect requires substantiating information, submit data justifying dollar amounts in question. Include the following with the Application for Payment :
 - 1. Record Documents as specified in Section 01 78 00, for review by the Owner which will be returned to the Contractor.
 - 2. Affidavits attesting to off-site stored products.
 - 3. Construction progress schedules, revised and current as specified in Section 01 33 00.

1.04 SALES TAX EXEMPTION

- A. Owner is exempt from sales tax on products permanently incorporated in Work of the Project.

1.05 CHANGE PROCEDURES

- A. Submittals: Submit name of the individual authorized to receive change documents, and be responsible for informing others in Contractor's employ or Subcontractors of changes to the Work.
- B. The Architect will advise of minor changes in the Work not involving an adjustment to Contract Sum or Contract Time by issuing supplemental instructions on AIA Form G710
- C. The Architect may issue a Proposal Request which includes a detailed description of a proposed change with supplementary or revised Drawings and specifications, a change in Contract Time for executing the change with a stipulation of any overtime work required and the period of time during which the requested price will be considered valid. Contractor will prepare and submit an estimate within fifteen (15) days.
- D. The Contractor may propose changes by submitting a request for change to the Architect, describing the proposed change and its full effect on the Work. Include a statement describing the reason for the change, and the effect on the Contract Sum and Contract Time with full

documentation, and a statement describing the effect on Work by separate or other Contractors. Document any requested substitutions in accordance with Section 01 60 00.

- E. Stipulated Sum Change Order: Based on Proposal Request, and Contractor's fixed price quotation, or Contractor's request for a Change Order as approved by Architect.
- F. Unit Price Change Order: For contract unit prices and quantities, the Change Order will be executed on a fixed unit price basis. For unit costs or quantities of units of work that are not pre-determined, execute the Work under a Construction Change Directive. Changes in the Contract Sum or Contract Time will be computed as specified for a Time and Material Change Order.
- G. Construction Change Directive: Architect may issue a directive, on AIA Form G713 Construction Change Directive signed by the Owner, instructing the Contractor to proceed with a change in the Work, for subsequent inclusion in a Change Order. Document will describe changes in the Work, and designate method of determining any change in the Contract Sum or Contract Time. Promptly execute the change.
- H. Time and Material Change Order: Submit an itemized account and supporting data after completion of the change, within the time limits indicated in the Conditions of the Contract. The Architect will determine the change allowable in the Contract Sum and Contract Time as provided in the Contract Documents.
- I. Maintain detailed records of work done on a Time and Material basis. Provide full information required for an evaluation of the proposed changes, and to substantiate costs for the changes in the Work.
- J. Document each quotation for a change in cost or time with sufficient data to allow an evaluation of the quotation. Provide detailed breakdown of costs and estimates for labor and materials including a detailed breakdown for subcontractor's or vendor's Work. Include copies of written quotations from subcontractors or vendors.
- K. Change Order Forms: AIA G701 Change Order.
- L. Execution of Change Orders: The Architect will issue Change Orders for signatures of the parties as provided in the Conditions of the Contract.
- M. Correlation Of Contractor Submittals:
 - 1. Promptly revise the Schedule of Values and the Application for Payment forms to record each authorized Change Order as a separate line item and adjust the Contract Sum.
 - 2. Promptly revise progress schedules to reflect any change in the Contract Time, revise sub-schedules to adjust times for any other items of work affected by the change, and resubmit.
 - 3. Promptly enter changes in the Project Record Documents.

1.06 DEFECT ASSESSMENT

- A. Replace the Work, or portions of the Work, not conforming to specified requirements.
- B. If, in the opinion of the Architect, it is not practical to remove and replace the Work, the Architect will direct an appropriate remedy or adjust payment.

- C. The defective Work may remain, but the unit sum will be adjusted to a new sum at the discretion of the Architect.
- D. The defective Work will be partially repaired to the instructions of the Architect, and the unit sum will be adjusted to a new sum at the discretion of the Architect.
- E. The individual Specification Sections may modify these options or may identify a specific formula or percentage sum reduction.
- F. The authority of the Architect to assess the defect and identify a payment adjustment is final.
- G. Non-Payment for Rejected Products: Payment will not be made for rejected products for any of the following:
 - 1. Products wasted or disposed of in a manner that is not acceptable.
 - 2. Products determined as unacceptable before or after placement.
 - 3. Products not completely unloaded from the transporting vehicle.
 - 4. Products placed beyond the lines and levels of the required Work.
 - 5. Products remaining on hand after completion of the Work.
 - 6. Loading, hauling, and disposing of rejected products.

1.07 UNIT PRICES

- A. Authority: Measurement methods are delineated in the individual specification Sections.
- B. Measurement methods delineated in the individual specification Sections complement the criteria of this section. In case of conflict, the requirements of the individual specification Section govern.
- C. Take measurements and compute quantities. The Architect will verify measurements and quantities.
- D. Unit Quantities: The quantities and measurements indicated in the Bid Form are for contract purposes only. The quantities and measurements supplied or placed in the Work shall determine payment.
 - 1. When the actual Work requires more or fewer quantities than those quantities indicated, provide the required quantities at the unit sum contracted.
 - 2. When the actual Work requires a 25 percent or greater change in quantity than those quantities indicated, the Owner or Contractor may claim for a Contract Price adjustment.
- E. Unit Price amount includes: Full compensation for required labor, products, tools, equipment, plant and facilities, transportation, services and incidentals; erection, application or installation of an item of the Work; overhead and profit.
- F. Final payment for Work governed by unit prices will be made on the basis of the actual measurements and quantities accepted by the Architect multiplied by the unit sum for Work which is incorporated in or made necessary by the Work.
- G. Measurement of Quantities:
 - 1. Weigh Scales: Inspected, tested and certified by the applicable state Weights and Measures department within the past year.
 - 2. Platform Scales: Of sufficient size and capacity to accommodate the conveying vehicle.

3. Metering Devices: Inspected, tested and certified by the applicable State department within the past year.
4. Measurement by Weight: Concrete reinforcing steel, rolled or formed steel or other metal shapes will be measured by handbook weights. Welded assemblies will be measured by handbook or scale weight.
5. Measurement by Volume: Measured by cubic dimension using mean length, width and height or thickness.
6. Measurement by Area: Measured by square dimension using mean length and width or radius.
7. Linear Measurement: Measured by linear dimension, at the item centerline or mean chord.
8. Stipulated Sum Measurement: Items measured by weight, volume, area, or linear means or combination, as appropriate, as a completed item or unit of the Work.

H. See Bid Form for schedule of Unit Prices.

PART 2 - PRODUCTS

Not Used.

PART 3 - EXECUTION

Not Used.

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SECTION 01 21 00

ALLOWANCES

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Cash allowances.

1.02 CASH ALLOWANCES

- A. Costs Included in Cash Allowances: Cost of product to Contractor or Subcontractor, labor for installation and finishing, less applicable trade discounts; delivery to site, and applicable taxes
- B. Costs Not Included in Cash Allowances But Included in the Contract Sum: Product delivery to site and handling at the site, including unloading, uncrating, and storage; protection of products from elements and from damage.
- C. Architect Responsibilities:
 - 1. Consult with Contractor for consideration and selection of products, suppliers, and installers.
 - 2. Select products in consultation with Owner and transmit decision to Contractor.
 - 3. Prepare Change Order.
- D. Contractor Responsibilities:
 - 1. Assist Architect in selection of products, suppliers and installers.
 - 2. Obtain proposals from suppliers and installers and offer recommendations.
 - 3. On notification of selection by Architect, execute purchase agreement with designated supplier and installer.
 - 4. Arrange for and process shop drawings, product data, and samples. Arrange for delivery.
 - 5. Promptly inspect products upon delivery for completeness, damage, and defects. Submit claims for transportation damage.
- E. Differences in costs will be adjusted by Change Order.
- F. Allowances Schedule:
 - 1. **Allowance No. 1: Signage:**
Include the sum of **six hundred dollars (\$ 600.00)** for all work associated with the purchase and installation of signage.

PART 2 - PRODUCTS

Not Used.

PART 3 - EXECUTION

Not Used.

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SECTION 01 22 00

ALTERNATES

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Alternates.

1.02 ALTERNATES

- A. Alternates quoted on Bid Forms will be reviewed and accepted or rejected at Owner's option. Accepted Alternates will be identified in Owner-Contractor Agreement.
- B. Coordinate related work and modify surrounding work as required.
- C. Schedule of Alternates:
1. Alternate No. 1: HVAC Alternate Design
This Alternate contemplates the deduction from the Base Bid all work associated with the deletion of the air conditioning system as described in Specification Section 23 00 00 – HVAC Alternate Design. This also includes all work noted on the drawings that are listed as a part of the Alternate.
 2. Alternate No. 2: Electric Transformer Pad (Containment Deleted)
This Alternate contemplates the deduction from the Base Bid all work associated with the change of the electric transformer concrete pad from a containment design to a design without a containment.
See drawings for additional information.
 2. Alternate No. 3: Interior of Boiler Asbestos Abatement:
This Alternate contemplates the addition to the Base Bid all work associated with the removal, disposal and encapsulation of asbestos containing material in the interior of the existing boiler prior to the boiler being removed from the boiler room.
See Asbestos Abatement Plan for additional information.
The testing of the material inside the boiler will be performed by the Owner at the beginning of the boiler demolition by the Contractor.

PART 2 - PRODUCTS

Not Used.

PART 3 - EXECUTION

Not Used.

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SECTION 01 31 00

ADMINISTRATIVE REQUIREMENTS

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Coordination and project conditions.
- B. Preconstruction meeting.
- C. Site mobilization meeting.
- D. Progress meetings.
- E. Preinstallation meetings.

1.02 COORDINATION AND PROJECT CONDITIONS

- A. Coordinate the scheduling, submittals, and the Work of the various Sections of the Project Manual to ensure an efficient and orderly sequence of the installation of interdependent construction elements with provisions for accommodating the items installed later.
- B. Verify that the utility requirements and characteristics of the operating equipment are compatible with the building utilities. Coordinate the Work of the various Sections having interdependent responsibilities for installing, connecting to, and placing in service, such equipment.
- C. In finished areas except as otherwise indicated, conceal the pipes, ducts, and wiring within the construction. Coordinate the locations of fixtures and outlets with the finish elements.
- D. Coordinate the completion and clean up of the Work of the separate Sections in preparation for Substantial Completion.
- E. After the Owner's occupancy of the premises, coordinate access to the site for correction of the defective Work and the Work not in accordance with the Contract Documents, to minimize disruption of the Owner's activities.

1.03 PRECONSTRUCTION MEETING

- A. The Architect will schedule a meeting after a Notice to Proceed is issued to the Contractor.
- B. Attendance Required: Owner, Architect, and Contractor.
- C. Agenda:
 - 1. Execution of the Owner-Contractor Agreement.
 - 2. Submission of the executed bonds and insurance certificates.
 - 3. Distribution of the Contract Documents.
 - 4. Submission of a list of Subcontractors, a list of products, schedule of values, and a progress schedule.
 - 5. Designation of the personnel representing the parties in the Contract, and the Architect.

6. The procedures and processing of the field decisions, submittals, substitutions, applications for payments, proposal requests, Change Orders, and Contract closeout procedures.
 7. Scheduling.
- D. Record the minutes and distribute copies within two days after the meeting to the participants, with two copies to the Architect, the Owner, the participants, and those affected by the decisions made.

1.04 SITE MOBILIZATION MEETING

- A. The Architect will schedule a meeting at the Project site prior to the Contractor's occupancy.
- B. Attendance Required: The Owner, Architect, Special Consultants, and, Contractor, the Contractor's Superintendent, and major Subcontractors.
- C. Agenda:
1. Use of the premises by the Owner and the Contractor.
 2. The Owner's requirements and occupancy.
 3. Construction facilities and controls provided by the Owner.
 4. Temporary utilities provided by the Owner.
 5. Survey and building layout.
 6. Security and housekeeping procedures.
 7. Schedules.
 8. Application for payment procedures.
 9. Procedures for testing.
 10. Procedures for maintaining the record documents.
 11. Requirements for start-up of the equipment.
 12. Inspection and acceptance of the equipment put into service during the construction period.
- D. Record the minutes and distribute the copies within two days after the meeting to the participants, with two copies to the Architect, Owner, participants, and those affected by the decisions made.

1.05 PROGRESS MEETINGS

- A. Schedule and administer the meetings throughout the progress of the Work at maximum bi-weekly (14 day) intervals.
- B. Make arrangements for the meetings, prepare the agenda with copies for the participants, and preside at the meetings.
- C. Attendance Required: The job superintendent, major subcontractors and suppliers, the Owner, Architect, as appropriate to agenda topics for each meeting.
- D. Agenda:
1. Review the minutes of previous meetings.
 2. Review of the Work progress.
 3. Field observations, problems, and decisions.
 4. Identification of the problems which impede the planned progress.
 5. Review of the submittals schedule and status of the submittals.
 6. Review of the off-site fabrication and delivery schedules.
 7. Maintenance of the progress schedule.
 8. Corrective measures to regain the projected schedules.

9. Planned progress during the succeeding work period.
10. Coordination of the projected progress.
11. Maintenance of the quality and work standards.
12. Effect of the proposed changes on the progress schedule and coordination.
13. Other business relating to the Work.

- E. Record the minutes and distribute the copies within two days after the meeting to the participants, with two copies to the Architect, Owner, participants, and those affected by the decisions made.

1.06 PREINSTALLATION MEETING

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

PART 2 - PRODUCTS

Not used.

PART 3 - EXECUTION

Not used.

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SECTION 01 33 00

SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Submittal procedures.
- B. Construction progress schedules.
- C. Proposed products list.
- D. Method for Submission of Shop Drawings and Product Data
- E. Product data.
- F. Shop drawings.
- G. Samples.
- H. Design data.
- I. Test reports.
- J. Certificates.
- K. Manufacturer's instructions.
- L. Manufacturer's field reports.
- M. Erection drawings.

1.02 SUBMITTAL PROCEDURES

- A. Master List Submittal:
 - 1. Submit a master list of the required submittals with a proposed date for each item to be submitted.
 - 2. Show the date submittal was sent, days since submittal was sent, status of submittal, date submittal was received in return, and any date associated with resubmittals.
 - 3. Up date master list with each submission and response.
 - 4. Issue copy of master list at least monthly to the Architect.
- B. Transmit each submittal with a transmittal form.
- C. Sequentially number the transmittal form. Mark revised submittals with the original number and a sequential alphabetic suffix.

- D. Identify the Project, Contractor, subcontractor and supplier; the pertinent drawing and detail number, and the specification Section number, appropriate to the submittal.
- E. Apply a Contractor's stamp, signed or initialed, certifying that the review, approval, verification of products required, field dimensions, adjacent construction Work, and coordination of the information is in accordance with the requirements of the Work and the Contract Documents.
- F. Schedule submittals to expedite the Project, and deliver to the Architect at their business address. Coordinate the submission of related items. Upon completion of the submittal's review, the Architect's office will notify the Contractor. The Contractor is then responsible to pick-up the submittals in a timely manner.
- G. For each submittal for review, allow fifteen (15) days excluding the delivery time to and from the Contractor.
- H. Identify the variations from the Contract Documents and the Product or system limitations that may be detrimental to a successful performance of the completed Work.
- I. Allow space on the submittals for the Contractor's and the Architect's review stamps.
- J. When revised for resubmission, identify the changes made since the previous submission.
- K. Distribute copies of the reviewed submittals as appropriate. Instruct the parties to promptly report an inability to comply with the Contract requirements.
- L. Submittals not requested will not be recognized or processed.
- M. The Contractor will compensate the Architect and all consulting Engineers for services performed reviewing submittals beyond the original review and two follow-up reviews of the same product, material, sample or assembly. The compensation will be made through a credit change order that will reduce the total contract amount.

1.03 CONSTRUCTION PROGRESS SCHEDULES

- A. Submit preliminary outline Schedules within fifteen (15) days after the date of receipt of a Notice to Proceed for coordination with the Owner's requirements. After a review, submit detailed schedules within fifteen (15) days modified to accommodate the revisions recommended by the Architect.
- B. Submit revised Progress Schedules with each Application for Payment.
- C. Distribute copies of the reviewed schedules to the Project site file, subcontractors, suppliers, and other concerned parties.
- D. Instruct the recipients to promptly report, in writing, the problems anticipated by the projections indicated in the schedules.
- E. Submit a computer generated horizontal bar chart with a separate line for each major portion of the Work or operation, or section of the Work, identifying the first workday of each week.

- F. Show a complete sequence of construction by activity, identifying the Work of separate stages and other logically grouped activities. Indicate the early and late start, the early and late finish, float dates, and the duration.
- G. Indicate an estimated percentage of completion for each item of the Work at each submission.
- H. Provide a separate schedule of submittal dates for shop drawings, product data, and samples, including Owner furnished Products and Products identified under Allowances, if any, and the dates reviewed submittals will be required from the Architect. Indicate the decision dates for selection of the finishes.
- I. Indicate the delivery dates for Owner furnished Products, and for Products identified under Allowances.
- J. Revisions to Schedules:
 - 1. Indicate the progress of each activity to the date of submittal, and the projected completion date of each activity.
 - 2. Identify the activities modified since the previous submittal, major changes in the scope, and other identifiable changes.
 - 3. Provide a narrative report to define the problem areas, the anticipated delays, and impact on the Schedule. Report the corrective action taken, or proposed, and its effect including the effect of changes on the schedules of separate contractors.

1.04 PROPOSED PRODUCTS LIST

- A. Within fifteen (15) days after the date of receipt of a Notice to Proceed, submit a list of major products proposed for use, with the name of the manufacturer, the trade name, and the model number of each product.
- B. For the products specified only by reference standards, give the manufacturer, trade name, model or catalog designation, and reference standards.
- C. With each product listed, indicate the submittal requirements specified to be adhered to, and an indication of relevant "long-lead-time" information, when appropriate.

1.05 METHOD FOR SUBMISSION OF SHOP DRAWING AND PRODUCT DATA

- A. Method of electronic or hard copy delivery of shop drawing and data submittals is to be discussed with Architect at Preconstruction meeting.
Use one of the three methods listed below:
 - 1. Use an internet-based system agreed upon by the Architect and Contractor.
Comply with required transmittal and data formats using numbering system approved by Architect.
Assemble submittal package into a single indexed file incorporating submittal and cover sheet explaining project name, number, Architect, Contractor and submittal number.
 - 2. Email an electronic format (PDF) copy to the Architect.
Comply with required transmittal and data formats using numbering system approved by Architect.
Assemble submittal package into a single indexed file incorporating submittal and cover sheet explaining project name, number, Architect, Contractor and submittal number.

3. Hard copies delivered to the Architect are to be submitted with the number of copies that the Contractor requires, plus three copies the Architect will retain.
- B. All shop drawings 24" x 36" or larger are to be delivered to the Architect in hard copy format as noted in Method 3 above.
- C. All submittals are to include a Contractor's review stamp confirming approval prior to submission to the Architect.
- D. The Architect will return the reviewed submittal to the Contractor for distribution to subcontractors, suppliers, fabricators, and others as necessary for proper performance of the Work.
- E. Submit color samples on actual product material for final color selection by sending them via postal or delivery service directly to the Architect's office.

1.06 PRODUCT DATA

- A. Product Data: Submit to the Architect for review for the limited purpose of checking for conformance with the information given and the design concept expressed in the Contract Documents. Provide copies and distribute in accordance with the SUBMITTAL PROCEDURES article and for the record documents purposes described in Section 01 78 00.
- B. Mark each copy to identify the applicable products, models, options, and other data. Supplement the manufacturers' standard data to provide the information specific to this Project.
- C. Indicate the product utility and electrical characteristics, the utility connection requirements, and the location of utility outlets for service for functional equipment and appliances.
- D. After receiving approved submittals, distribute in accordance with the Submittal Procedures article above and provide copies for record documents described in Section 01 78 00.

1.07 SHOP DRAWINGS

- A. Shop Drawings: Submit to the Architect for review for the limited purpose of checking for conformance with the information given and the design concept expressed in the Contract Documents. Produce copies and distribute in accordance with the SUBMITTAL PROCEDURES article and for the record documents purposes described in Section 01 78 00.
- B. Indicate the special utility and electrical characteristics, the utility connection requirements, and the location of utility outlets for service for functional equipment and appliances.
- C. Submit the number of copies that the Contractor requires, plus three copies the Architect will retain.

1.08 SAMPLES

- A. Samples: Submit to the Architect for review for the limited purpose of checking for conformance with the information given and the design concept expressed in the Contract Documents. Produce duplicates and distribute in accordance with the SUBMITTAL PROCEDURES article and for the record documents purposes described in Section 01 78 00.

- B. Samples For Selection as Specified in Product Sections:
 - 1. Submit to the Architect for aesthetic, color, or finish selection.
 - 2. Submit samples of the finishes, indicating colors, texture, and patterns for the Architect's selection.
 - 3. After review, produce duplicates and distribute in accordance with the SUBMITTAL PROCEDURES article and for the record documents purposes described in Section 01 78 00.
- C. Submit samples to illustrate the functional and aesthetic characteristics of the product, with integral parts and attachment devices. Coordinate the sample submittals for interfacing Work.
- D. Include identification on each sample, with the full Project information.
- E. Submit the number of samples specified in the individual specification Sections; the Architect will retain one sample.
- F. Reviewed samples, which may be used in the Work, are indicated in the individual specification Sections.
- G. Samples will not be used for testing purposes unless they are specifically stated to be in the specification Section.

1.09 DESIGN DATA

- A. Submit for the Architect's knowledge as contract administrator.
- B. Submit for information for the limited purpose of assessing conformance with the information given and the design concept expressed in the Contract Documents.

1.10 TEST REPORTS

- A. Submit for the Architect's knowledge as contract administrator.
- B. Submit test reports for information for the limited purpose of assessing conformance with the information given and the design concept expressed in the Contract Documents.

1.11 CERTIFICATES

- A. When specified in the individual specification Sections, submit certification by the manufacturer, installation/application subcontractor, or the Contractor to the Architect, in the quantities specified for the Product Data.
- B. Indicate that the material or product conforms to or exceeds the specified requirements. Submit supporting reference data, affidavits, and certifications as appropriate.
- C. Certificates may be recent or previous test results on the material or product, but must be acceptable to the Architect.

1.12 MANUFACTURER'S INSTRUCTIONS

- A. When specified in the individual specification Sections, submit printed instructions for delivery, storage, assembly, installation, start-up, adjusting, and finishing, to the Architect for delivery to the Owner in the quantities specified for Product Data.
- B. Indicate the special procedures, and the perimeter conditions requiring special attention, and the special environmental criteria required for application or installation.

1.13 MANUFACTURER'S FIELD REPORTS

- A. Submit reports for the Architect's benefit as contract administrator.
- B. Submit the report in duplicate within thirty (30) days of observation to the Architect for information.
- C. Submit for information for the limited purpose of assessing conformance with the information given and the design concept expressed in the Contract Documents.

1.14 ERECTION DRAWINGS

- A. Submit drawings for the Architect's benefit as contract administrator.
- B. Submit for information for the limited purpose of assessing conformance with the information given and the design concept expressed in the Contract Documents.
- C. Data indicating inappropriate or unacceptable Work may be subject to action by the Architect.

PART 2 - PRODUCTS

Not Used.

PART 3 - EXECUTION

Not Used.

END OF SECTION

SECTION 01 42 13

ABBREVIATIONS, ACRONYMS & DEFINITIONS

ABBREVIATIONS & ACRONYMS

The following is a list of abbreviations and acronyms and their meanings as used throughout this Specification.

ACM	Asbestos-Containing Material
AHERA	Asbestos Hazard Emergency Response Act
AIHA	American Industrial Hygiene Association
CFM	Cubic Feet Per Minute
CFR	Code of Federal Regulations
CO	Carbon Monoxide
CPR	Cardiopulmonary Resuscitation
DEP	Department of Environmental Protection
DOP	Diocetylphthalate
EPA	Environmental Protection Agency
°F	Degrees Fahrenheit
f/cc	Fibers Per Cubic Centimeter
GFCI	Ground Fault Circuit Interrupter
HEPA	High Efficiency Particulate Air
HUD	Housing and Urban Development
HVAC	Heating, Ventilation, and Air Conditioning
IH	Industrial Hygienist
NECA	National Electric Contractors Association
NEMA	National Electric Manufacturers Association
NESHAP	National Emission Standards for Hazardous Air Pollutants
NIOSH	National Institute for Occupational Safety and Health
OSHA	Occupational Safety and Health Administration
PAPR	Powered Air Purifying Respirator
PAT	Proficiency Analytical Testing Program
PEL	Permissible Exposure Limit
PSI	Pounds Per Square Inch
RI	Rhode Island
RIDOH	Rhode Island Department of Health
TWA	Time Weighted Average
UL	Underwriters Laboratories
US	United States
VAT	Vinyl Asbestos Floor Tile

DEFINITIONS

Aggressive Sampling	Air sampling which takes place after final clean-up while the air is being physically agitated.
Airborne Asbestos Analysis	Determination of the amount of asbestos fibers suspended in a given amount of air.
Air Lock	A system of enclosures consisting of two polyethylene-curtained doorways at least three feet apart that does not permit air movement between clean and contaminated areas.
Air Monitoring	The process of measuring the airborne fiber concentration of a specific quantity of air over a given amount of time.
Air Plenum	Any space used to convey air in a building or structure. The space above a suspended ceiling is often used as an air plenum.
Ambient Air	The surrounding air or atmosphere in a given area under normal conditions.
Amended Water	Water to which a chemical wetting agent (surfactant) has been added to improve penetration into asbestos-containing materials that are being removed.
Approved Landfill	A site for the disposal of asbestos-containing and other hazardous wastes that has been given EPA approval.
Asbestos	A generic name given to a number of naturally occurring hydrated mineral silicates that possess a unique crystalline structure, are incombustible in air, and are separable into fibers. Asbestos includes the asbestiform varieties of chrysotile (serpentine); crocidolite (riebeckite); amosite (cummingtonite-grunerite); anthophyllite; and actinolite.
Asbestos Abatement	Procedures to control fiber release from asbestos-containing materials in buildings.
Asbestos Fibers	Fibers greater than five microns in length and with a length to width ratio of 3:1, generated from an asbestos-containing material.
CFM	Cubic feet per minute.
Clean Area	The first stage of the decontamination enclosure system in which workers prepare to enter the work area.
Decontamination Unit	A series of connected rooms with polyethylene doorways for the purpose of preventing contamination of areas adjacent to the work area.
Dirty Room or Area	Any area in which the concentration of airborne asbestos fibers exceeds 0.01 f/cc, or where there is visible asbestos residue.

Encapsulant (sealant)	A substance applied to asbestos-containing material which controls the release of airborne asbestos-fibers.
EPA	Environmental Protection Agency.
Equipment Room	The last stage or room of the worker decontamination system before entering the work area.
Facepiece	The portion of a respirator which covers the wearer's nose, mouth, and eyes in a full facepiece.
f/cc	Fibers per cubic centimeters of air.
Fiber Control	Minimizing the amount of airborne fiber generation through the application of amended water onto asbestos-containing material, or enclosure (isolation) of the material.
Fireproofing	Spray- or trowel-applied fire resistant materials.
Friable Asbestos	Any materials that contain more than 1% asbestos by weight and can be crumbled, pulverized, or reduced to powder by hand pressure.
Full-Facepiece Respirator	A respirator which covers the wearer's entire face from the hairline to below the chin.
Glovebag	Plastic bag-type enclosure placed around asbestos-containing pipe lagging so that it may be removed without generating airborne fibers into the atmosphere.
Ground Fault Circuit Interrupter	A circuit breaker that is sensitive to very low levels of current leakage from a fault in an electrical system.
HEPA	High Efficiency Particulate Air (Air Filter).
HVAC System	Heating, Ventilation, and Air Conditioning System, usually found in large business and industry facilities.
Logbook	An official record of all activities which occurred during a removal project.
Make-up Air	Supplied or recirculated air to offset that which has already been exhausted from an area.
Medical Examinations	An evaluation of a person's health status performed by a medical doctor.
Method 7400	NIOSH sampling and analytical method for fibers which uses Phase-contrast microscopy. Replaces Method P&CAM 239.
Micron	One millionth of a meter.
Millimeter	One thousandth of a meter.

MSDS	Material Safety Data Sheet.
Negative Pressure	An atmosphere created in a work area enclosure such that airborne fibers will tend to be drawn through the filtration system rather than leak out into the surrounding areas. The air pressure inside the work area is less than that outside the work area.
NESHAP	National Emission Standards for Hazardous Air Pollutants – EPA Regulation 40 CFR Subpart M, Part 61.
NIOSH	National Institute for Occupational Safety and Health, established by the Occupational Safety and Health Act of 1970.
NIOSH/MSHA	The official approving agencies for respiratory protective equipment who test and certify respirators.
OSHA	The Occupational Safety and Health Administration, created by the Occupational Safety and Health Act of 1970; serves as the enforcement agency for safety and health in workplace environments.
Personal Sample	An air sample taken with the sampling pump directly attached to the worker with the collecting filter placed in the worker's breathing zone.
Phase Contrast Microscopy (PCM)	An optical microscopic technique used for the counting of fibers in air samples, but which does not distinguish fiber types.
Polyethylene	Six-mil fire retardant plastic sheeting which is often used to seal off an area in which asbestos removal is taking place to prevent contamination of other areas.
Powered Air Purifying Respirator (PAPR)	Either a full facepiece, helmet, or hooded respirator that has the breathing air powered to the wearer after it has been purified through a filter.
Qualitative Fit Test	A method of testing a respirator's face-to-facepiece seal by covering the inhalation or exhalation valves and breathing either in or out to determine the presence of any leaks.
Recordkeeping	Detailed documentation of all program activities, decisions, analyses, and any other information pertinent to a project.
Shower Room	A room between the clean room and the equipment room in a worker decontamination system in which workers take showers when leaving the work area.
Substrate	The material or existing surface located under or behind the asbestos-containing material.

Supplied Air Respirator	A respirator that has a central source of breathing which is supplied to the wearer by way of an airline.
Surfactant	A chemical wetting agent added to water to improve its penetration abilities into asbestos-containing materials.
TWA	Time-Weighted Average, as in air sampling.
Visual Inspection	A walk-through type inspection of the work area to detect incomplete work, damage, or inadequate clean-up of a work site.
Water Damage	Deterioration or delamination of ceiling or wall materials due to leaks from plumbing or cracks in the roof.
Wetting Agents	Materials that are added to water which is used for wetting asbestos-containing material in order for the water to penetrate more effectively.
Workers' Compensation	A system of insurance required in some states by law, financed by employers, which provides payments to employees or their families for occupational injuries, illnesses, or fatalities resulting in loss of wage or income incurred while at work.

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SECTION 01 43 00

QUALITY REQUIREMENTS

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Quality control and control of installation.
- B. Verification of Credentials and Licenses.
- C. Safety Awareness Policy
- D. Tolerances
- E. References.
- F. Mock-up requirements.
- G. Manufacturers' field services.

1.02 QUALITY CONTROL AND CONTROL OF INSTALLATION

- A. Monitor a quality control over suppliers, manufacturers, products, services, site conditions, and workmanship, to produce Work of the specified quality.
- B. Comply with the manufacturers' instructions, including each step in sequence.
- C. When the manufacturers' instructions conflict with the Contract Documents, request a clarification from the Architect before proceeding.
- D. Comply with the specified standards as a minimum quality for the Work except where more stringent tolerances, codes, or specified requirements indicate higher standards or more precise workmanship.
- E. Perform the Work by persons qualified to produce the required and specified quality.
- F. Verify that field measurements are as indicated on the Shop Drawings or as instructed by the manufacturer.
- G. Secure products in place with positive anchorage devices designed and sized to withstand stresses, vibration, physical distortion, or disfigurement.
- H. Field measurements
 - 1. Verify actual measurements/openings by field measurements before fabrication; show recorded measurements on shop drawings. Coordinate field measurements, fabrication scheduled with construction progress to avoid construction delays.

- I. The Contractor, by approving and submitting Shop Drawings, Product Data, Samples, and similar submittals thereby represent that they have determined and verified all dimensions, quantities, field dimensions, relations to existing work, coordination with work to be installed later, coordination with information on previously accepted Shop Drawings, Product Data, Samples, or similar submittals and verification of compliance with all the requirements of the Contract Documents. The accuracy of all such information is the responsibility of the Contractor. In reviewing Shop Drawings, Product Data, Samples, and similar submittals the Architect shall be entitled to rely upon the Contractor's representation that such information is correct and accurate.

1.03 VERIFICATION OF CREDENTIALS AND LICENSES

- A. All persons employed on the project site must have appropriate and current credentials and licenses in their possession, at the project site, for the work they are performing.
- B. Be forewarned that inspectors will be checking for verification of credentials and licenses of both union and non-union persons, in their onsite inspections.
- C. Inspectors will also be reviewing Contractor's Certified Monthly Payroll Records for conformance with RI State Prevailing Wage Rate requirements.
- D. Those persons without the appropriate credentials and licenses will be subject to dismissal from the project site.

1.04 SAFETY AWARENESS POLICY

- A. In accordance with Rhode Island General Laws, Title 28, S28-20-35 5.1 Safety awareness program required. (Effective January 1, 2002.) all contractors who bid on municipal and state construction projects with a total project cost of One Hundred Thousand Dollars(\$100,000.00) or more, shall have an OSHA "ten hour safety construction program" for their on-site employees. The training shall utilize instructors trained by the Occupational Safety Health Administration, using OSHA approved curriculum. Graduates shall receive a card from the U. S. Department of Labor Occupational Safety and Health Administration certifying the successful completion of the training course. The director of the Rhode Island Department of Labor and Training shall promulgate rules, regulations and penalties to enforce provisions of this section.
- B. The Contractor is required to conform to all applicable OSHA requirements on this project.

1.05 TOLERANCES

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

1.06 REFERENCES

- A. For products or workmanship specified by association, trade, or other consensus standards, comply with requirements of the standard, except when more rigid requirements are specified or are required by applicable codes.
- B. Conform to reference standard by the date of issue current on the date of the Contract Documents, except where a specific date is established by code.
- C. Obtain copies of the standards where required by the product specification Sections.
- D. When the specified reference standards conflict with the Contract Documents, request a clarification from the Architect before proceeding.
- E. Neither the contractual relationships, duties, nor responsibilities of the parties in the Contract, nor those of the Architect, shall be altered from the Contract Documents by mention or inference otherwise in reference documents.

1.07 MOCK-UP REQUIREMENTS

- A. Tests will be performed under the provisions identified in this Section and identified in the respective product specification Sections.
- B. Assemble and erect the specified items with the specified attachment and anchorage devices, flashing, seals, and finishes.
- C. Accepted mock-ups shall be a comparison standard for the remaining Work.
- D. Where the mock-up has been accepted by the Architect and is specified in the product specification Sections to be removed, remove the mock-up and clear the area when directed to do so by the Architect.

1.08 MANUFACTURERS' FIELD SERVICES

- A. When specified in the individual specification Sections, require the material or Product suppliers, or manufacturers, to provide qualified staff personnel to observe the site conditions, the conditions of the surfaces and installation, the quality of workmanship, the start-up of equipment, or test, adjust and balance of equipment as applicable, and to initiate instructions when necessary.
- B. Submit the qualifications of the observer to the Architect thirty (30) days in advance of the required observations. The Observer is subject to approval by the Architect.
- C. Report the observations and the site decisions or instructions given to the applicators or installers that are supplemental or contrary to the manufacturers' written instructions.
- D. Refer to Section 01 33 00 - SUBMITTAL PROCEDURES, MANUFACTURER'S FIELD REPORTS article.

PART 2 - PRODUCTS

Not Used.

PART 3 - EXECUTION

Not used.

END OF SECTION

SECTION 01 50 00

TEMPORARY FACILITIES AND CONTROLS

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Temporary Utilities:
 - 1. Temporary electricity.
 - 2. Temporary lighting for construction purposes.
 - 3. Temporary heating.
 - 4. Temporary ventilation.
 - 5. Temporary water service.
 - 6. Temporary sanitary facilities.
- B. Construction Facilities:
 - 1. Storage sheds and trailers.
 - 2. Field office
 - 3. Temporary scaffolding
 - 4. Hoisting
 - 5. Vehicular access.
 - 6. Parking.
 - 7. Progress cleaning and waste removal.
- C. Temporary Controls:
 - 1. Barriers
 - 2. Enclosures
 - 3. Dust control.
 - 4. Noise control.
 - 5. Pollution control.
 - 6. Fire Detection
 - 7. Pest control.
 - 8. Rodent control.
- D. Removal of utilities, facilities, and controls.

1.02 TEMPORARY ELECTRICITY

- A. The Owner will pay the cost of energy used. Exercise measures to conserve energy. Utilize the Owner's existing power service.
- B. Permanent convenience receptacles may be utilized during construction.

1.03 TEMPORARY LIGHTING FOR CONSTRUCTION PURPOSES

- A. Provide and maintain incandescent lighting for construction operations to achieve a minimum lighting level of 2 watt/sq ft.
- B. Permanent building lighting may be utilized during construction.

1.04 TEMPORARY HEATING

- A. Existing heating equipment may be used.
- B. The Owner will pay the cost of heat. Exercise measures to conserve energy. Utilize the Owner's existing heat plant, extend and supplement with temporary heat devices as needed to maintain the specified conditions for construction operations.
- C. Maintain a minimum ambient temperature of 50 degrees F in the areas where construction is in progress, unless indicated otherwise in the product Sections.

1.05 TEMPORARY VENTILATION

- A. Ventilate the enclosed area to achieve a curing of materials, to dissipate humidity, and to prevent the accumulation of dust, fumes, vapors, or gases.
- B. Utilize the existing ventilation equipment. Extend and supplement the equipment with temporary fan units as required to maintain clean air for construction operations.

1.06 TEMPORARY WATER SERVICE

- A. The Owner will pay the cost of temporary water. Exercise measures to conserve energy. Utilize the Owner's existing water system, extend and supplement with temporary devices as needed to maintain the specified conditions for construction operations.

1.07 TEMPORARY SANITARY FACILITIES

- A. Provide and maintain the required facilities and enclosures. Existing facility use is not permitted. Provide facilities at the time of project mobilization.

1.08 FIELD OFFICES, TRAILERS AND SHEDS

- A. Existing building spaces may be used for field offices and storage in locations designated by the Owner.
- B. Storage Areas, Sheds and Trailers: Size to the storage requirements for the products of the individual Sections, allowing for access and orderly provision for the maintenance and for the inspection of Products to the requirements of Section 01 60 00.
- C. Maintenance and Cleaning
 - 1. Weekly janitorial services for the offices, periodic cleaning and maintenance for the office and storage areas.
 - 2. Maintain the approach walks free of mud, water, and snow.
- D. Removal: At the completion of the Work remove the trailers and debris. Restore the areas to original condition.

(NOTE: All materials and products ordered prior to the start of construction must be stored on the Contractor's premises or an arrangement can be made with the school department for storage in trailers on site but all such materials will remain the responsibility of the Contractor.)

1.09 TELEPHONE SERVICE

- A. The Contractor is required to insure the on-site Project Supervisor maintains a cell phone in their possession for the duration of the Contract.

1.10 TEMPORARY SCAFFOLDING

- A. Contractor is to provide temporary scaffolding as necessary for construction purposes.
- B. The scaffolding is to be braced properly, assembled and installed as required to meet all OSHA requirements.
- C. Remove from the site all scaffolding, associated bracing and supports upon completion of construction. Repair all surfaces and site to original condition including all landscaping, grass and hardscape.
- D. Scaffolding must allow for unimpeded entry and egress from the building at all times when it is occupied by employees or the public.
- E. The existing building surfaces are to be thoroughly protected from damage due to construction to the Owner's satisfaction. Any damages to the existing building due to construction are the Contractor's responsibility and shall be restored to original condition to the Owner's satisfaction.

1.11 HOISTING

- A. Contractor is responsible for all hoisting required to facilitate, serve, stock, clean, and complete the Work. Include all costs for operating engines, fuel, delivery and removal, mobilization, staging, protection of grades and surfaces, and equipment. All surfaces damaged by hoisting equipment or crane are to be cleaned and repaired to match original condition. All damaged grass is to receive loam and seed to match existing.
- B. Method of transporting all equipment to the rooftop is the Contractor's responsibility and must be reviewed and approved by the Owner. The building surfaces are to be thoroughly protected from damage due to construction to the Owner's satisfaction. The Contractor is responsible to adhere to all OSHA requirements.

1.12 VEHICULAR ACCESS

- A. Provide unimpeded access for emergency vehicles. Maintain 20 foot width driveways with turning space between and around combustible materials.
- B. Provide and maintain access to fire hydrants and control valves free of obstructions.
- C. Use designated existing on-site roads for construction traffic.

1.13 PARKING

- A. Arrange for temporary surface parking areas to accommodate the construction personnel.
- B. Location must be approved by the Owner.
- C. Use of existing parking facilities by construction personnel is permitted.
- D. When site space is not adequate, arrange through the Owner for additional off-site parking.
- E. Use of designated existing on-site streets and driveways for construction traffic is permitted. Tracked vehicles are not allowed on paved areas.
- F. Do not allow heavy vehicles or construction equipment in parking areas.

1.14 PROGRESS CLEANING AND WASTE REMOVAL

- A. Maintain areas free of waste materials, debris, and rubbish. Maintain the site in a clean and orderly condition.
- B. Collect and remove waste materials, debris, and rubbish from the site periodically, weekly, or daily, as necessary to prevent an on-site accumulation of waste material, debris, and rubbish, and dispose off-site.
- C. Open free-fall chutes are not permitted. Terminate closed chutes into appropriate containers with lids.

1.15 BARRIERS

- A. Provide barriers to prevent unauthorized entry to the construction areas and to protect existing facilities from damage from the construction operations, or demolition.

1.16 ENCLOSURES

- A. Provide temporary fire resistant polyethylene dust drapes as required to separate the work areas from the Owner occupied areas, to prevent penetration of dust and moisture into the Owner occupied areas, and to prevent damage to the existing materials and equipment. Seal perimeter as required.

1.17 DUST CONTROL

- A. Execute the Work by methods to minimize raising dust from construction operations.
- B. Provide positive means to prevent air-borne dust from dispersing into the atmosphere.

1.18 NOISE CONTROL

- A. Provide methods, means, and facilities to minimize noise produced by the construction operations.
- B. Restrictions on Noise:
 - 1. Use equipment with well-maintained mufflers.

2. Use the least noisy techniques practical.
3. Schedule noisy activities when ambient background noise level is highest.
4. Turn off all unneeded and idling equipment and engines.
5. Locate noise sources as far as practical from noise sensitive locations.
6. Orient noise sources away from noise sensitive locations

1.19 POLLUTION CONTROL

- A. Provide methods, means, and facilities to prevent the contamination of soil, water, and the atmosphere from discharge of noxious, toxic substances, and pollutants produced by the construction operations.

1.20 FIRE DETECTION

- A. Before beginning any construction that can potentially trigger the existing fire detection system, notify the Owner and request to temporarily disconnect the system in the specific areas of construction, for as long as may be necessary.

1.21 PEST CONTROL

- A. Provide methods, means, and facilities to prevent pests and insects from damaging the Work, or entering the facility.

1.22 RODENT CONTROL

- A. Provide methods, means, and facilities to prevent rodents from accessing or invading the premises.

1.23 REMOVAL OF UTILITIES, FACILITIES, AND CONTROLS

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

PART-2 - PRODUCTS

Not Used.

PART 3 - EXECUTION

Not Used.

END OF SECTION

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SECTION 01 60 00

PRODUCT REQUIREMENTS

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Products.
- B. Product delivery requirements.
- C. Product storage and handling requirements.
- D. Product options.
- E. Product substitution procedures.

1.02 PRODUCTS

- A. Products: Means new material, machinery, components, fixtures, or systems forming the Work; but does not include the machinery or equipment used for the preparation, fabrication, conveying, or erection of the Work. Products may include the existing materials or components required or specified for reuse.
- B. Furnish products of qualified manufacturers suitable for the intended use. Furnish products of each type by a single manufacturer unless specified otherwise.
- C. Do not use materials and equipment removed from the existing premises, except as specifically permitted by the Contract Documents.
- D. Furnish interchangeable components of the same manufacturer for the components being replaced.

1.03 PRODUCT DELIVERY REQUIREMENTS

- A. Transport and handle products in accordance with the manufacturer's instructions.
- B. Promptly inspect shipments to ensure that the products comply with the requirements, the quantities are correct, and the products are undamaged.
- C. Provide equipment and personnel to handle the products by methods to prevent soiling, disfigurement, or damage.

1.04 PRODUCT STORAGE AND HANDLING REQUIREMENTS

- A. Store and protect the products in accordance with the manufacturers' instructions.
- B. Store with seals and labels intact and legible.

- C. Store sensitive products in weather tight, climate controlled, enclosures in an environment favorable to the product.
- D. For exterior storage of fabricated products, place on sloped supports above the ground.
- E. Provide bonded off-site storage and protection when the site does not permit on-site storage or protection.
- F. Cover products subject to deterioration with impervious sheet covering. Provide ventilation to prevent the condensation and degradation of products.
- G. Store loose granular materials on solid flat surfaces in a well-drained area. Prevent mixing with foreign matter.
- H. Provide equipment and personnel to store the products by methods to prevent soiling, disfigurement, or damage.
- I. Arrange storage of the products to permit access for inspection. Periodically inspect to verify that the products are undamaged and are maintained in acceptable condition.

1.05 PRODUCT OPTIONS

- A. Products Specified by Reference Standards or by Description Only:
Any Product meeting those standards or description.
- B. Products Specified by Naming One or More Manufacturers with a Provision for Substitutions:
Submit a request for substitution for any manufacturer not named in accordance with the following article.
- C. Products Specified by Naming Three or More Manufacturers with No Substitutions:
Products of one of the manufacturers listed and meeting the specifications, no options or substitutions allowed.

1.06 PRODUCT SUBSTITUTION PROCEDURES

- A. Throughout these Specifications, types of materials may be specified by manufacturer's name, and product information in order to establish standards of quality and performance and not for the purpose of limiting competition.
- B. Inclusion of additional names of manufacturers, other than the Basis of Design manufacturer, does not imply acceptability of standard products from those manufacturers listed. All manufacturers listed shall conform, with modification as necessary, to criteria established by the specification for performance, efficiency, materials, finishes and special accessories along with, at a minimum, matching the Basis of Design product.
- C. No substitutions will be considered prior to receipt of Bids unless written request for approval (by hard copy or email) has been received by the Architect at least 10 calendar days prior to the Bid due date. If the product substitution is approved prior to receipt of the Bids, such approval will be set forth in an Addendum. Bidders shall not rely upon approvals announced in any other manner.

It will be the Architect's and Owner's option to consider a formal request, review and acceptance of a product substitution following award of the contract. For all requests made after award of the contract, the Architect will review the requests with reasonable promptness and notify the Contractor in writing of the decision to accept or reject the substitution.

- D. A request for substitution of any manufacturer or product not named in a specification section is to be submitted in accordance with the following.
1. Document each request with complete data substantiating the compliance of a proposed Substitution with the Contract Documents.
 2. A request constitutes a representation that the Contractor:
 - a. Has investigated the proposed product and determined that it is equal to or superior in all respects to the specified product.
 - b. Will provide the same warranty for the substitution as for the specified product.
 - c. Will coordinate the installation and make changes to other Work that may be required for the Work to be complete with no additional cost to the Owner.
 - d. Waives claims for additional costs or time extension that may subsequently become apparent.
 - e. Will coordinate installation with all affected trade Contractors, specialty Contractors and the like and will be responsible for any and all costs which may arise as a result of this substitution.
 - f. Will reimburse the Owner and the Architect for review or redesign services associated with re-approval by the authorities having jurisdiction.
- E. Substitutions will not be reviewed when a substitution is implied on the Shop Drawing or Product Data submittals without a separate written request or when acceptance will require revision to the Contract Documents.
- F. If the Contractor proposes to use a material which, while suitable for the intended use, deviates in any way from the detailed requirements of the Contract Documents, the Contractor shall inform the Architect in writing of the nature of such deviations at the time the material is submitted for review.
- G. Substitution Submittal Procedure:
1. Submit the Request for Substitution letter, Shop Drawings, Product Data, direct comparison table and the certified test results attesting to the proposed product equivalence by E-mail via an electronic format (PDF) copy to the Architect. Assemble package into a single indexed file incorporating all the required information.
 2. The Contractor shall submit a separate request for each product substitution.
 3. Provide direct comparison between the specified product and the proposed substitution. The burden of proof is on the proposer.
Supporting data to be submitted to permit a fair evaluation of the proposed substitution must address:
 - a. Performance;
 - b. Capacity;
 - c. Efficiency;
 - d. Safety;
 - e. Function;
 - f. Appearance;
 - g. Quality and durability;

- h. Finish;
 - i. Warranty terms and conditions;
 - j. Directly compare, side-by side, in table format, all listed testing agency performance requirements;
 - k. Delivery times and effect on schedules, if any;
 - l. Changes in space requirements or affect on other elements of work, if any;
 - m. Availability of maintenance service and source of replacement materials, if applicable.
- H. The Contract Documents are intended to produce a building of consistent character and quality of design. All components of the building including visible items of mechanical and electrical equipment have been selected to have a coordinated design in relation to the overall appearance of the building. The Architect shall judge the design and appearance of proposed substitutes on the basis of their suitability in relation to the overall design of the Project, as well as for their intrinsic merits. The Architect will not approve as equal to materials specified proposed substitutes which, in the Architect's opinion, would be out of character, obtrusive, or otherwise inconsistent with the character or quality of design of the Project. In order to permit coordinated design of color and finishes the Contractor shall, if required by the Architect, furnish the substituted material in any color, finish, texture, or pattern which would have been available from the manufacturer originally specified, at no additional cost to the Owner.

PART 2 - PRODUCTS

Not Used.

PART 3 - EXECUTION

Not Used.

END OF SECTION

SECTION 01 70 00

EXECUTION REQUIREMENTS

PART 1 – GENERAL

1.01 SECTION INCLUDES

- A. Examination.
- B. Preparation.
- C. Protection of adjacent construction.
- D. Cutting and patching.
- E. Special procedures.
- F. Progress cleaning and waste removal.
- G. Final cleaning.
- H. Starting and adjusting of systems.
- I. Demonstration and Instructions.
- J. Protecting Installed Construction.

1.02 EXAMINATION

- A. Acceptance of Conditions:
 - 1. Verify that the existing applicable site conditions, substrates, or substrate surfaces are acceptable or meet the specific requirements of the individual specifications Sections, for subsequent Work to proceed.
 - 2. Verify that the existing substrate is capable of structural support or attachment of new Work being applied or attached.
 - 3. Examine and verify specific conditions described in the individual specifications Sections.
 - 4. Verify that utility services are available, of the correct characteristics, and in the correct locations.
 - 5. Beginning of new Work, that relies upon the quality and proper execution of the Work of a preceding trade, means acceptance of that preceding Work as appropriate for the proper execution of subsequent Work.
 - 6. Acceptance of preceding Work that can be shown later to have adversely affected proper performance of new Work may result in removal and repeat performance of all Work involved at no cost to the Owner.

1.03 PREPARATION

- A. Clean substrate surfaces prior to applying the next material or substance.
- B. Seal cracks or openings of the substrate prior to applying the next material or substance.
- C. Apply a manufacturer required or recommended substrate primer, sealer, or conditioner prior to applying any new material or substance in contact or bond.
- D. Prior to the application, installation, or erection of any products and product components, perform any other preparatory operations, or surface or substrate modifications, as may be specified or directed by the product manufacturers.

1.04 PROTECTION OF ADJACENT CONSTRUCTION

- A. Protect the existing adjacent properties and provide special protection where specified in the individual Specification Sections.
- B. Protect the existing finished floors, stairs, and other existing surfaces from traffic, dirt, wear, damage, or movement of heavy objects, by protecting with durable sheet materials.
- C. Repair adjacent properties damaged by the construction operations to the original condition to the satisfaction of the Owner.
- D. Prohibit unnecessary traffic from the existing landscaped areas.
- F. Restore the grassed landscaped areas damaged by the construction operations to a full healthy growth by installing loam and sod.

1.05 CUTTING AND PATCHING

- A. Employ the original, or skilled and experienced installer to perform cutting and patching.
- B. Submit a written request in advance of the cutting or altering elements which affect:
 - 1. Structural integrity of element.
 - 2. Integrity of weather-exposed or moisture-resistant elements.
 - 3. Efficiency, maintenance, or safety of the element.
 - 4. Visual qualities of sight-exposed elements.
 - 5. Existing construction, or the Work of separate contractor.
- C. Execute cutting, fitting, and patching including excavation and fill, to complete the Work, and to:
 - 1. Fit the several parts together, to integrate with the other Work.
 - 2. Uncover Work to install or correct ill-timed Work.
 - 3. Remove and replace defective and non-conforming Work.
 - 4. Remove samples of installed Work for testing.
 - 5. Provide openings in the elements of Work for penetrations of mechanical and electrical Work.
- D. Execute Work by methods that will avoid damage to other Work, and provide proper surfaces to receive patching and finishing.

- E. Cut masonry, concrete, and other rigid materials using a masonry saw or core drill.
- F. Restore the Work with new Products in accordance with the requirements of Contract Documents.
- G. Fit Work tight to the pipes, sleeves, ducts, conduits, and other penetrations through surfaces.
- H. At the penetration of fire rated partition, ceiling, or floor construction completely seal the voids with a fire rated or fire resistant material to the full thickness of the penetrated element as required to equal the rating of the surrounding construction.
- I. Refinish surfaces to match the adjacent finishes. For continuous surfaces refinish to nearest intersection; for an assembly refinish the entire unit.
- J. Identify any hazardous substance or conditions exposed during the Work to the Architect for a decision or remedy.

1.06 SPECIAL PROCEDURES

- A. Materials: As specified in the product Sections; match the existing with new products, or salvaged products as appropriate, for patching and extending work.
- B. Employ a skilled and experienced installer to perform alteration work.
- C. Cut, move, or remove items as necessary for access to the alterations and renovation Work. Replace and restore at completion.
- D. Remove unsuitable material not marked for salvage, such as rotted wood, corroded metals, and deteriorated masonry and concrete. Replace the materials as specified for finished Work.
- E. Remove the debris and abandoned items from the area and from concealed spaces.
- F. Prepare the surface and remove surface finishes to provide the installation of new Work and finishes,
- G. Close the openings in exterior surfaces to protect the existing Work from the weather and extremes of temperature and humidity.
- H. Remove, cut, and patch the Work in a manner to minimize damage and to provide a means of restoring products and finishes to the original or specified condition.
- I. Where new Work abuts or aligns with the existing, provide a smooth and even transition. Patch the Work to match the existing adjacent Work in texture and appearance.
- J. When finished surfaces are cut so that a smooth transition with the new Work is not possible, terminate the existing surface along a straight line at a natural line of division and submit a recommendation to the Architect for review.
- K. Where a change of plane of 1/4 inch or more occurs, submit a recommendation for providing a smooth transition to the Architect for review.

- L. Patch or replace the portions of existing surfaces which are damaged, or showing other imperfections.
- M. Finish surfaces as specified in the individual product Sections or as indicated on the Drawings.

1.07 PROGRESS CLEANING AND WASTE REMOVAL

- A. Maintain areas free of waste materials, debris, and rubbish. Maintain the site in a clean and orderly condition.
- B. Remove the debris and rubbish from pipe chases, plenums, attics, crawl spaces, and other closed or remote spaces, prior to enclosing the space.
- C. Collect and remove the waste materials, debris, and rubbish from the site periodically or weekly and dispose of off-site.
- D. Open free-fall chutes are not permitted. Terminate closed chutes into appropriate containers with lids.

1.08 FINAL CLEANING

- A. Execute final cleaning of areas affected by the Work prior to the final project assessment.
- B. Clean the equipment and fixtures to a sanitary condition using cleaning materials appropriate to the surface and material being cleaned.
- C. Clean or replace filters of operating equipment as directed by the Architect.
- E. Clean the debris from roofs, gutters, downspouts, and drainage systems.
- F. Clean the site; sweep the paved areas, rake clean the landscaped surfaces.
- G. Remove the waste and surplus materials, rubbish, and the construction facilities from the site.

1.09 STARTING AND ADJUSTING OF SYSTEMS

- A. Coordinate the schedule for the starting and adjusting of various equipment and systems.
- B. Notify the Architect and the Owner seven days prior to the starting and adjusting of each item.
- C. Verify that each piece of equipment or system has been checked for the proper lubrication, drive rotation, belt tension, control sequence, or other conditions which may cause damage.
- D. Verify that the tests, meter readings and the specified electrical characteristics agree with those required by the equipment or system manufacturer.
- E. Verify wiring and support components for equipment are complete and tested.
- F. Execute the starting and adjusting under the supervision of the responsible Contractor's personnel or manufacturer's representative, in accordance with the manufacturer's instructions.

- G. Adjust the operating Products and equipment to ensure smooth and unhindered operation.
- H. When specified in the individual specifications Section, require the manufacturer to provide the authorized representative to be present at the site to inspect, check, and approve the equipment or system installation prior to starting, and to supervise the placing of equipment or system in operation.
- I. Submit a written report in accordance with Section 01400 that the equipment or system has been properly installed and is functioning correctly.

1.10. DEMONSTRATION AND INSTRUCTIONS

- A. Demonstrate the operation and maintenance of Products to the Owner's personnel two weeks prior to the date of Substantial Completion.
- B. For equipment or systems requiring seasonal operation, perform a demonstration for the other season within six months.
- C. Utilize the operation and maintenance manuals as the basis for instruction. Review the manuals with the Owner's personnel in detail to explain all aspects of the operation and maintenance.
- D. Demonstrate the start-up, operation, control, adjustment, trouble shooting, servicing, maintenance, and shutdown of each item of equipment at a scheduled or agreed upon time, at the equipment or system location.
- E. Prepare and insert additional data in the operations and maintenance manuals when the need for additional data becomes apparent during the instruction.

1.11 PROTECTING INSTALLED CONSTRUCTION

- A. Protect the installed Work and provide special protection where specified in the individual specification sections.
- B. Provide temporary and removable protection for the installed products. Control activity in the immediate work area to prevent damage.
- C. Protect finished floors, stairs, and other surfaces from traffic, dirt, wear, damage, or movement of heavy objects, by protecting with durable sheet materials.
- D. Repair or replace the installed Work damaged by construction operations, as directed by the Architect.

PART 2 - PRODUCTS

Not Used.

PART 3 - EXECUTION

Not Used.

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SECTION 01 74 19

WASTE MATERIALS MANAGEMENT AND RECYCLING

PART 1 GENERAL

1.1 RELATED DOCUMENTS:

- A. Drawings and general provisions of each prime Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 WASTE MANAGEMENT GOALS FOR THE PROJECT

- A. The Owner has established that this Project shall generate the least amount of waste possible and that processes shall be employed that ensure the generation of as little waste as feasible including prevention of damage due to mishandling, improper storage, contamination, inadequate protection or other factors as well as minimizing overall packaging and poor quantity estimating.
- B. Of the inevitable waste that is generated, the waste materials designated in this specification shall be salvaged for reuse or recycling. Waste disposal in landfills or incinerators shall be minimized. On new construction projects this means careful recycling of job site waste, on demolition projects this also means careful removal for salvage.
- C. The Contractor is to follow the NE-CHPS Materials Prerequisite 3: Site Waste Management requirements to recycle, reuse and/or salvage at least 50% (by weight) of all non-hazardous construction and demolition waste, not including land clearing and associated debris.

1.3 SUMMARY:

- A. This Section includes required salvage and recycling of the following waste materials and applies to all such listed waste materials produced during the course of this Contract:
 - 1. Concrete, Masonry, and Other Inert Fill Material: Concrete, brick, rock, clean soil not intended for other on-site use, broken up asphalt pavement containing no ABC stone, clay, concrete, or other contaminants, and other inert material.
 - 2. Metals: Metal scrap including iron, steel, copper, brass, and aluminum.
 - 3. Untreated Wood: Unpainted, untreated dimensional lumber, plywood, oriented strand board, masonite, particleboard, and wood shipping pallets.
 - 4. Gypsum Wallboard Scrap: Excess drywall construction materials including cuttings, other scrap, and excess materials.
 - 5. Cardboard: Clean, corrugated cardboard such as used for packaging, etc.
 - 6. Paper: Discarded office refuse such as unwanted files, correspondence, etc.
 - 7. Plastic Buckets: Containers for various liquid and semi-solid or viscous construction materials and compounds.
 - 8. Beverage Containers: Aluminum, glass, and plastic containers.
 - 9. Other Mixed Construction and Demolition Waste: Solid waste resulting solely from construction, remodeling, repair, or demolition operations on pavement, buildings, or other structures exclusive of waste materials listed herewith.
 - 10. Materials to be salvaged if possible:
 - a. Dimensioned Lumber and Heavy Timbers.
 - b. Structural Steel.

- c. Insulation.
- d. Brick and block.
- e. Electric Equipment and Light Fixtures.
- f. Plumbing fixtures and brass.

- B. Non-Recyclable Waste: Collect and segregate non-recyclable waste for delivery to a permitted landfill site.
 - 1. Mixed Solid Waste: Solid waste usually collected as a municipal service, exclusive of waste materials listed above.

1.4 HAZARDOUS MATERIAL SUSPICION

- A. If, during the course of construction, the Contractor suspects a material to contain asbestos, all work involving the material is to be stopped and the Architect notified immediately of the suspicion. Until the material is confirmed to be safe or tested and determined to be an asbestos containing material, the Contractor is to assume it contains asbestos and is to avoid contact. Upon notification of its composition the Architect will determine the course of action and inform the Contractor accordingly.

1.5 DEFINITIONS:

- A. Waste Materials are defined as large and small pieces of the materials indicated which are excess to the contract requirements and generally include materials which are to be salvaged from existing construction and items of trimmings, cuttings and damaged goods resulting from new installations, which can not be effectively used in the Work.

1.6 SUBMITTALS:

- A. **NOTE:** The Owner is applying for reimbursement from the state through conformance with the program Northeast Collaborative for High Performance Schools (NE-CHPS) thus the following items are required to be submitted by the General Contractor to the Architect.
- B. Construction Waste Management Plan: Before start of construction, submit for the approval of the Architect a construction waste management plan indicating how Contractor proposes to collect, segregate, and dispose of all construction wastes and debris produced by the work of this Contract. Show compliance with regulations specified under "Quality Assurance" article below. Include a list of recycling facilities to which indicated recyclable materials will be distributed for disposal. Identify materials that are not recyclable or otherwise conservable that must be disposed of in a landfill or other means acceptable under governing State and local regulations. List permitted landfills and/or other disposal means to be employed. Indicate any instances where compliance with requirements of this specification does not appear to be possible and request resolution from the Architect.
- C. Delivery Receipts: Provide to the Construction Quality Manager delivery receipts for waste materials salvaged and sent to permitted waste materials processors or recyclers within 48 hours of delivery that indicate the location and name of firm accepting recyclable waste materials, types of materials, net weights of each type, date of delivery and value of materials. Hazardous weights are not to be included.

- D. Application for Payments: The Contractor shall submit with each Application for Payment a summary of waste materials, recycled, salvaged and disposed of using a form generated by the Contractor and approved by the Architect. Failure to submit this information shall render the Application for Payment incomplete and shall delay Payment. The Summary shall contain the following information: For each material salvaged and recycled from the Project, include the amount (in cubic yards or tons or in the case of salvaged items state quantities by number, type and size of items) and the destination (i.e. recycling facility, used building materials yard). For each material land filled or incinerated from the Project, include the amount (in cubic yards or tons) of material and the identity of the landfill, incinerator or transfer station.

1.7 QUALITY ASSURANCE:

- A. Regulatory Requirements: Comply with all applicable requirements of the federal, state or local authorities concerning Management of Construction, Demolition, Land Clearing, Inert, and Yard Trash Debris
- B. Disposal Sites, Recyclers, and Waste Materials Processors: Use only facilities properly permitted by the State and by local authorities where applicable.
- C. Pre-Construction Waste Management Conference: Prior to beginning work at the site, schedule and conduct a conference to review the Construction Waste Management Plan and discuss procedures, schedules and specific requirements for waste materials recycling and disposal. Discuss coordination and interface between the Contractor and other construction activities. Identify and resolve problems with compliance with requirements.
1. Attendees: The Contractor and related Contractor personnel associated with the work of this section, including personnel to be in charge of the waste management program; Owner, and the Architect.
 2. Plan Revision: Make any revisions to the Construction Waste Management Plan agreed upon during the meeting and incorporate resolutions agreed to be made subsequent to the meeting. Submit the revised plan to the Architect for approval.
- D. Implementation: Designate an on-site party responsible for instructing workers and implementing the Construction Waste Management Plan. Distribute copies of the Construction Waste Management Plan to the job site foreman and each subcontractor. Include waste management and recycling in worker orientation. Provide on-site instruction on appropriate separation, handling, recycling, and salvaging methods to be used by all parties at the appropriate stages of the work at the site. Include waste management and recycling discussion in pre-fabrication meetings with subcontractors and fabricators. Also include discussion of waste management and recycling in regular job meetings and job safety meetings conducted during the course of work at the site.

1.8 STORAGE AND HANDLING:

- A. Site Storage: Remove all indicated recyclable materials from the work location to approved containers daily. Failure to remove waste materials will be considered cause for withholding payment and termination of Contract.
- B. Position covered containers for recyclable waste materials at a designated location on the Project Site. Select a location for the recyclable materials containers separated from that of general waste and rubbish containers. Provide separate collection containers for a minimum of the following materials:
 - 1. Untreated lumber.
 - 2. Paper, paper products, and cardboard.
 - 3. Plastics.
 - 4. Metals.
 - 5. Glass.
 - 6. Other salvageable materials.
- C. Change out loaded containers for empty ones as demand requires, but not less than weekly.
- D. Handling: Deposit all indicated recyclable materials in the containers in a clean (no mud, adhesives, solvents, petroleum contamination), debris-free condition. Do not deposit contaminated materials into the containers until such time as such materials have been cleaned.
- E. If the contamination chemically combines with the material so that it can not be cleaned, do not deposit into the recycle containers. Comply disposal with all legal and regulatory requirements.

1.9 PROJECT/SITE CONDITIONS:

- A. Environmental Requirements: Transport recyclable waste materials from the Work Area to the recycle containers and carefully deposit in the containers without excess noise and interference with other activities, in a manner to minimize noise and dust. Reclose container covers immediately after materials are deposited.
 - 1. Do not place recyclable waste materials on the ground adjacent to a container.
- B. Existing Conditions: Coordinate with "Instructions to Bidders" and "Supplementary Conditions".

PART 2 PRODUCTS (Not Used)

PART 3 EXECUTION

3.1 WASTE MANAGEMENT:

- A. General: Implement waste management procedures in accordance with approved construction waste management plan. Maintain procedure throughout the life of this Contract.
- B. Source Separation: Separate, store, protect, and handle at the project site all identified recyclable and salvageable waste products to prevent contamination of materials and maximize recyclability and salvageability of materials.

- C. Arrange for the regular collection, transport from the site, and delivery to respective approved recycling centers of indicated recyclable waste materials. Maintain records accessible to the Architect for verification of construction waste materials recycling.
- D. Delivery Receipts: Arrange for timely pickups from the site or deliveries to approved recycling facilities of designated waste materials to keep construction site clear and prevent contamination of recyclable materials. Keep and maintain records of all deliveries to recycling facilities and all pickups of waste materials at the site by others as specified above.

3.2 RECYCLABLE WASTE MATERIALS HANDLING:

- A. General: The following paragraphs supplement handling requirements for various materials identified for classification and recycling listed in Part 1 "Summary" article above.
- B. Paper: Classify and handle waste paper goods as follows:
 - 1. Bond Paper: As generally found in the construction offices and used for specifications, correspondence, copiers, printers and FAX machines. Collect in a separate container at each workstation and deposit loose in the appropriate recycle container daily.
 - 2. Newsprint: Newspapers and tabloid style advertising. Collect in a single location and deposit daily in the appropriate recycle container.
 - 3. Prints (drawings): Set up a single location for collection. Roll together to minimize space. Deposit daily in the appropriate recycle container.
- C. Packaging materials:
 - 1. Cardboard and paperboard cartons and boxes: Knock-down, fold flat and deposit in the appropriate recycle container.
 - 2. Paper packing materials (separators, stiffeners, etc.) shall be placed in the same container.
 - 3. Newsprint, used as packing (shredded or whole), shall be deposited in the recyclable container for newsprint.
 - 4. Plastic (polystyrene peanuts and other shapes) shall be deposited in the recyclable container for plastics.
 - 5. Metal and plastic banding materials shall be deposited in the appropriate container.
- D. Metals: Cut all items to lengths and sizes to fit within the container provided, when necessary. Where there is sufficient quantity of a specific recyclable waste item (for example; salvaged metal roofing or duct work), make special arrangements for items to be bundled, banded or tied, and stack in a designated location for a special pick-up. Coordinate all special arrangements with the Architect.
- E. Plastics: Collect recyclable plastics (polystyrene and others specifically marked for recycling) daily from work areas and deposit in designated containers.
- F. Glass: Remove waste glass products (sheet, bottles, etc.) daily from the work area and deposit in designated containers. Where glass containers are marked for separation by color or type, segregate glass accordingly. Glass containing imbedded wire (typical in some fire rated doors having glazed lights) is not recyclable.
- H. Other Items: Where recyclability classification of any given waste material is unclear, verify with the Architect.

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SECTION 01 78 00

CLOSEOUT SUBMITTALS

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Closeout procedures.
- B. Quality assurance.
- C. Maintenance service.
- D. Owner's Manuals
- E. Operations and maintenance manuals.
- F. Materials and finishes manuals.
- G. Equipment and systems manuals
- H. Spare parts and maintenance materials.
- I. Product warranties and product bonds.
- J. Project Record documents.
- K. Project close out inspections – Punch List

1.02 CLOSEOUT PROCEDURES

- A. Submit a written certification that the Contract Documents have been reviewed, the Work has been inspected, and that the Work is complete in accordance with the Contract Documents and is ready for the Architect's review.
- B. Provide submittals to Architect that are required by the governing or other authorities, including the following closeout documents:
 - 1. AIA Document G706 - Contractor's Affidavit of Payment of Debts and Claims, 1994 Edition.
 - 2. AIA Document G706A - Contractor's Affidavit of Release of Liens, 1994 Edition.
 - 3. AIA Document G707 - Consent of Surety to Final payment, 1994 Edition.
- C. Submit final Application for Payment identifying total adjusted Contract Sum, previous payments, and sum remaining due.
- D. The Owner will occupy all portions of the building as specified in Section 01 10 00.

1.03 QUALITY ASSURANCE

- A. Employ personnel assembling submittals experienced in the maintenance and the operation of the described products and systems.

1.04 MAINTENANCE SERVICE

- A. Submit a contract for furnishing service and maintenance of the components indicated in the specification Sections for one year from date of Substantial Completion, or during the warranty period, whichever period of time is the longest.
- B. Provide for an examination of the system components at a frequency consistent with reliable operation. Clean, adjust, and lubricate as required.
- C. Include a systematic cleaning, examination, adjustment, and lubrication of the components. Repair or replace the parts whenever required. Use the parts produced by the manufacturer of the original component.
- D. Do not assign or transfer the maintenance service to an agent or Subcontractor without the prior written consent of the Owner.

1.05 OWNER'S MANUALS

- A. Submit the data for Operations and Maintenance, Materials and Finishes, and Equipment and Systems Manuals bound in 8-1/2 x 11 inch text pages, in maximum 2 inch size, D side three - ring commercial quality binders with durable cleanable plastic covers.
- B. Prepare binder covers with the printed title of the manual, title of the project, and the subject matter of binder when multiple binders are required.
- C. Internally subdivide the binder contents with permanent page dividers, logically organized as described below; with tab titling clearly printed under reinforced laminated plastic tabs.
- D. Drawings: Provide with reinforced punched binder tab. Bind in with the text; fold the larger drawings to the size of the text pages.
- E. Submit one copy of the completed volumes for review. They will be reviewed and returned with the Architect's comments. Revise the content of the manuals as required prior to final submission.
- F. Submit one set of revised final volumes in final form.
- G. Submit one copy of all the manuals for Operations and Maintenance, Materials and Finishes, and Equipment and Systems in PDF electronic format on a Compact Disc or DVD.

1.06 OPERATIONS AND MAINTENANCE MANUALS

- A. Contents: Prepare the Table of Contents for each volume, with each product or system description identified, typed on white paper, in three parts as follows:
 - 1. Part 1: Directory, listing the names, addresses, and telephone numbers of the Architect, Contractor, Subcontractors, and major equipment suppliers.
 - 2. Part 2: Operation and maintenance instructions, arranged by system and subdivided by the specification Section. For each category, identify the names, addresses, and telephone numbers of the Subcontractors and suppliers. Identify the following:
 - a. Significant design criteria.
 - b. List of equipment.
 - c. Parts list for each component.
 - d. Operating instructions.
 - e. Maintenance instructions for equipment and systems.
 - f. Maintenance instructions for special finishes, including recommended cleaning methods and materials, and special precautions identifying detrimental agents.
 - 3. Part 3: Project documents and certificates, including the following:
 - a. Shop drawings and product data.
 - b. Air and water balance reports.
 - c. Certificates.
 - d. Photocopies of warranties and bonds.
 - e. MSDS for applicable products.

1.07 MATERIALS AND FINISHES MANUALS

- A. Instruction for Care and Maintenance: include manufacturer's instructions for cleaning agents and methods, precautions against detrimental agents and methods, and a recommended schedule for cleaning and maintenance.
- B. Moisture Protection and Weather Exposed Products: Include product data listing applicable reference standards, chemical composition, and details of installation. Include recommendations for inspections, maintenance, and repair.
- C. Include Material Safety Data Sheets (MSDS) for all applicable products. These are required to provide both workers and emergency personnel with the proper procedures for handling or working with a particular substance. MSDS's include information such as physical data (melting point, boiling point, flash point etc.), toxicity, health effects, first aid, reactivity, storage, disposal, protective equipment, and spill/leak procedures.
- D. Additional Requirements: As specified in the individual product specification Sections.
- E. Include a listing in the Table of Contents for design data, with a tabbed flysheet and a space for the insertion of data.

1.08 EQUIPMENT AND SYSTEMS MANUALS

- A. For equipment, or component parts of equipment put into service during construction and operated by the Owner, submit documents within 10 days after acceptance.
- B. Each Item of Equipment and Each System: Include a description of the unit or system, and the component parts. Identify the function, normal operating characteristics, and limiting conditions. Include performance curves, with engineering data and tests, and complete nomenclature and model number of replaceable parts.
- C. Panelboard Circuit Directories: Provide electrical service characteristics, controls, and communications; by label machine.
- D. Include color-coded wiring diagrams as installed.
- E. Operating Procedures: Include start-up, break-in, and routine normal operating instructions and sequences. Include regulation, control, stopping, shutdown, and emergency instructions. Include summer, winter, and special operating instructions.
- F. Maintenance Requirements: Include routine procedures and guide for preventative maintenance and troubleshooting; disassembly, repair, and reassembly instructions; and alignment, adjusting, balancing, and checking instructions.
- G. Include a servicing and lubricating schedule, and a list of lubricants required.
- H. Include the manufacturer's printed operation and maintenance instructions.
- I. Include sequence of operation by the controls manufacturer.
- J. Include the original manufacturer's parts list, illustrations, assembly drawings, and diagrams required for maintenance.
- K. Include control diagrams by the controls manufacturer as installed.
- L. Include the Contractor's coordination drawings, with color-coded piping diagrams as installed.
- M. Include charts of valve tag numbers, with the location and function of each valve, keyed to the flow and control diagrams.
- N. Include a list of the original manufacturer's spare parts, current prices, and recommended quantities to be maintained in storage.
- O. Include test and balancing reports as specified in Section 01 43 00.
- P. Additional Requirements: As specified in the individual product specification Sections.
- Q. Include a listing in the Table of Contents.

1.09 SPARE PARTS AND MAINTENANCE PRODUCTS

- A. Furnish spare parts, maintenance, and extra products in the quantities specified in the individual specification Sections.
- B. Deliver to the Project site and place in a location as directed by the Owner; obtain a receipt prior to final payment.

1.10 PRODUCT WARRANTIES AND PRODUCT BONDS

- A. Obtain warranties and bonds executed in duplicate by the responsible subcontractors, suppliers, and manufacturers, within 10 days after the completion of the applicable item of work.
- B. Execute and assemble the transferable warranty documents and bonds from the subcontractors, suppliers, and manufacturers.
- C. Verify that the documents are in the proper form, contain full information, and are notarized.
- D. Co-execute the submittals when required.
- E. Submit two copies in D side three ring binders with a durable plastic cover.
- F. Submit prior to the final Application for Payment.
- G. Time of Submittals:
 - 1. For equipment or component parts of equipment put into service during construction with the Owner's permission, submit the documents within 10 days after acceptance.
 - 2. Make other submittals within 10 days after the Date of Substantial Completion, prior to the final Application for Payment.
 - 3. For items of Work for which acceptance is delayed beyond the Date of Substantial Completion, submit within 10 days after acceptance, listing the date of acceptance as the beginning of the warranty or bond period.

1.11 PROJECT RECORD DOCUMENTS

- A. Maintain on the site one set of the following record documents; record actual revisions of the Work for all trades:
 - 1. Construction drawings.
 - 2. Specifications.
 - 3. Addenda.
 - 4. Change Orders and other modifications to the Contract.
 - 5. Reviewed Shop Drawings, Product Data, and Samples.
 - 6. Manufacturer's instructions for assembly, installation, and adjusting.
- B. Ensure the entries are complete and accurate, enabling future reference by the Owner.
- C. Store the record documents separate from the documents used for construction.
- D. Record information concurrent with the construction progress, not less than weekly.

- E. Specifications: Legibly mark and record at each product Section description of the actual products installed, including the following:
 - 1. Manufacturer's name and product model and number.
 - 2. Product substitutions or alternates utilized.
 - 3. Changes made by Addenda and modifications.
- F. Construction Record Drawings and Shop Drawings: Legibly mark each item to record the actual construction including:
 - 1. Measured locations of internal utilities and appurtenances concealed in the construction.
 - 2. Field changes of dimension and detail.
 - 3. Details not on the original contract construction drawings.
- G. Legibly marked Specifications, and legibly marked Record Construction Drawings and Shop Drawings shall constitute the Project Record Documents.
- H. Update the on-site Project Record Documents on a regular basis. Monthly payments will not be processed if Project Record Documents are not maintained up to date.
- I. At completion of the Work of the Contract, the Architect will furnish the Contractor with an electronic copy of the construction drawings in AutoCad or Autodesk Revit format, and the Project Manual content in Adobe Acrobat PDF format.
- J. Transfer the information from the Project Record Documents onto the electronic documents (Drawings in AutoCad or Autodesk Revit format and the Project Manual in Adobe Acrobat PDF format copied onto a CD or DVD ROM disc). These documents will constitute the As-Built Documents.
Deliver the As-Built Documents to the Architect on two copies of compact disc and paper. The two paper copies are to be bound and printed full size.
Also deliver the paper Project Record Documents to the Architect.
- K. The Architect will review the As-Built Documents and compare them with the Project Record Documents for accuracy, and if necessary return them to the Contractor for final correction.
At the time of final submission of the As-Built documents, submit the final Application for Payment.
- L. No review or receipt of record of As-Built Documents by the Architect or the Owner shall be interpreted as a waiver of any deviation from the Contract Documents or Shop Drawings , or in any way relieve the Contractor from responsibility to perform the Work in accordance with the Contract Documents and the Shop Drawings to the extent they are in accordance with the Contract Documents
- M. At completion of the Work of the Contract submit to the Architect a summary of waste materials, recycled, salvaged and disposed of as outlined in Section 01 74 19.
The Summary shall contain the following information:
For each material salvaged and recycled from the Project, include the amount (in cubic yards or tons or in the case of salvaged items state quantities by number, type and size of items) and the destination (i.e. recycling facility, used building materials yard). For each material land filled or incinerated from the Project, include the amount (in cubic yards or tons) of material and the identity of the landfill, incinerator or transfer station.

- N. At completion of the Work of the Contract submit to the Architect (as outlined in Section 01 74 19) delivery receipts for waste materials salvaged and sent to permitted waste materials processors or recyclers that indicate the location and name of firm accepting recyclable waste materials, types of materials, net weights of each type, date of delivery and value of materials.
- O. At completion of the Work of the Contract submit to the Architect a table indicating information pertaining to construction materials used on the project that includes the following:
 - Name of the material
 - Amount of low emissive VOC
 - Percentage of pre-consumer recycled content
 - Percentage of post consumer recycled content
 - Distance product was manufactured from construction site (Greater or less than 500 miles)

Also submit written documentation substantiating the information in the form of a manufacturer's cut sheet, material safety data sheet or letter from the manufacturer.

1.12 PROJECT CLOSE OUT INSPECTIONS - PUNCH LIST

- A. When the work has reached such a point of completion that the building or buildings, equipment, apparatus or phase of construction or any part thereof required by the Owner for occupancy or use can be so occupied and used for the purpose intended, the Contractor, prior to notification to the Architect, shall make a preliminary inspection of the Work to insure that all requirements of the Contract have been met and the Work is substantially complete and is acceptable. Upon such notification, the Owner or the Architect and the consulting Engineers shall make detailed inspection of the Work to insure that all requirements of the Contract have been met and the Work is complete and is acceptable.
- B. Within ten (10) calendar days of notification, the Architect and the consulting Engineers will perform the inspection and a copy of the report of the inspection shall be furnished to the Contractor so that the Contractor may proceed without delay with any part of the Work found to be incomplete or defective. The Contractor shall complete the items listed within thirty (30) calendar days and notify the Owner and Architect
- C. When the items appearing on the report of inspection have been completed or corrected, the contractor shall so advise the Owner and the Architect. After receipt of this notification, the Owner or the Architect and consulting Engineers shall reinspect and inform the Contractor of any remaining items.

A copy of the report of the final inspection containing all remaining contract exceptions, omissions and incomplections shall be furnished to the Contractor within seven (7) calendar days of notification.

- D. The Contractor shall within fourteen (14) calendar days complete the items listed on the inspection report and provide notification of completion and all remaining contract exception, omissions and incomplections from the Contractor, the Owner and the Architect and consulting Engineers will reinspect the Work to verify completion of the exception items appearing on the report of final inspection.

Upon completion of reinspections, the Architect will prepare a certificate of final acceptance or will furnish to the Contractor a copy of the report of the Architect's reinspection detailing Work that is incomplete or obligations that have been fulfilled but are required for final acceptance.

The Contractor shall compensate the Architect and all consulting Engineers for services performed on Punch List inspections beyond the original inspection and two reinspections of the same area through a credit change order reducing the total contract amount.

- E. Upon Substantial Completion of the Work, the Contractor will be paid all retainage, less one hundred fifty percent (150%) of the value attributable to “punch list” work. As items on the punch list are completed, the Contractor will be paid one hundred fifty percent (150%) of their value at the next progress payment.

PART 2 - PRODUCTS

Not used.

PART 3 - EXECUTION

Not used.

END OF SECTION

SECTION 01 81 14

ENVIRONMENTAL IMPACT OF MATERIALS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and other Division-1 Specification sections, apply to this section.

1.2 WORK INCLUDED:

- A. Objectives: To obtain acceptable Indoor Air Quality (IAQ) for the completed project and minimize the environmental impacts of the construction and operation, the Contractor during the construction phase of this project shall implement the following procedures singly or in combination:
 - 1. Select products that minimize consumption of non-renewable resources, consume reduced amounts of energy and minimize amounts of pollution to produce, and employ recycled and/or recyclable materials. Obtain Architect's approval of all materials listed in Part 2 prior to placing the order with the manufacturer of the material.
 - 2. Maintain a materials log book and verification that materials used have been reviewed for environmental considerations as outlined in this section.
 - 3. Control sources of potential IAQ pollutants by controlled selection of materials and processes used in project construction in order to attain acceptable IAQ as defined in this section.
- B. Products and processes that achieve the above objectives to the extent currently possible and practical have been selected and shown in the Contract Documents. The Contractor is responsible to maintain and support these objectives in developing means and methods for performing the work of this Contract and in proposing product substitutions and/or changes to specified processes.

1.3 RELATED WORK:

- A. Division 1 sections: "Indoor Air Quality Management During Construction", and "Waste Materials Management and Recycling".

1.4 SUBMITTALS:

- A. Submit the following in accordance with Conditions of the Contract and Division 1 specification sections.
 - 1. Submit as part of the Division 1 Project Closeout documents indicating for each material the VOC content, the recycled content, and the Manufacturer's Safety Data Sheet (MSDS).

1.5 QUALITY ASSURANCE:

- A. As part of the Preconstruction Meeting specified in Division 1 discuss the IAQ and environmental impact compliances required by this Contract. The purpose of this agenda item is to develop a mutual understanding of the IAQ and environmental impact program requirements, and coordination of the Contractor's management of the program with the Architect.

PART 2 - PRODUCTS

2.1 MATERIALS:

- A. General: The following special IAQ and environmental impact requirements apply to materials specified in their respective technical specification sections of this Project Manual. See Tables 2.1 and 2.2 for definitions of low VOC content and recycled content.

The following list are qualities requested to be attained to the best ability of the Contractor for each of the described materials in the pursuit to achieve a more environmentally compatible building.

- B. Division 03 - Concrete:
1. Cast-in-Place Concrete:
 - a. Reinforcing steel shall maximize recycled scrap steel content.
 - b. Form release agents shall be low VOC content.
 - c. Liquid membrane-forming curing and sealing compound shall be low VOC content.
- C. Division 04 - Masonry:
1. Concrete Unit Masonry:
 - a. Concrete Unit Masonry shall maximize the use of recycled materials.
 - b. Reinforcing bars shall maximize the use of recycled steel.
- D. Division 05 - Metals:
1. Structural Steel: Framing steel shall maximize the use of recycled steel.
- E. Division 06 - Wood and Plastics: Wood products:
1. Each specified solid and veneer wood species must originate from a sustainably managed forest certified by a Forest Stewardship Council (FSC) accredited certification group such as Smartwood or Scientific Certification Systems (SCS).
 2. Fiberboard used as blocking, millwork, casework substrate, underlay and door cores must be urea-formaldehyde free, and not exceed ANSI A208.1-1993 emission standard of 0.20 ppm of formaldehyde.
 3. Structural fiberboard (OSB, MDF, and particleboard) shall maximize post-consumer waste material.
- F. Division 07 - Thermal and Moisture Protection:
1. Building Insulation:
 - a. Insulation materials manufactured using chlorofluorocarbons (CFCs) shall not be used. (CFCs have been completely phased out of U. S. manufactured insulation products.)
 - b. Extruded polystyrene insulation shall not be manufactured with chlorofluorocarbon (CFC) blowing agent and shall maximize recycled content.
 - c. Fiberglass batt insulation, fiberglass board insulation, and mineral wool insulation shall maximize use of recycled material.
 - d. Mineral wool fire safing insulation shall maximize recycled material.
 2. Single-Ply Membrane Roofing: Rigid insulation manufactured with chlorofluorocarbon (CFC) blowing agents shall not be used.

3. Joint Sealants:
 - a. Interior sealants shall not contain: mercury, butyl rubber, neoprene, SBR (styrene butadiene rubber), or nitrile.
 - b. Silicone sealants shall be low VOC content.
 - c. Polyurethane sealants containing mercury shall not be used.
 - d. Compressible foam joint fillers, polyester polyurethane foam impregnated with neoprene rubber or acrylic ester styrene copolymer used in this facility shall not be manufactured with CFC blowing agents.
 - e. Sealants formulated with aromatic solvents (organic solvent with a benzene ring in its molecular structure) fibrous talc or asbestos, formaldehyde, halogenated solvents, mercury, lead, cadmium, hexavalent chromium, or their components shall not be used.
- G. Division 09 - Finishes:
 1. Paint and Polychromatic Finish Coating:
 - a. Do not use water based paints formulated with aromatic hydrocarbons (organic solvent with a benzene ring in its molecular structure), formaldehyde, halogenated solvents, mercury or mercury compounds, or tinted with pigments of lead, cadmium, chromium VI and their oxides. Water based paints shall be low VOC and shall have a flash point of 61 degrees C or greater.
 - b. Where it is necessary to use solvent-based paints, they shall be formulated for low VOC emissions and shall not be formulated with formaldehyde, halogenated solvents, mercury or mercury compounds, or tinted with pigments of lead, cadmium, chromium VI and their oxides, nor formulated with more than 10% aromatic hydrocarbons by weight.
 - c. The following shall be low VOC and not be formulated with aromatic hydrocarbons (organic solvent with a benzene ring in its molecular structure) formaldehyde, halogenated solvents, mercury or mercury compounds, or tinted with pigments of lead, cadmium, chromium VI and their oxides.
High performance water based acrylic coatings.
Pigmented acrylic sealers.
Catalyzed epoxy coatings.
High performance silicone grafted epoxy coatings.

Table 2.1 Definition of Low VOC Content Levels

<u>Material or Product</u>	<u>Low VOC Content Level</u>
Form Release Agents	350 g/L VOC content
Water based Joint Sealants	50 g/L VOC content
Non-water based Joint Sealants	350 g/L VOC content
Water-based Paint & Polychromatic finish coatings	150 g/L VOC content
Solvent -based Paint	380 g/L VOC content
High Performance Water-Based Acrylic coatings	250 g/L VOC content
Pigmented Acrylic Sealers	250 g/L VOC content
Catalyzed Epoxy coatings	250 g/L VOC content
High Performance Silicone	250 g/L VOC content
Liquid membrane-forming curing & sealing compound	350 g/L VOC content

Table 2.2 Required Minimum Recycled Content of Materials

<u>Material or Product</u>	<u>Recommended Recycle Content</u>
Reinforcing Steel in Concrete	60% recycled scrap steel 1
Reinforcing Bars in Precast Concrete	60% recycled steel 1
Concrete Unit Masonry	50% recycled content
Reinforcing Bars in Concrete Unit Masonry	60% recycled steel 1
Framing steel	30% recycled steel 1
Fiberglass batt insulation	20% recycled glass cullet2
Fiberglass board insulation	20% recycled glass cullet2
Mineral wool insulation	75% recycled material (slag)2
Mineral wool fire safing insulation	75% recycled material by weight (slag)2
Mineral Fiber Sound Attenuation Blankets	75% recovered material by weight (slag)2
Steel studs, runners, and channels	60% recycled steel 1
Hydromulch	100% recovered materials2
Structural fiberboard	80-100% recycled content2

Notes for Table 2.2:

1. 60% represents the average recycled content for the U. S. steel industry. Use of U. S. manufactured steel will meet this requirement.
2. As per EPA Comprehensive Guideline for Procurement of Products Containing Recovered Materials (60 FR 21370, effective May 1, 1996).

PART 3 - EXECUTION

3.1 GENERAL:

- A. Submit to the Architect for review and approval product data such as MSDS and environmental impact data prior to ordering project materials.
- B. Prepare and maintain a Materials Log, providing information on content of materials, where specific materials are to be used, MSDS, and environmental specifications of the material. Maintain the log book weekly as materials are ordered.

3.2 FIELD QUALITY CONTROL:

- A. The Owner reserves the right to take samples and perform, at random, tests of approved materials delivered to the job site to verify compliance of actual materials with specifications.

END OF SECTION

SECTION 01 81 22

INDOOR AIR QUALITY MANAGEMENT
DURING CONSTRUCTION

PART 1- GENERAL

1.01 SUMMARY

- A. IAQ Management during Construction
 - 1. Develop and implement an Indoor Air Quality (IAQ) Management Plan for the construction and pre-occupancy phases of the building as follows:
 - a. During construction meet or exceed the recommended Control Measures of the Sheet Metal and Air Conditioning National Contractors Association (SMACNA) IAQ Guideline for Occupied Buildings under Construction, latest edition, Chapter 3.
 - b. Protect stored on-site or installed absorptive materials from moisture damage.
 - c. Replace all filtration media immediately prior to occupancy with MERV 8 filters or higher.

1.02 OVERVIEW

- A. The intent of this IAQ Plan is to:
 - 1. Minimize exposure of construction workers to air pollutants;
 - 2. Prevent air pollutants from collecting in building systems and on building materials; and
 - 3. Prevent air pollutants caused by construction from migrating into occupied spaces.
- B. For the purposes of this plan, air pollutants are defined as: Particulates, Volatile organic compounds, Formaldehyde, Combustion emissions, Airborne bacteria and micro-organisms and Airborne inorganic compounds, such as ozone (from electric motors), metal fumes (from smoldering and welding), and ammonia and chlorine (from cleaning products).

PART 2- PRODUCTS

Not used

PART 3-EXECUTION

3.01 HVAC EQUIPMENT AND DUCT WORK

- A. HVAC equipment and ductwork will be protected from dust and other pollutants via the following procedures:
 - 1. Sealing Ductwork and Air Handling Equipment
 - a. Openings into installed or existing ductwork and air-handling equipment not in active use will be sealed using taped plastic, taped cardboard, or other reasonably air-tight coverings. Sealing will occur prior to, or immediately upon installation of the new ductwork or equipment. Regular walk-throughs will be conducted by the Contractor to check for damaged or displaced coverings. Repair or replacement of damaged or displaced coverings will occur immediately upon discovery, at the direction of the Contractor.
 - b. Construction work that generates air pollution will be avoided where ductwork or

air handling equipment is being installed. If visible air pollutants are present in a space where ductwork is to be installed, spot cleaning or other measures will be used to prevent ductwork or equipment contamination.

2. Use of Mechanical Systems during Construction
 - a. Exhaust and makeup air supply systems:
When a system is operated during construction, its filters will be replaced upon completion of construction with MERV 13 filters.
 - b. Air handling systems will be subject to these provisions when operated during construction:
 1. The AHU will be protected with a temporary filter having a minimum rating of MERV 8, per ASHRAE 52.2.
 2. Distribution elements needing filters, including all return air ductwork, will be protected with temporary filters having a minimum rating of MERV 8 per ASHRAE 52.2 unless otherwise noted below.
 - c. All components of the distribution on the return side will be protected, including but not limited to:
 1. The portion of the air handler upstream of the central fan;
 2. Return vents, ducts and shafts;
 3. VAV box intakes; and
 4. Transfer ducts.
 - d. Components of the distribution system on the supply side will typically not need protection except if portions of the supply system become contaminated, coarse filters will be applied to completely cover supply outlets, to prevent the distribution of particulates into building spaces.
3. Filter Replacement and Tracking
 - a. MERV 8 filters used for ductwork protection will be replaced on an as-needed basis, as determined by the Contractor.
 - b. Upon completion, the MERV 8 filters used for ductwork protection will be discarded. New filters will be installed at all air handlers.

3.02 TEMPORARY LOCAL EXHAUST

- A. Where available, operable vents and windows will be opened to ventilate the building during application of interior finishes when weather conditions are suitable. Spaces with fixed glazing or no windows will be ventilated by localized temporary exhaust, as described below, or by using building mechanical systems (described above).
 1. Local temporary exhaust will be accomplished using fans, duct extensions, and filters.
 2. Local temporary exhaust will not discharge near air intakes or other openings that lead into the building.

3.03 COVERING OR SEALING SOURCES OF POLLUTION

- A. The following are rules that apply to materials that emit air pollution or odors:
 1. Containers containing wet materials will be covered whenever they are not in active use.
 2. Waste materials will be covered or sealed and regularly removed from the building.
 3. Absorptive materials or materials with an odor will be covered while moved through the building.
 4. Whenever possible, material containers will be disposed of with the covers on.
 5. Materials that require a surface coating to control pollutants or odors will be coated promptly.

3.04 CONTROLLING POLLUTION AT ENTRANCES

- A. Measures will be taken to prevent pollutants from being tracked into interior spaces by workers or equipment. These will include temporary walk-off mats and floor protection.

3.05 PROTECTION OF STORED MATERIALS

- A. Measures will be taken to minimize dust accumulation on material surfaces and the absorption of other pollutants by absorbent materials. The measures will include the following:
 - 1. Materials will be handled and stored according to the manufacturer's recommendations.
 - 2. Unwrapped absorbent materials will be shrink-wrapped if necessary.
 - 3. Highly absorbent materials like duct liner, acoustic tile, carpeting, or insulation will be stored indoors in the original packaging, or covered and sealed.
 - 4. Moderately porous materials like gypsum board will be stored indoors, wrapped or away from dust and materials prone to off-gas VOC's.
 - 5. Framing lumber will be stored indoors whenever possible. If stored outdoors, the lumber will be covered with a water proof covering, stored off the ground, and located away from standing water.
 - 6. Dense material like glass, metal framing, ductwork and equipment will be covered and kept dry.
 - 7. If condensation forms on cold material, care will be taken not to expose it to dust or other particles. If exposed to pollution, housekeeping measures will be used promptly to clean the material before installation.

3.06 PREVENTING CONTAMINATION OF COMPLETED AREAS FROM WORK UNDER CONSTRUCTION

- A. When work is completed in an area, the area will be protected from pollutants generated in other parts of the building still under construction. One or more of the following methods of pathway interruption will be used:
 - 1. Erecting barriers between completed areas and areas still under construction
 - 2. Where present, doors and windows will be closed and locked between completed portions of the building and portions of the building still under construction.

3.07 HOUSEKEEPING

- A. The following housekeeping measures will be employed throughout construction:
 - 1. A regular housekeeping schedule will be instituted. Cleaning measures and frequency will be selected according to the pollutants generated in a space.
 - 2. Low-odor cleaning agents will be used.
 - 3. Spills of water or solvent will be cleaned up immediately.
 - 4. Attention will be given to cleaning hidden or hard-to-reach surfaces, such as wall cavities, tops of door, ledges, and behind water closets.

3.08 SCHEDULING

- A. Construction activities shall be scheduled such that construction and occupancy do not overlap in time. Provide adequate time for carpet, paint and other finishes time to off-gas prior to occupancy.

END OF SECTION

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SECTION 01 81 30

NE-CHPS DESIGN REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract and other Division 01 Specification Sections apply to this Section.

1.2 SUMMARY

- A. This Section includes special project administrative and procedure requirements related to the State of Rhode Island program for energy conservation and efficiency, indoor air quality, and natural resource efficiency which are in compliance with the Northeast High Performance Green Schools Guidelines: Criteria, (referred to herein as "CHPS, or NECHPS"). The Owner has established minimum CHPS credit points to achieve which will provide the Owner with a reimbursement funding grant necessary for completion of this Project. The General Contractor and subcontractors shall, as part of the Contract with the Owner, comply with requirements of CHPS in the performance of the Work. The General Contractor, at a minimum, shall implement the following:
 - 1. The General Contractor shall designate a "Contractor's CHPS Representative" who will assist the Owner and Architect with fulfilling documentation and submittals which are required by CHPS.
 - 2. Provide products that minimize consumption of non-renewable resources, consume reduced amounts of energy and minimize amounts of pollution to produce and employ recycled and/or recyclable materials.
 - 3. Provide verification that materials used have been reviewed for environmental considerations as specified.
 - 4. Maintain a materials log.
 - 5. Conduct special meetings.
 - 6. Provide building commissioning plan in conjunction with General Commissioning Specification.
 - 7. Control environmental air quality pollutants by controlled selection of materials and processes used in project construction in order to attain acceptable indoor air quality as specified.
- B. Contractor shall follow specified compliance requirements in conjunction with environmental quality requirements specified in other individual specification sections. Notify Owner and Architect if conflicts arise between performance of the work and environmental goals. This specification is not intended to limit alternative means of achieving these goals. Suggestions and input from the General Contractor and subcontractors

for implementing these goals are encouraged.

1.3 RELATED SECTIONS

- A. Section 01 60 00 - SUBSTITUTION PROCEDURES.
- B. Section 01 31 00 - PROJECT COORDINATION:
 - 1. Preconstruction, progress and special project meeting requirements regarding CHPS Certification.
- C. Section 01 33 00 - SUBMITTAL PROCEDURES:
 - 1. CHPS Certification Report
 - 2. Environmental product certifications.
- D. Section 01 60 00 - PRODUCT REQUIREMENTS.
- E. Section 01 74 19 - WASTE MATERIALS MANAGEMENT AND RECYCLING.
- F. Section 01 78 00 - CLOSEOUT SUBMITTALS.
- G. Individual Specification Sections: Submittal, performance and material requirements related to CHPS criteria submissions.

1.4 DEFINITIONS

- A. The term "CHPS" as used herein and throughout the Project Manual refers to the Northeast High Performance Green Schools Guidelines: Criteria, Version 4.0.
- B. Regionally Manufactured Materials: Materials that are manufactured within a radius of 500 miles from the project location. Manufacturing refers to the final assembly of components into the building product that is installed at the project site.
- C. Regionally Extracted, Harvested, or Recovered Materials: Materials that are extracted, harvested, or recovered and manufactured within a radius of 500 miles from the project site.
- D. Recycled Content: The percentage of weight of constituents that have been recovered or otherwise diverted from the solid waste stream, either during the manufacturing process (preconsumer), or after consumer use (post-consumer).
 - 1. Spills and scraps from the original manufacturing process that are combined with other constituents after a minimal amount of reprocessing for use in further production or the same product are not recycled materials.
 - 2. Discarded materials from one manufacturing process that are used as constituents in another manufacturing process are pre-consumer recycled materials.

1.5 CONTRACTOR'S CHPS REPRESENTATIVE

- A. The General Contractor shall designate a CHPS Representative, acceptable to the Owner, experienced in construction management and waste-recycling documentation. The Contractor's CHPS Representative is responsible for implementation, coordination, and documentation of specified CHPS Credit Requirements.

- B. The Contractor's CHPS Representative is responsible for overseeing the Owner's environmental goals for this project during construction.
- C. The Contractor's CHPS Representative shall attend all Environmental Quality Review Meetings, Project Progress Meetings (at least monthly), Pre-installation Meetings, and Special Meetings regarding environmental issues throughout the term of construction.
- D. Prior to the start of on-site Work, the Contractor's CHPS Representative shall distribute copies of the CHPS certification requirements and credit goals to the Construction Project Team (Project Manager and Project Superintendent), and each applicator, installer, and supplier involved with the Project.
 - 1. Copies of the distribution list shall be furnished to the Owner's Project Representative and the Architect. Update distribution list as additional applicators, installers, and suppliers are contracted, re-issue as distribution list is revised.

1.6 CHPS CERTIFICATION PLAN

- A. Submit to Architect a written plan for achieving the specified CHPS Credit Certification requirements within 14 calendar days of Notice to Proceed. Plan shall include a written narrative describing proposed procedures to be implemented.
- B. Contractor shall submit to Architect two copies of a CHPS Certification Progress Report each month throughout the work. Include a written narrative describing progress to date.

1.7 GENERAL CHPS CREDIT REQUIREMENTS

- A. Contractor shall submit CHPS certification documentation demonstrating compliance with the corresponding CHPS Credit Requirements. Submit CHPS documentation under provisions of Section 01 33 00 - SUBMITTAL PROCEDURES.
 - 1. The following is an overview schedule of Credit Requirements for which the Contractors shall contribute to CHPS certification. The schedule is provided as a guide and does not supersede CHPS Certification requirements specified in individual Specification Sections.
 - 2. Submission of CHPS documentation is separate and additional to, progress schedules, product literature submittals, samples, mock-ups, commissioning and all other project related submittals required under other Division One Specification Sections and individual Specification Sections.
- B. The CHPS Credit Requirements for CHPS compliance are in addition to environmental quality requirements specified elsewhere in the Specifications.

PART 2 - PRODUCTS

Not Used

PART 3 – EXECUTION

Not Used

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SECTION 01 91 00

GENERAL COMMISSIONING REQUIREMENTS

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Commissioning: Commissioning is a systematic process of ensuring that all building systems perform interactively according to the design intent and the owner's operational needs. This is achieved by beginning in the design phase and documenting design intent and continuing through construction, acceptance and the warranty period with actual verification of performance. The commissioning process shall encompass and coordinate the traditionally separate functions of system documentation, equipment startup, control system calibration, testing and balancing, performance testing and training.
- B. Commissioning during the construction phase is intended to achieve the following specific objectives according to the Contract Documents:
1. Verify that applicable equipment and systems are installed according to the manufacturer's recommendations and to industry accepted minimum standards and that they receive adequate operational checkout by installing contractors.
 2. Verify and document proper performance of equipment and systems.
 3. Verify that O&M documentation left on site is complete.
 4. Verify that the Owner's operating personnel are adequately trained.
- C. The commissioning process does not take away from or reduce the responsibility of the system designers or installing contractors to provide a finished and fully functioning product.
- D. Abbreviations: The following are common abbreviations used in the Specifications and in the Commissioning Plan. Definitions are found in Section 1.6.
- | | |
|---------|-----------------------------|
| 1. A/E | Architect / Engineer |
| 2. CA | Commissioning Authority |
| 3. CC | Controls Contractor |
| 4. CM | Construction Manager |
| 5. Cx | Commissioning |
| 6. EC | Electrical Contractor |
| 7. FPT | Functional Performance Test |
| 8. GC | General Contractor |
| 9. MC | Mechanical Contractor |
| 10. PC | Prefunctional Checklist |
| 11. PM | Project Manager (Owner) |
| 12. TAB | Test and Balance Contractor |

1.2 COORDINATION

- A. Commissioning Team: The members of the commissioning team consist of the Commissioning Authority (CA), the Project Manager (PM), the designated representative of the owner's Construction Management firm (CM), the architect and design engineers (particularly the mechanical engineer), the Mechanical Contractor (MC), the Electrical Contractor (EC), the TAB representative, the Controls Contractor (CC), any other installing subcontractors or suppliers of equipment. If known, the Owner's building or plant operator/engineer is also a member of the commissioning team.
- B. Management: **The CA is hired by the Owner directly.** The CA directs and coordinates the commissioning activities and the reports to the CM/GC and the owner's representative, and is part of the CM team. All members work together to fulfill their contracted responsibilities and meet the objectives of the Contract Documents.

The Commissioning Authority for this project has been hired by the Owner and is Stephen Turner Inc., 317 Hope Street, Providence, RI 02906,
Tel: 401-273-1935
Email: info@sturnerinc.com
www.buildingcommissioning.com

- C. Scheduling: The CA will work with the CM and GC according to established protocols to schedule the commissioning activities. The CA will provide sufficient notice to the CM and GC for scheduling commissioning activities. The GC will integrate all commissioning activities into the master schedule. All parties will address scheduling problems and make necessary notifications in a timely manner in order to expedite the commissioning process.
- D. The CA will provide the initial schedule of primary commissioning events at the commissioning scoping meeting. The Commissioning Plan—Construction Phase provides a format for this schedule. As construction progresses more detailed schedules are developed by the CA. The Commissioning Plan also provides a format for detailed schedules.

1.3 COMMISSIONING PROCESS

- A. Commissioning Plan: The commissioning plan provides guidance in the execution of the commissioning process. Just after the initial commissioning meeting the CA will update the plan, which is then considered the "final" plan, though it will continue to evolve and expand as the project progresses.
- B. Commissioning Process: The following narrative provides a brief overview of the typical commissioning tasks during construction and the general order in which they occur.
 - 1. Commissioning during construction begins with a meeting conducted by the CA where the commissioning process is reviewed with the commissioning team members.
 - 2. Additional meetings will be required throughout construction, scheduled by the CA with necessary parties attending, to plan, scope, coordinate, schedule future activities and resolve problems.
 - 3. Approved Equipment documentation is submitted to the CA during normal submittals, including detailed start-up procedures.

4. The CA works with the Subs, including providing the Subs with pre-functional checklists to be completed, during the startup process.
5. In general, the checkout and performance verification proceeds from simple to complex; from component level to equipment to systems and intersystem levels with pre-functional checklists being completed before functional testing.
6. The Subs, under their own direction, execute and document the pre-functional checklists and perform startup and initial checkout. The CA documents that the checklists and startup were completed according to the approved plans. This may include the CA witnessing start-up of selected equipment.
7. The CA develops specific equipment and system functional performance test procedures. The Subs review the procedures.
8. The procedures are executed by the Subs, under the direction of, and documented by the CA.
9. Items of non-compliance in material, installation or setup are corrected at the Sub's expense and the system retested.
10. The CA reviews the O&M documentation for completeness.
11. Commissioning is completed before Substantial Completion as directed by the GC/CM in accordance with the project schedule.
12. The CA reviews, comments on, and helps coordinate the training provided by the Subs and verifies that it was completed.
13. Deferred testing is conducted, as specified or required.

1.4 RESPONSIBILITIES

A. All Parties

1. Follow the Commissioning Plan.
2. Attend commissioning meetings and additional meetings, as necessary.

B. Architect (of A/E)

1. Construction and Acceptance Phase
 - a. Attend the commissioning meeting and selected commissioning team meetings.
 - b. Perform normal submittal review, construction observation, as-built drawing preparation, O&M manual preparation, etc., as contracted.
 - c. Provide any design narrative documentation requested by the CA.
 - d. Coordinate resolution of system deficiencies identified during commissioning, according to the contract documents.
 - e. Prepare and submit final as-built design intent documentation for inclusion in the O&M manuals. Review and approve the O&M manuals.
2. Warranty Period
 - a. Coordinate resolution of design non-conformance and design deficiencies identified during warranty-period commissioning.

C. Mechanical and Electrical Designers/Engineers (of the A/E)

1. Construction and Acceptance Phase

1. Perform normal submittal review, construction observation, as-built drawing preparation, etc., as contracted. One site observation should be completed just prior to system startup.
2. Provide any design narrative and sequences documentation requested by the CA. The designers shall assist (along with the contractors) in clarifying the operation and control of commissioned equipment in areas where the specifications, control drawings or equipment documentation is not sufficient for writing detailed testing procedures.
3. Attend commissioning meetings and other selected commissioning team meetings.
4. Participate in the resolution of system deficiencies identified during commissioning, according to the contract documents.
5. Review and approve the O&M manuals.
6. Provide a presentation at one of the training sessions for the Owner's personnel.
7. Review the pre-functional checklists for major pieces of equipment for sufficiency prior to their use.
8. Review the functional test procedure forms for major pieces of equipment for sufficiency prior to their use.

2. Warranty Period

- a. Participate in the resolution of non-compliance, non-conformance and design deficiencies identified during commissioning during warranty-period commissioning.

D. Commissioning Authority (CA)

1. The CA is not responsible for design concept, design criteria, compliance with codes, design or general construction scheduling, cost estimating, or construction management. The CA may assist with problem solving non-conformance or deficiencies, but ultimately that responsibility resides with the general contractor and the A/E. The primary role of the CA is to develop and coordinate the execution of a testing plan, observe and document performance that systems are functioning in accordance with the documented design intent and in accordance with the Contract Documents. The Contractors will provide all tools or the use of tools to start, checkout and functionally test equipment and systems, except for specified testing with portable data-loggers, which shall be supplied and installed by the CA.
2. Construction and Acceptance Phase
 - a. Coordinates and directs the commissioning activities in a logical, sequential and efficient manner using consistent protocols and forms, centralized documentation, clear and regular communications and consultations with all necessary parties, frequently updated timelines and schedules and technical expertise.
 - b. Coordinate the commissioning work and, with the CM, ensure that commissioning activities are being scheduled into the master schedule.
 - c. Update commissioning plan as required.

- d. Plan and conduct a commissioning meeting and other commissioning meetings.
- e. Request and review additional information required to perform commissioning tasks, including O&M materials, contractor start-up and checkout procedures.
- f. Before startup, gather and review the current control sequences and interlocks and work with contractors and design engineers until sufficient clarity has been obtained, in writing, to be able to write detailed testing procedures.
- g. Review approved Contractor submittals applicable to systems being commissioned for compliance with commissioning needs, concurrent with the A/E reviews.
- h. Write and distribute pre-functional tests and checklists.
- i. Perform site visits, as necessary, to observe component and system installations. Attends selected planning and job-site meetings to obtain information on construction progress. Review construction meeting minutes for revisions/substitutions relating to the commissioning process. Assist in resolving any discrepancies. Responsibility for deficiency resolution shall remain that of the A/E and the CM.
- j. Approve pre-functional tests and checklist completion by reviewing pre-functional checklist reports and by selected site observation and spot-checking.
- k. Document systems startup by reviewing completed start-up reports and by selected site observation.
- l. Review TAB execution plan.
- m. Review completed TAB reports and comment as required.
- n. With necessary assistance and review from installing contractors, write the functional performance test procedures for equipment and systems. This may include energy management control system trending, stand-alone data logger monitoring or manual functional testing. Submit to CM for review, and for approval if required.
- o. Analyze any functional performance trend logs and monitoring data to verify performance.
- p. Coordinate with the CM, witness and approve manual functional performance tests performed by installing contractors. CM to coordinate all retesting as necessary until satisfactory performance is achieved.
- q. Maintain a master deficiency and resolution log and a separate testing record. Provide the CM with written progress reports and test results with recommended actions.
- r. Review equipment warranties to ensure that the Owner's responsibilities are clearly defined.
- s. Review contractor training of the Owner's operating personnel for completeness and compliance with the respective contract requirements.
- t. Compile and maintain a commissioning record.
- u. Review O&M manuals as submitted by the contractors for completeness and compliance with the respective contract requirements.
- v. Provide a final commissioning report (as described in this section).
- w. Prepare a standard trend logging package of primary parameters that will provide the operations staff clear indications of system function in order to identify proper system operation and trouble shoot problems. The CA shall also provide any needed information on interpreting the trends.

3. Warranty Period
 - a. Coordinate and supervise required seasonal or deferred testing and deficiency corrections.
 - b. Return to the site at 10 months into the 12 month warranty period and review with facility staff the current building operation and the condition of outstanding issues related to the original and seasonal commissioning. Also interview facility staff and identify problems or concerns they have operating the building as originally intended. Make suggestions for improvements and for recording these changes in the O&M manuals. Identify areas that may come under warranty or under the original construction contract

E. Construction Manager (CM)

1. Construction and Acceptance Phase
 - a. Facilitate the coordination of the commissioning work by the CA, and with the CA, ensure that commissioning activities are being scheduled into the master schedule.
 - b. Include the cost of commissioning in the total contract price.
 - c. In each purchase order or subcontract written, include requirements for submittal data, O&M data, commissioning tasks and training.
 - d. Ensure that all Subs execute their commissioning responsibilities according to the Contract Documents and schedule.
 - e. Review and approve the final *Commissioning Plan—Construction Phase*.
 - f. Attend a commissioning scoping meeting and other commissioning team meetings.
 - g. Perform the normal review of Contractor submittals.
 - h. Furnish a copy of all construction documents, addenda, change orders and approved submittals and shop drawings related to commissioned equipment to the CA.
 - i. Review and approve the functional performance test procedures submitted by the CA, prior to testing.
 - j. When necessary, observe and witness prefunctional checklists, startup and functional testing of selected equipment.
 - k. Review commissioning progress and deficiency reports.
 - l. Coordinate the resolution of non-compliance and design deficiencies identified in all phases of commissioning.
 - m. Sign-off (final approval) on individual commissioning tests as completed and passing. Recommend completion of the commissioning process to the Project Manager.
 - n. Oversee and coordinate the preparation of O&M manuals, according to the Contract Documents, including the clarification and updating of the original sequences of operation to as-built conditions.
 - o. Coordinate the training of owner personnel.
2. Warranty Period
 - a. Assist the CA as necessary in the seasonal or deferred testing and deficiency corrections required by the specifications.

F. Owner's Project Manager (PM)

1. Construction and Acceptance Phase
 - a. Manage the contract of the A/E and of the CM.
 - b. Arrange for facility operating and maintenance personnel to attend various field commissioning activities and field training sessions according to the Commissioning Plan—Construction Phase.
 - c. Provide final approval for the completion of the commissioning work.
2. Warranty Period
 - a. Ensure that any seasonal or deferred testing and any deficiency issues are addressed.

G. Subcontractor

1. Construction and Acceptance Phase
 - a. Provide all requested submittal data, including detailed start-up procedures and specific responsibilities of the Owner to keep warranties in force.
 - b. Provide Start-up and Pretest Checklists Reports
 - c. Assist in all pre-functional testing for equipment that the subcontractor is responsible for.
 - d. Include all special tools and instruments (only available from vendor, specific to a piece of equipment) required for testing equipment according to these Contract Documents in the base bid price to the Contractor, except for stand-alone data logging equipment that may be used by the CA.
 - e. Provide information requested by CA (through the CM) regarding equipment sequence of operation and testing procedures.
 - f. Review test procedures created by the CA and comment as necessary.
 - g. A representative shall attend commissioning meetings and other necessary meetings scheduled by the CA to facilitate the Cx process.
 - h. Resolve deficiencies identified in all phases of commissioning, as directed by the CM in accordance with the Contract Documents, and all applicable codes and standards.
 - i. Implement training of owner personnel according to the Contract Documents.
 - j. Prepare O&M manuals, according to the Contract Documents, including clarifying and updating the original sequences of operation to as-built conditions.
 - k. Provide specific as-built, maintenance, and one-line documentation for the development of the Systems Manual.
2. Warranty Period
 - a. Ensure that Subs execute seasonal or deferred functional performance testing, witnessed by the CA, according to the specifications.
 - b. Correct deficiencies and make necessary adjustments to O&M manuals and as-built drawings for applicable issues identified in any seasonal testing.

H. Equipment Supplier / Vendor

1. Provide all requested submittal data, including detailed start-up procedures and specific responsibilities of the Owner to keep warranties in force.
2. Provide on site assistance for all pre-functional testing for all equipment with integral packaged controls.
3. Perform equipment start-ups as requested by the responsible contractor, required as part of manufacturer warranty, or required by the Contract Documents.
4. Include all special tools and instruments (only available from vendor, specific to a piece of equipment) required for testing equipment according to these Contract Documents in the base bid price to the Contractor, except for stand-alone datalogging equipment that may be used by the CA.
5. Resolve deficiencies identified in all phases of commissioning, as directed by the CM in accordance with the Contract Documents, and all applicable codes and standards.
6. Furnish all training requirements and materials for owner personnel in accordance with the Contract Documents.
7. Prepare O&M manuals, in accordance with the Contract Documents.
8. Furnish all warranty data in accordance with the Contract Documents

1.5 DEFINITIONS

- A. Acceptance Phase - phase of construction after startup and initial checkout when functional performance tests, O&M documentation review and training occurs.
- B. Approval - acceptance that a piece of equipment or system has been properly installed and is functioning in the tested modes according to the Contract Documents.
- C. Architect / Engineer (A/E) - the prime consultant (architect) and sub-consultants who comprise the design team, generally the HVAC mechanical designer/engineer and the electrical designer/engineer.
- D. Basis of Design - The basis of design is the documentation of the primary thought processes and assumptions behind design decisions that were made to meet the design intent. The basis of design describes the systems, components, conditions and methods chosen to meet the intent. Some reiterating of the design intent may be included.
- E. Commissioning authority (CA) - an independent agent, not otherwise associated with the A/E team members or the Contractor, though he/she may be hired as a subcontractor to them. The CA directs and coordinates the day-to-day commissioning activities. The CA does not take an oversight role like the CM. The CA is part of the Construction Manager (CM) team or shall report directly to the CM.
- F. Commissioning Plan - an overall plan, developed before or after bidding that provides the structure, schedule and coordination planning for the commissioning process.
- G. Contract Documents - the documents binding on parties involved in the construction of this project (drawings, specifications, change orders, amendments, contracts, *Cx Plan*, etc.).
- H. Contractor - the general contractor or authorized representative.
- I. Control system - the central building energy management control system.

- J. Construction Manager (CM) - a) the Owner's representative in the day-to-day activities of construction. In general, the construction management services contractor (CM) is hired by the owner to assist the government in the overall management of the project including supervising and on-site managing authority over a project's construction. The General Contractor reports to the CM. The CM is the Owner's on-site representative.
- K. Datalogging - monitoring flows, currents, status, pressures, etc. of equipment using stand-alone dataloggers separate from the control system.
- L. Deferred Functional Tests - FTs that are performed later, after substantial completion, due to partial occupancy, equipment, seasonal requirements, design or other site conditions that disallow the test from being performed.
- M. Deficiency - a condition in the installation or function of a component, piece of equipment or system that is not in compliance with the Contract Documents (that is, does not perform properly or is not complying with the design intent).
- N. Design Intent - a dynamic document that provides the explanation of the ideas, concepts and criteria that are considered to be very important to the owner. It is initially the outcome of the programming and conceptual design phases.
- O. Design Narrative or Design Documentation - sections of either the Design Intent or Basis of Design.
- P. Factory Testing - testing of equipment on-site or at the factory, by factory personnel, with an Owner's representative present.
- Q. Functional Performance Test (FT) - test of the dynamic function and operation of equipment and systems using manual (direct observation) or monitoring methods. Functional testing is the dynamic testing of systems (rather than just components) under full operation (e.g., the chiller pump is tested interactively with the chiller functions to see if the pump ramps up and down to maintain the differential pressure setpoint). Systems are tested under various modes, such as during low cooling or heating loads, high loads, component failures, unoccupied, varying outside air temperatures, fire alarm, power failure, etc. The systems are run through all the control system's sequences of operation and components are verified to be responding as the sequences state. Traditional air or water test and balancing (TAB) is not functional testing, in the commissioning sense of the word. TAB's primary work is setting up the system flows and pressures as specified, while functional testing is verifying that which has already been set up. The commissioning authority develops the functional test procedures in a sequential written form, coordinates, oversees and documents the actual testing, which is usually performed by the installing contractor or vendor. FTs are performed after prefunctional checklists and startup are complete.
- R. Indirect Indicators - indicators of a response or condition, such as a reading from a control system screen reporting a damper to be 100% closed.
- S. Manual Test - using hand-held instruments, immediate control system readouts or direct observation to verify performance (contrasted to analyzing monitored data taken over time to make the "observation").
- T. Monitoring - the recording of parameters (flow, current, status, pressure, etc.) of equipment operation using dataloggers or the trending capabilities of control systems.
- U. Non-Compliance - see Deficiency.
- V. Non-Conformance - see Deficiency.

- W. Over-written Value - writing over a sensor value in the control system to see the response of a system (e.g., changing the outside air temperature value from 50F to 75F to verify economizer operation). See also "Simulated Signal."
- X. Owner-Contracted Tests - tests paid for by the Owner outside the GC's contract and for which the CA does not oversee. These tests will not be repeated during functional tests if properly documented.
- Y. Phased Commissioning - commissioning that is completed in phases (by floors, for example) due to the size of the structure or other scheduling issues, in order minimize the total construction time.
- Z. Prefunctional Checklist (PC) - a list of items to inspect and elementary component tests to conduct to verify proper installation of equipment, provided by the CA to the Sub. Prefunctional checklists are primarily static inspections and procedures to prepare the equipment or system for initial operation (e.g., belt tension, oil levels OK, labels affixed, gages in place, sensors calibrated, etc.). However, some prefunctional checklist items entail simple testing of the function of a component, a piece of equipment or system (such as measuring the voltage imbalance on a three phase pump motor of a chiller system). The word prefunctional refers to before functional testing. Prefunctional checklists augment and are combined with the manufacturer's start-up checklist. Even without a commissioning process, contractors typically perform some, if not many, of the prefunctional checklist items a commissioning authority will recommend. However, few contractors document in writing the execution of these checklist items. Therefore, for most equipment, the contractors execute the checklists on their own. The commissioning authority only requires that the procedures be documented in writing, and does not witness much of the prefunctionalchecklisting, except for larger or more critical pieces of equipment.
- AA. Project Manager (PM) - the contracting and managing authority for the owner over the design and/or construction of the project, a staff position.
- BB. Sampling. - Functionally testing only a fraction of the total number of identical or near identical pieces of equipment. Refer to Section 17100, Part 3.6, F for details.
- CC. Seasonal Performance Tests - FT that are deferred until the system(s) will experience conditions closer to their design conditions.
- DD. Simulated Condition - condition that is created for the purpose of testing the response of a system (e.g., applying a hair blower to a space sensor to see the response in a VAV box).
- EE. Simulated Signal - disconnecting a sensor and using a signal generator to send an amperage, resistance or pressure to the transducer and DDC system to simulate a sensor value.
- FF. Specifications - the construction specifications of the Contract Documents.
- GG. Startup - the initial starting or activating of dynamic equipment includes executing pre-functional checklists.
- HH. Subs - the subcontractors to the GC who provide and install building components and systems.
- II. Test Procedures - the step-by-step process, which must be executed to fulfill the test requirements. The CA develops the test procedures.
- JJ. Test Requirements - requirements specifying what modes and functions, etc. shall be tested. The test requirements are not the detailed test procedures. The test requirements are specified in the Contract Documents (Divisions 23, 26, Etc..).
- KK. Trending - monitoring using the building control system.

LL. Vendor - supplier of equipment.

MM. Warranty Period - warranty period for entire project, including equipment components. Warranty begins at Substantial Completion and extends for at least one year, unless specifically noted otherwise in the Contract Documents and accepted submittals.

1.6 SYSTEMS TO BE COMMISSIONED

- A. All energy-related systems to be commissioned in this project.
 - 1. Building Management System
 - 2. Energy Recovery Units
 - 3. Energy Recovery Ventilators
 - 4. Electric Heaters
 - 5. Roof Top Units
 - 6. Dedicated Outdoor Air Systems
 - 7. VRF Systems including Fan Coils, Condensing Units, and Branch Controllers
 - 8. VAV Boxes
 - 9. Split Systems
 - 10. Smoke Dampers
 - 11. Exhaust Fans
 - 12. Exhaust Hoods
 - 13. Water Heaters

PART 2 - PRODUCTS

2.1 TEST EQUIPMENT

- A. All standard testing equipment required to perform startup and initial checkout and required functional performance testing shall be provided by the Division contractor for the equipment being tested. For example, the mechanical contractor of Division 23 shall ultimately be responsible for all standard testing equipment for the HVAC system and controls system in Division 23, except for equipment specific to and used by TAB in their commissioning responsibilities.
- B. Special equipment, tools and instruments (only available from vendor, specific to a piece of equipment) required for testing equipment, according to these Contract Documents shall be included in the base bid price to the Contractor and left on site, except for stand-alone datalogging equipment that may be used by the CA.
- C. Datalogging equipment and software required to test equipment will be provided by the CA, but shall not become the property of the Owner.
- D. All testing equipment shall be of sufficient quality and accuracy to test and/or measure system performance with the tolerances specified in the Specifications. All equipment shall be calibrated according to the manufacturer's recommended intervals and when dropped or damaged. Calibration tags shall be affixed or certificates readily available.

PART 3 - EXECUTION

3.1 MEETINGS

- A. Kick-off Meeting: The CA will schedule, plan and conduct a commissioning scoping meeting with the entire commissioning team in attendance. Meeting minutes will be distributed to all parties by the CA. Information gathered from this meeting will allow the CA to modify the Commissioning Plan to its “final” version, which will also be distributed to all parties.
- B. Miscellaneous Meetings: Other meetings will be planned and conducted by the CA as construction progresses. These meetings will cover coordination, deficiency resolution and planning issues with particular Subs. The CA will plan these meetings and will minimize unnecessary time being spent by Subs. For large projects, these meetings may be held monthly, until the final 3 months of construction when they may be held as frequently as one per week. It is intended that the Commissioning meeting will be part of or a supplement to regularly scheduled subcontractor construction meetings (to be coordinated through the CM).

3.2 REPORTING

- A. The CA will provide regular reports to the CM and the Owner’s PM with increasing frequency as construction and commissioning progresses. Standard forms (Commissioning Action List) are provided and referenced in the Commissioning Plan.
- B. The CA will regularly communicate with all members of the commissioning team (as directed by the owner and CM), keeping them apprised of commissioning progress and scheduling changes through memos, progress reports, etc.
- C. Testing or review reports and non-conformance and deficiency reports are made regularly with the review and testing as described in later sections.
- D. A final summary report by the CA will be provided to the Owner and CM, focused on the results of the commissioning process (process overview, issues summary, test documents, etc.). All acquired documentation, logs, minutes, reports, deficiency lists, communications, findings, unresolved issues, etc., will be compiled in appendices and provided with the summary report. Prefunctional checklists, functional tests and monitoring reports will not be part of the final report, but will be stored in the Commissioning Record in the O&M manuals.

3.3 SUBMITTALS

- A. The CA will provide the CM with a specific request for the type of submittal documentation the CA requires to facilitate the commissioning work. These requests will be integrated into the normal submittal process and protocol of the construction team. At minimum, the request will include the manufacturer and model number, the manufacturer’s printed installation and detailed start-up procedures, full sequences of operation, O&M data, performance data, any performance test procedures, control drawings and details of owner contracted tests. In addition, the installation and checkout materials that are actually shipped inside the equipment and the actual field checkout sheet forms to be used by the factory or field technicians shall be submitted to the Commissioning au-

thority. All documentation requested by the CA will be included by the Subs in their O&M manual contributions.

- B. The Commissioning authority will review approved submittals related to the commissioned equipment for conformance to the Contract Documents as it relates to the commissioning process, to the functional performance of the equipment and adequacy for developing test procedures. This review is intended primarily to aid in the development of functional testing procedures and only secondarily to verify compliance with equipment specifications. The Commissioning authority will notify the CM, PM or A/E as requested, of items missing or areas that are not in conformance with Contract Documents and which require resubmission.
- C. The CA may request additional design narrative from the A/E and Controls Contractor, depending on the completeness of the design intent documentation and sequences provided with the Specifications.
- D. These submittals to the CA do not constitute compliance for O&M manual documentation. The O&M manuals are the responsibility of the Contractor, though the CA will review them.

3.4 START-UP, PREFUNCTIONAL CHECKLISTS AND INITIAL CHECKOUT

- A. The following procedures apply to all equipment to be commissioned, according to Section 1.6, Systems to be Commissioned. Some systems that are not comprised so much of actual dynamic machinery, e.g., electrical system power quality, may have very simplified PCs and startup.
- B. General: Prefunctional checklists are important to ensure that the equipment and systems are hooked up and operational. It ensures that functional performance testing (in-depth system checkout) may proceed without unnecessary delays. Each piece of equipment receives full prefunctional checkout. No sampling strategies are used. The prefunctional testing for a given system must be successfully completed prior to formal functional performance testing of equipment or subsystems of the given system.
- C. Start-up and Initial Checkout Plan: The appropriate contractor/manufacturer is responsible for developing detailed start-up plans for all equipment. The primary role of the CA in this process is to ensure that there is written documentation that each of the manufacturer-recommended procedures have been completed. Parties responsible for startup in accordance with the contract documents are identified in the commissioning scoping meeting and in the checklist forms. Responsibility for equipment start-up requirements, protocols, and reports shall be that of the appropriate contractor/manufacturer. CM to forward copies of the completed start-up documentation to the CA.
 - 1. The CA adapts, if necessary, the representative prefunctional checklists and procedures from the Contract Document Requirements. These checklists indicate required procedures to be executed as part of startup and initial checkout of the systems and the party responsible for their execution.
 - 2. It is the Contractor's responsibility to provide these checklists and tests. The Contractor determines which trade is responsible for executing and documenting each of the line item tasks and notes that trade on the form. Each form will have more than one trade responsible for its execution.

3. The subcontractor responsible for the purchase of the equipment develops the full start-up plan by combining the manufacturer's detailed start-up and checkout procedures from the O&M manual and the normally used field checkout sheets. The plan will include checklists and procedures with specific boxes or lines for recording and documenting the checking and inspections of each procedure and a summary statement with a signature block at the end of the plan.
 4. The full start-up plan could consist of something as simple as:
 - a. The manufacturer's or contractor's installation checklists.
 - b. The manufacturer's standard written start-up procedures copied from the installation manuals with check boxes by each procedure and a signature block added by hand at the end.
 - c. The Control Contractor's Point-to-Point Checkout Sheets.
 - d. The TAB Report (if applicable).
 3. The subcontractor submits the full startup plan to the A/E, CM and CA for review.
 4. The A/E, CM and CA review the procedures and the format for documenting them, noting any procedures that need to be added.
- D. Execution of Prefunctional Checklists and Startup.
1. Prior to startup, the Subs and vendors schedule startup and checkout with the CM. The performance of the prefunctional checklists, startup and checkout are directed and executed by the Sub or vendor. When checking off prefunctional checklists, signatures may be required of other Subs for verification of completion of their work.
 2. The Subs and vendors shall execute startup and provide the CA with a signed and dated copy of the completed start-up and prefunctional tests and checklists.
 3. Only individuals that have direct knowledge and witnessed that a line item task on the prefunctional checklist was actually performed shall initial or check that item off. It is not acceptable for witnessing supervisors to fill out these forms.
- E. Deficiencies, Non-Conformance and Approval in Checklists and Startup.
1. The Subs shall clearly list any outstanding items of the initial start-up and prefunctional procedures that were not completed successfully, at the bottom of the procedures form or on an attached sheet. The procedures form and any outstanding deficiencies are provided to the CA within two days of test completion.
 2. The CA reviews the report and submits either a non-compliance report or an approval form to the Sub or CM. The CA shall work with the Subs and vendors through the CM to correct and retest deficiencies or uncompleted items. The installing Subs or vendors shall correct all areas that are deficient or incomplete in the checklists and tests in a timely manner, and shall notify the CM as soon as outstanding items have been corrected and resubmit an updated start-up report and a Statement of Correction on the original non-compliance report. When satisfactorily completed, the CA recommends approval of the execution of the checklists and startup of each system to the CM using a standard form.
 3. Items left incomplete, which later cause deficiencies or delays during functional testing may result in back-charges to the responsible party to be determined by the CM. Refer to Part 3.7 herein for details.

3.5 PHASED COMMISSIONING

- A. If the project requires startup and initial checkout to be executed in phases, this phasing will be planned and scheduled in a coordination meeting of the CA, CM, mechanical, TAB and controls contractors. Results will be added to the master and commissioning schedule.

3.6 FUNCTIONAL PERFORMANCE TESTING

- A. This sub-section applies to all commissioning functional testing for all divisions.
- B. Objectives and Scope: The objective of functional performance testing is to demonstrate that each system is operating according to the documented design intent and Contract Documents. Functional testing facilitates bringing the systems from a state of substantial completion to full dynamic operation. Additionally, during the testing process, areas of deficient performance are identified and corrected, improving the operation and functioning of the systems.
- C. In general, each system should be operated through all modes of operation (seasonal, occupied, unoccupied, warm-up, cool-down, part- and full-load) where there is a specified system response. Verifying each sequence in the sequences of operation is required. Proper responses to such modes and conditions as power failure, freeze condition, low oil pressure, no flow, equipment failure, etc. shall also be tested. Specific modes required in this project are specified in the appropriate sections of the Contract Documents.
- D. Development of Test Procedures: Before test procedures are written, the CA shall obtain all requested documentation and a current list of change orders affecting equipment or systems, including an updated points list, program code, control sequences and parameters. Using the testing parameters and requirements the appropriate sections of the Contract Documents, the CA shall develop specific test procedures and forms to verify and document proper operation of each piece of equipment and system. Each Sub or vendor responsible to execute a test shall provide limited assistance to the CA in developing the procedures review (answering questions about equipment, operation, sequences, etc.). Prior to execution, the CA shall provide a copy of the test procedures to the Sub(s) through the CM who shall review the tests for feasibility, safety, equipment and warranty protection. The CA may submit the tests to the A/E for review, if requested. The purpose of any given specific test is to verify and document compliance with the stated criteria of acceptance given on the test form as developed based on the Contract Documents. The test procedure forms developed by the CA shall include (but not be limited to) the following information, if applicable:
 - 1. System and equipment or component name(s)
 - 2. Equipment location and ID number
 - 3. Unique test ID number, and reference to unique prefunctional checklist and start-up documentation ID numbers for the piece of equipment
 - 4. Date
 - 5. Project name
 - 6. Participating parties

7. A copy of the specific sequence of operations or other specified parameters being verified
8. Formulas used in any calculations
9. Required pre-test field measurements
10. Instructions for setting up the test.
11. Special cautions, alarm limits, etc.
12. Specific step-by-step procedures to execute the test, in a clear, sequential and repeatable format
13. Acceptance criteria of proper performance with a Yes / No check box to allow for clearly marking whether or not proper performance of each part of the test was achieved.
14. A section for comments
15. Signatures and date block for the CA

E. Test Methods:

1. Functional performance testing and verification may be achieved by: 1) manual testing (persons manipulate the equipment and observe performance); 2) utilizing the control system by implementing a required control action and witnessing the subsequent equipment or system reaction; or 3) monitoring the performance and analyzing the results using the control system's trend log capabilities or by stand-alone data loggers. The CA will determine which method is most appropriate for tests that do not have a method specified.
2. Simulated Conditions: Simulating conditions shall be allowed, though timing the testing to experience actual conditions is encouraged wherever practical.
3. Overwritten Values: Overwriting sensor values to simulate a condition, such as overwriting the outside air temperature reading in a control system to be something other than it really is, shall be allowed, but shall be used with caution and avoided when possible. Such testing methods often can only test a part of a system, as the interactions and responses of other systems will be erroneous or not applicable. Simulating a condition is preferable. e.g., for the above case, by heating the outside air sensor with a hair blower rather than overwriting the value or by altering the appropriate set point to see the desired response. Before simulating conditions or overwriting values, sensors, transducers and devices shall have been calibrated.
4. Simulated Signals: Using a signal generator which creates a simulated signal to test and calibrate transducers and DDC constants is generally recommended over using the sensor to act as the signal generator via simulated conditions or overwritten values.
5. Altering Set points: Rather than overwriting sensor values, and when simulating conditions is difficult, altering set points to test a sequence is acceptable. For example, to see the AC compressor lockout work at an outside air temperature below 55F, when the outside air temperature is above 55F, temporarily change the lock-out set point to be 2F above the current outside air temperature.
6. Indirect Indicators: Relying on indirect indicators for responses or performance shall be allowed only after visually and directly verifying and documenting, over the range of the tested parameters, that the indirect readings through the control system represent actual conditions and responses. Much of this verification is completed during prefunctional testing.
7. Setup: Each function and test shall be performed under conditions that simulate actual conditions as close as is practically possible. The Sub executing the test shall provide all necessary materials, system modifications, etc. to produce the

necessary flows, pressures, temperatures, etc. necessary to execute the test according to the specified conditions. At completion of the test, the Sub shall return all affected building equipment and systems, due to these temporary modifications, to their pre-test condition.

8. Sampling: Multiple identical pieces of non-life-safety or otherwise non-critical equipment may be functionally tested using a sampling strategy. Significant application differences and significant sequence of operation differences in otherwise identical equipment invalidates their common identity. It is noted that no sampling by Subs is allowed in prefunctional checklist execution. The example below describes a 20% Sampling—10% Failure Rule.
 - a. Randomly test at least 20% of each group of identical equipment. In no case test less than three units in each group. This 20%, or three, constitute the “first sample.”
 - b. If 10% of the units in the first sample fail the functional performance tests, test another 20% of the group (the second sample).
 - c. If 10% of the units in the second sample fail, test all remaining units in the whole group.
 - d. If at any point, frequent failures are occurring and testing is becoming more troubleshooting than verification, the CA may stop the testing and notify the CM to require the responsible Sub to perform and document a checkout of the remaining units, prior to continuing with functionally testing the remaining units.
- G. Coordination and Scheduling: The Subs shall provide sufficient notice to the CA regarding their completion schedule for the prefunctional checklists and startup of all equipment and systems. The CA will schedule functional tests through the CM. The CA shall direct, witness and document the functional testing of all equipment and systems. The Subs shall execute the tests.
- H. In general, functional testing is conducted after prefunctional testing and startup has been satisfactorily completed. The control system check out/testing required for the TAB work shall be the responsibility of the controls and TAB contractor. The air balancing and water balancing is completed and debugged before functional testing of air-related or water-related equipment or systems. Testing proceeds from components to subsystems to systems. When the proper performance of all interacting individual systems has been achieved, the interface or coordinated responses between systems is checked.
- I. Problem Solving: The CA will recommend solutions to problems found, however the burden of responsibility to solve, correct and retest problems is with the CM, Subs and A/E.

3.7 DOCUMENTATION, NON-CONFORMANCE AND APPROVAL OF TESTS

- A. Documentation: The CA shall witness and document the results of all functional performance tests using the specific procedural forms developed for that purpose. Prior to testing, these forms are provided to the CM for review and approval and to the Subs for review. The CA will include the filled out forms in the final Commissioning report and as a supplement package to the O&M manuals.

B. Non-Conformance:

1. The CA will record the results of the functional test on the procedure or test form. All deficiencies or non-conformance issues shall be noted and reported to the CM on a standard non-compliance form (Commissioning Action Item List).
2. Corrections of minor deficiencies identified may be made during the tests at the discretion of the CA. In such cases the deficiency and resolution will be documented on the procedure form.
3. Every effort will be made to expedite the testing process and minimize unnecessary delays, while not compromising the integrity of the procedures.
4. As tests progress and a deficiency is identified, the CA discusses the issue with the executing contractor.
 - a. When there is no dispute on the deficiency and the Sub accepts responsibility to correct it:
 - 1) The CA documents the deficiency and the Sub's response and intentions and they go on to another test or sequence. After the day's work, the CA submits the non-compliance reports to the CM for signature, if required. A copy is provided to the Sub and CA. The Sub corrects the deficiency, signs the statement of correction at the bottom of the non-compliance form certifying that the equipment is ready to be retested and sends it back to the CA.
 - 2) The CA reschedules the test and the test is repeated (Reference 3.7, B.5 below).
 - b. If there is a dispute about a deficiency, regarding whether it is a deficiency or who is responsible:
 - 1) The deficiency shall be documented on the non-compliance form with the Sub's response and a copy given to the CM.
 - 2) Resolutions are made at the lowest management level possible. Other parties are brought into the discussions as needed. Final interpretive authority is with the A/E. Final acceptance authority is with the Owner's Project Manager and CM.
 - 3) The CA documents the resolution process.
 - 4) Once the interpretation and resolution have been decided, the appropriate party corrects the deficiency, signs the statement of correction on the non-compliance form and provides it to the CA, through the CM. The CA reschedules the test and the test is repeated until satisfactory performance is achieved.
5. Cost of Retesting.
 - a. Cost for Retesting shall be determined by and be the responsibility of the CM.
4. The Contractor shall respond in writing to the CA and CM at least as often as commissioning meetings are being scheduled concerning the status of each apparent outstanding discrepancy identified during commissioning. Discussion shall cover explanations of any disagreements and proposals for their resolution.
5. The CA retains the original non-conformance forms until the end of the project.
6. Any required retesting by any contractor shall not be considered a justified reason for a claim of delay or for a time extension by the prime contractor.

- C. Failure Due to Manufacturer Defect: If 10%, or three, whichever is greater, of identical pieces (size alone does not constitute a difference) of equipment fail to perform to the Contract Documents (mechanically or substantively) due to manufacturing defect, not allowing it to meet its submitted performance spec, all identical units may be considered unacceptable by the CM or PM. In such case, the Contractor shall provide the Owner with the following:
1. Within one week of notification from the CM or PM, the Contractor or manufacturer's representative shall examine all other identical units making a record of the findings. The findings shall be provided to the CM or PM within two weeks of the original notice.
 2. Within two weeks of the original notification, the Contractor or manufacturer shall provide a signed and dated, written explanation of the problem, cause of failures, etc. and all proposed solutions which shall include full equipment submittals. The proposed solutions shall not significantly exceed the specification requirements of the original installation.
 3. The CM or PM will determine whether a replacement of all identical units or a repair is acceptable.
 4. Two examples of the proposed solution will be installed by the Contractor and the CM will be allowed to test the installations for up to one week, upon which the CM or PM will decide whether to accept the solution.
 5. Upon acceptance, the Contractor and/or manufacturer shall replace or repair all identical items, at their expense and extend the warranty accordingly, if the original equipment warranty had begun. The replacement/repair work shall proceed with reasonable speed beginning within one week from when parts can be obtained.
- D. Approval: The CA notes each satisfactorily demonstrated function on the test form. Formal approval of the functional test is made later after review by the CA, A/E, the CM, if necessary. The CA recommends acceptance of each test to the CM using a standard form. The CM gives final approval on each test using the same form, providing a signed copy to the CA and the Contractor.

3.8. OPERATION AND MAINTENANCE MANUALS

- A. Standard O&M Manuals:
1. The specific content and format requirements for the standard O&M manuals are detailed in the appropriate sections of the Contract Documents.

3.9 TRAINING OF OWNER PERSONNEL

- A. The CM is responsible for training coordination and scheduling, and ultimately for ensuring that all training is completed.
1. Each Sub and vendor responsible for training will submit a written training plan to the CA, through the CM, for review and prior to training. The plan will cover the following elements:
 - a. Equipment (included in training)

- b. Intended audience
- c. Location of Training
- d. Objectives
- e. Subjects covered and approximate time devoted to each.
- f. Qualified instructor
- g. Method/Type of instruction, i.e., classroom, video, walk through, operational demonstrations, written materials, etc

3.10 DEFERRED TESTING

- A. Unforeseen Deferred Tests: If any check or test cannot be completed due to the building structure, required occupancy condition or other deficiency, execution of checklists and functional testing may be delayed upon approval of the PM. These tests will be conducted in the same manner as the seasonal tests as soon as possible. Services of necessary parties will be negotiated.
- B. Seasonal Testing: During the warranty period, seasonal testing if required, shall be completed as part of this contract. The CA shall coordinate this activity through the CM. The appropriate Functional Performance Tests will be executed and documented. A supplemental report will be completed by the CA and forwarded to the CM and Owner.

3.11 WRITTEN WORK PRODUCTS

- A. The commissioning process generates a number of written work products described in various parts of the Specifications. The Commissioning Plan—Construction Phase, lists all the formal written work products, describes briefly their contents, who is responsible to create them, their due dates, who receives and approves them and the location of the specification to create them. In summary, the written products are:

<u>Product</u>	<u>Developed By</u>
1. Final commissioning plan	CA
2. Cx Meeting minutes	CA
3. Commissioning schedules	CM with CA
4. Equipment documentation submittals	Subs
5. Sequence clarifications	Subs and A/E as needed
5. Prefunctional checklists	Subs
6. Startup and initial checkout plan	Subs
7. Startup and initial checkout forms filled out	Subs
8. Final TAB report	TAB
9. Issues log (Action List)	CA
10. Functional test forms	CA
11. Completed functional tests	CA
12. O&M manuals	Subs
13. Overall training plan	Subs
14. Specific training agendas	Subs
15. Final commissioning report	CA

END OF SECTION

SECTION 02 41 19

SELECTIVE DEMOLITION

PART 1 - GENERAL

1.01 SUMMARY

- A. Related Documents:
The Drawings and general provisions of the Contract, including General and Supplementary General Conditions, and Division 1 Requirements, apply to the work in this Section.

1.02 SECTION INCLUDES

- A. All material, labor and equipment required for demolition and removal of existing structures and items as shown on the drawings and as may be required to permit the proper installation of any new work.

1.03 QUALITY ASSURANCE

- A. Perform work in accordance with all applicable local and state Codes.
- B. NOTE: The Owner has determined there is asbestos containing material to be encountered in the Work of this Project. See Section 02 82 13 for additional information.

1.04 SEQUENCING

- A. Coordinate with the occupancy of the owner under provisions of Section 01 10 00.
- B. Avoid interference with the use of and passage to and from adjacent buildings and facilities.

PART 2 - PRODUCTS

Not Used

PART 3 - EXECUTION

3.01 PREPARATION

- A. Inspection
 - 1. The contractor shall inspect the entire site, premises and all objects designated to be removed and those to be preserved.
 - 2. Locate all existing utility lines and determine the requirements for their protection or abandonment.
- B. Notification
 - 1. Notify the owner at least two full working days prior to commencing the work of this section.

C. Verification

1. Prior to commencing the work of this section, verify with the owner and the Architect all objects to be removed and all objects to be preserved.

D. Protection

1. Protect all objects and utilities designated to remain as required. Active utilities shall not be interrupted.
2. Provide shoring and bracing for the support of existing structures, that are to remain in place, where necessary to prevent collapse of structures.
3. Dust control shall be as necessary to prevent the spread of dust and flying particles during performance of the work of this section. Provide taped fire resistant polyethylene dust barriers as required. Thoroughly moisten all surfaces as required. Protect HVAC systems from absorbing excessive amounts of contaminants.
4. The contractor shall be responsible to repair or replace all items designated to remain that are damaged due the surrounding demolition.

3.02 CLEANING

- A. Clean work under provisions of Section 01 70 00.
- B. Remove all debris and trash from the site on a daily basis and dispose of in accordance with all local and state Codes.
- C. All removed items scheduled to be retained shall be given to the owner for their use.
- D. Burning at the site will not be permitted.

3.03 SCHEDULE

A. Finishes

1. Remove all existing floor finishes, base materials and adhesives in all areas scheduled to receive new finishes unless instructed otherwise. Patch and repair all substrate damaged by removal as required to install new finish.
2. Remove all finishes as indicated on the drawings and as required by new construction. Repair or replace substrate damaged by removals.

B. Gypsum Board Partitions

1. Remove partitions, blocking, and associated framing indicated to be removed on the drawings and as required by new construction.
2. Remove all appurtenances, equipment and fixtures from partitions to be demolished.
3. Remove all nails, screws and other fastening hardware associated with partitions to be demolished.
4. Remove all doors, windows and frames within partition to be demolished.

C. Concrete

1. Assume all concrete is reinforced.
2. Use a saw cut on all concrete to be removed that butts concrete to remain
3. Always remove concrete in small sections
4. Remove all concrete slabs or walls as indicated on the drawings.

D. Masonry

1. Assume all masonry is reinforced.
2. Remove all masonry as indicated on the drawings and as required by new construction
3. All new openings in existing walls will be saw cut.
4. Remove reinforcing flush with surfaces scheduled to remain.
5. Remove steel lintels within walls to be demolished.
6. Provide core boring through masonry walls as required to install new utilities.
7. Remove all appurtenances, equipment and fixtures from masonry partitions to be demolished.

E. Doors, Windows and Louvers

1. Remove all doors, frames, hardware, fasteners, sub frame material and anchors from openings indicated on the plans or as required by new construction.
2. Remove window, sub frame materials, and other related items indicated on the plans or as required by new construction.
3. Remove louvers, grills, and vents, including anchors and sub frame materials where indicated or as required by new construction.
4. Modify existing openings for new construction as indicated on plans.
5. Provide new lintels as required by new construction.

F. Mechanical, Electrical and Plumbing.

1. Refer to the mechanical, electrical, and plumbing drawings and specifications for equipment removal requirements.
2. Provide cutting of holes in floors, partitions or ceilings for all mechanical, electrical, and plumbing as required.
3. Remove all mechanical, electrical, and plumbing equipment and fixtures from partitions to be demolished.
4. Remove all existing fixtures and equipment in areas scheduled to receive new fixtures and equipment unless instructed otherwise.
Patch and repair all substrate and finishes damaged by removal of items as required to match existing or to prepare for a new finish as scheduled. Dispose of all removed fixtures and equipment unless noted otherwise.

END OF SECTION

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SECTION 02 82 13

ASBESTOS ABATEMENT

PART1-GENERAL

1.01 SECTION INCLUDES:

- A. Abatement procedures.
- B. Specifications for Asbestos Abatement.

1.02 ABATEMENT PROCEDURES.

- A. The Owner has determined there are asbestos-containing materials to be encountered in the Work of this project.
- B. The contractor's authorization to contract for abatement work is enabled by a prepared abatement plan. The plan shall be submitted by the owner for approval by the Rhode Island Department of Health for the performance of the Work described in the plan.
- C. Obtain the services of a State of Rhode Island Certified Abatement Contractor to remove and dispose of the asbestos-containing materials and asbestos contaminated items in accordance with the approved abatement plan and with the requirements of the Rhode Island Department of Health, Office of Healthy Homes and Environment, Asbestos Program.
- D. Retain abatement invoices for submittal with required close out record documents. Invoices must be accompanied by complete shipping documents showing final disposal location.

1.03 SUMMARY OF THE WORK:

- A. The following is a Summary of the Work, at a minimum, to be performed:
- B. Asbestos-Containing Materials:
 - 1. All Asbestos Abatement work under this Section shall be performed by an Asbestos Abatement Contractor holding a current Rhode Island Department of Health (RIDOH) Asbestos Abatement Contractor's License. The Abatement Contractor shall furnish all labor, worker training, materials, equipment and services for the complete and proper removal and disposal of asbestos- containing materials and asbestos contaminated items as specified herein.
- C. Hoxsie Elementary School — 55 Glenwood Drive, Warwick, RI:

Removal and disposal of specified asbestos-containing materials (ACM) from select building areas. This shall include all identified ACM and various associated work as described on the drawings and in the project manual.

 - 1. Work area preparations, including pre-cleaning, installation of critical barriers and polyethylene sheeting, construction of decontamination facilities, work area enclosure, sealing, isolation, pre-cleaning of surfaces, and other activities as directed by the Consultant.
 - 2. Sealing of penetrations and items remaining in the work areas with critical barriers consisting of one (1) layer of six (6.0) mil polyethylene sheeting and duct tape.
 - 3. ACM boiler breeching insulation, ACM pipe/elbow/fitting insulation, ACM boiler

cement/pad/gaskets full containment removal area walls shall be covered with a minimum of two (2) layers of four (4.0) mil polyethylene sheeting and duct tape. Removal work area floors shall be covered with a minimum of two (2) layers of six (6.0) mil polyethylene sheeting secured with duct tape. Construction of three (3) and two (2) chamber decontamination units for each mini/full containment work area.

4. Due to limited access of pipe/elbow/fitting insulation in wall/ceiling/floor cavities and due to limited removal in some areas of pipe/elbow/fitting insulation, two (2) layer six (6.0) mini-containment procedures has been requested from RIDOH. "Wrap and cut" removal procedures for pipe/elbow/fitting insulation shall be utilized in work areas with one layer six (6.0) mil polyethylene sheeting mini- containment procedures. Due to limited quantity of non-friable ACM sink waterproofing and intact removal methods, a waiver of containment has been requested from RIDOH. Contractor shall remove entire sinks intact to avoid ACM disturbance.
5. Work area preparations including installation of negative air machines and establishment of negative air pressure for each containment and glove bag work area and other activities as directed by the Consultant.
6. Use of HEPA vacuums for each work area.
7. Removal of ACM boiler breeching, ACM pipe/elbow/fitting insulation, ACM boiler cement/pad, ACM boiler gaskets, ACM sink waterproofing identified in Section 1.3 and in accordance with Section 1.4 of this Specification.
8. Compliance with all applicable federal, state, and local regulations, as well as all requirements set forth in these Specifications and facility requirements.
9. Decontamination and clean up following removal activities in the designated work areas.
10. Performance of any other work or activities required by these Specifications, applicable regulations, or as necessary to perform a complete job to the satisfaction of the General Contractor, Owner or Consultant.

C. Locations:

1. See floor plan.

D. Asbestos-Containing Materials: Hoxsie Elementary School

1. Asbestos-containing boiler breeching insulation.
2. Asbestos-containing pipe/elbow/fitting insulation.
3. Asbestos-containing boiler cement, pad and gaskets.
4. Asbestos-containing sink waterproofing.

1.4 SEQUENCE OF THE WORK:

- A. The following is a typical sequence of work that Abatement Contractor shall adhere to during the asbestos abatement project. Consultant may authorize deviations from this typical sequence based upon the specific conditions encountered during the project.
- B. HOXSIE ELEMENTARY SCHOOL — Boiler Room — removal of asbestos boiler breeching insulation, asbestos pipe/elbow/fitting insulation, asbestos boiler cement, pad and gaskets.

1. The abatement contractor shall adhere to the warning sign provisions of OSHA and RIDOH. Warwick Schools shall shutdown and lockout HVAC prior to commencement of work and remove movable objects from the work area.
2. Abatement personnel shall utilize proper respiratory and clothing protection, in strict compliance with OSHA 29 CFR 1926.1101 for the duration of the project.
3. Critical barriers consisting of a minimum of one (1) layer of six (6.0) mil polyethylene sheeting sealed airtight with duct tape are required on all openings, including but not limited to: ductwork, electrical panels, wires, ceiling openings, windows, doors, air handler vents, diffusers, etc. inside the work area.
4. Dividing walls that will separate work areas from non-work areas shall be constructed of a minimum of two (2) layers of six (6.0) mil polyethylene sheeting secured airtight with bracing strips, 2 x 4 wood framing and duct tape to the existing floor, wall and ceiling surfaces.
5. Two (2) layer full containment procedures shall be utilized. Wall surfaces shall be protected with a minimum of two (2) layers of four (4.0) mil polyethylene secured with duct tape. Floor surfaces shall be protected with a minimum of two (2) layers of six (6.0) mil polyethylene sheeting secured with duct tape. This containment may also include adjacent abatement areas (custodian office, hallway) depending on the phasing of the project.
6. Egress and ingress to the work area shall be through a three (3) chamber decontamination unit, consisting of a dirty room, operating shower room, and clean room. The decontamination unit shall be contiguous to the work area.
7. Safety equipment located on-site shall include a stocked first-aid kit and approved fire extinguisher. Ground Fault Circuit Interrupters (GFCI) shall be utilized on all electrical cords.
8. Continuous, localized negative pressure with intake in the work area shall be required. Microtrap units shall be properly exhausted to the outside of the building. Abatement contractor shall be responsible to secure openings where negative air machines are exhausted to prevent unauthorized building access during non-working hours.
9. Non-ACM contaminated fiberglass pipe insulation in the work area shall be disposed of as non- ACM waste prior to ACM removal commencement.
10. Removal shall commence upon approval of the containment and decontamination unit by the project Industrial Hygienist.
11. Asbestos-containing materials shall be adequately wetted prior to removal. Contractor shall demolish boilers and breeching to access cement, pad and gaskets and to ensure complete cement, boiler pad and gasket removal/final cleaning. Contractor shall dispose of ACM contaminated boiler/breeching components as ACM waste.
12. Asbestos waste shall be transported and disposed of in accordance with the provisions of the Rhode Island Rules and Regulations for Asbestos Control, 40 CFR 763 Appendix D, Subpart E and U.S.D.O.T. 49 CFR 173.1300.
13. Abatement contractor shall remedially clean via HEPA vacuums and wet wiping all surfaces

including wall surfaces, floor surfaces, pipe surfaces, polyethylene surfaces free of dust, debris, and residue, as part of the final cleaning procedures, to the satisfaction of the project Industrial Hygienist.

14. Abatement equipment no longer needed inside the work area shall be wet wiped and/or HEPA vacuumed upon completion of abatement activities and prior to the post abatement air sampling. Asbestos waste barrels/bags inside the containment shall be removed prior to the visual inspections. Abatement contractor shall spray removed surfaces and polyethylene sheeting with lockdown encapsulant after satisfactory visual inspections by the abatement contractor's supervisor and project Industrial Hygienist.
15. Abatement contractor shall be responsible for cleaning surfaces free of duct tape and spray glue residue during teardown procedures.
16. Abatement Contractor shall submit project closeout paperwork to the Owner as required not more than thirty (30) days after completion of asbestos removal work.

C. HOXSIE ELEMENTARY SCHOOL — removal of asbestos pipe/elbow/fitting insulation.

1. The abatement contractor shall adhere to the warning sign provisions of OSHA and RIDOH. Warwick Schools shall shutdown and lockout HVAC prior to commencement of work and remove movable objects from the containment work areas.
2. Abatement personnel shall utilize proper respiratory and clothing protection, in strict compliance with OSHA 29 CFR 1926.1101 for the duration of the project.
3. Critical barriers consisting of a minimum of one (1) layer of six (6.0) mil polyethylene sheeting sealed airtight with duct tape are required on all openings, windows, openings located above ceilings leading to areas outside of the abatement containment, doors, air handler vents, non moveable items such as book shelves and cabinets, unit ventilator air intake grilles, diffusers, etc. inside the work areas.
4. Room items including tables, desks, chairs, books, shelves, cabinets located outside/adjacent to containments shall be covered with a minimum of one (1) layer of six (6.0) mil polyethylene sheeting.
5. Due to limited "wrap and cut" removal of pipe elbows and fittings, full containment of the abatement areas shall not be required. Abatement areas shall be set up as mini-containments. Mini- containment walls shall be constructed of one (1) layer of six (6.0) mil polyethylene sheeting sealed airtight to existing roof deck or hard ceiling surfaces and sealed airtight with duct tape to floor surfaces. One (1) layer of six (6.0) mil polyethylene sheeting drop cloths shall be placed on the floors under the piping to be removed. Non-asbestos cutting of fiberglass insulated pipes shall occur only under negative pressure containment conditions to minimize any possible asbestos fiber release.
6. Egress and ingress to each work area shall be through a two (2) chamber decontamination unit consisting of a dirty room and clean room. Decontamination units shall be contiguous to each work area.
7. Continuous, localized negative pressure with intake in the work areas shall be required. Microtrap units shall be properly exhausted to the outside of the building. Abatement

contractor shall be responsible to secure openings where negative air machines are exhausted to prevent unauthorized building access during non-working hours.

8. Safety equipment located on-site shall include a stocked first-aid kit and approved fire extinguisher. Ground Fault Circuit Interrupters (GFCI) shall be utilized on all electrical cords.
 9. Removal shall commence upon approval of the containments and decontamination units by the project Industrial Hygienist.
 10. ACM pipe/elbow/fitting insulation shall be wrapped with two (2) layers six (6.0) mil polyethylene sheeting sealed airtight with duct tape prior to the cutting of the piping.
 11. Asbestos waste shall be transported and disposed of in accordance with the provisions of the Rhode Island Rules and Regulations for Asbestos Control 40 CFR 763 Appendix D, Subpart E and U.S.D.O.T. 49 CFR 173.1300.
 12. Abatement equipment no longer needed inside the containment areas shall be wet wiped and/or HEPA vacuumed upon completion of abatement activities and prior to the post abatement air sampling. Asbestos waste inside the containment shall be removed prior to the visual inspections.
 13. Abatement Contractor shall submit project closeout paperwork to the Owner as required not more than thirty (30) days after completion of asbestos removal work.
- D. HOXSIE ELEMENTARY SCHOOL — Rooms 2, 4, 15, Faculty Kitchen - removal of asbestos sink waterproofing.
1. Due to limited quantity of non-friable ACM and intact removal methods, a waiver of containment is requested. Contractor shall remove entire sinks intact to avoid ACM disturbance.
 2. Abatement personnel shall utilize proper respiratory and clothing protection, in strict compliance with OSHA 29 CFR 1926.1101 for the duration of the project.
 3. "Drop cloths" on floors shall consist of a minimum of one (1) layer of six (6.0) mil polyethylene sheeting.
 4. Intact sinks shall be wrapped and labelled on site in a minimum of two (2) layers of six six (6.0) mil polyethylene sheeting sealed with duct tape. Contractor shall utilize HEPA vacuums for cleaning purposes.
 5. After work completion, due to limited and intact removal methods, a waiver of post abatement air testing is requested. Contractor shall conduct personal air testing during the sink removals in lieu of post abatement air testing.
 6. Final visual inspections in each sink removal room shall be conducted by the abatement contractor's supervisor and project Industrial Hygienist.
 7. Asbestos waste shall be transported and disposed of in accordance with the provisions the Rhode Island Rules and Regulations for Asbestos Control 40 CFR 763 Appendix D, Subpart E and U.S.D.O.T. 49 CFR 173.1300.

8. Abatement Contractor shall submit project closeout paperwork to the Owner as required not more than thirty (30) days after completion of asbestos removal work.
- E. HOXSIE ELEMENTARY SCHOOL — Inside Wall, Ceiling, Floor Cavities — removal of asbestos pipe/elbow/fitting insulation.
1. The abatement contractor shall adhere to the warning sign provisions of OSHA and RIDOH.
 2. Critical barriers consisting of a minimum of one (1) layer of six (6.0) mil polyethylene sheeting sealed airtight with duct tape are required on all openings, including but not limited to: electrical panels, wires, ceiling openings, windows, doors, air handler vents, diffusers, etc. inside each mini-containment work area. Contractor shall be responsible for sealing any openings that lead outside the abatement work areas located above the suspended ceilings with critical barriers a consisting of a minimum of one (1) layer of six (6.0) mil polyethylene sheeting sealed airtight with duct tape.
 3. Dividing walls that will separate work areas from non-work areas shall be constructed of a minimum of two (2) layers of six (6.0) mil polyethylene sheeting secured airtight with bracing strips, 2 x 4 wood framing and duct tape to the existing floor, wall and ceiling surfaces.
 4. Due to limited access abatement areas, full containment of the areas shall not be required. Mini-containment procedures shall be utilized. Walls and floors inside the mini-containment work areas shall be protected and sealed with a minimum of two (2) layers of six (6.0) mil polyethylene sheeting secured airtight with duct tape to existing floor, wall and ceiling surfaces.
 5. Egress and ingress to the mini-containment work areas shall be through a three (3) chamber decontamination units, consisting of a dirty room, operating shower room, and clean room. The decontamination units shall be contiguous to each mini-containment work area.
 6. Safety equipment located on-site shall include a stocked first-aid kit and approved fire extinguisher. Ground Fault Circuit Interrupters (GFCI) shall be utilized on all electrical cords.
 7. Continuous, localized negative pressure with intake in the mini-containment work areas shall be required. Microtrap units shall be properly exhausted to the outside of the building. Abatement contractor shall be responsible to secure openings where negative air machines are exhausted to prevent unauthorized building access during non-working hours.
 8. Removal shall commence upon approval of the mini-containments and decontamination units by the project Industrial Hygienist.
 9. Asbestos-containing materials shall be adequately wetted prior to removal.
 10. Pipe insulation, pipe elbow, pipe fitting insulation exposed pipe ends that remain in the work areas shall be completely sealed with rewettable fiberglass wrap prior to the collection of the post abatement air samples.
 11. Asbestos waste shall be transported and disposed of in accordance with the provisions of the Rhode Island Rules and Regulations for Asbestos Control, 40 CFR 763 Appendix D, Subpart

E and U.S.D.O.T. 49 CFR 173.1300.

12. Abatement contractor shall remedially clean via HEPA vacuums and wet wiping all surfaces including wall surfaces, floor surfaces, pipe surfaces, polyethylene surfaces, ceiling tile gridwork and associated hangers, surfaces located above the suspended ceiling areas, free of dust, debris, and residue, as part of the final cleaning procedures, to the satisfaction of the project Industrial Hygienist.
13. Abatement equipment no longer needed inside the work areas shall be wet wiped and/or HEPA vacuumed upon completion of abatement activities and prior to the post abatement air sampling. Asbestos waste barrels/bags inside the mini-containment shall be removed prior to the visual inspections. Abatement contractor shall spray removed surfaces and polyethylene sheeting with lockdown encapsulant after satisfactory visual inspections by the abatement contractor's supervisor and project Industrial Hygienist.
14. Abatement contractor shall be responsible for cleaning surfaces free of duct tape and spray glue residue during teardown procedures.
15. Abatement Contractor shall submit project closeout paperwork to the Owner as required not more than thirty (30) days after completion of asbestos removal work.

1.5 ESTIMATES

- A. The abatement plan provides estimated quantities of asbestos-containing materials and presumed asbestos-containing materials to be removed. This data is provided for informational purposes only, and is based on the best information available at the time of specification preparation. Nothing in the abatement plan may be interpreted as limiting the scope of work otherwise required by this contract and related documents.
- B. The quantities and locations of ACM/presumed ACM/non-ACM and the extent of work included in the abatement plan are only best estimates which are limited by the physical constraints imposed by the facility. Bidders shall not use these estimates as the only basis for their bid. The Bidders are responsible to review and confirm all quantities and field conditions, prior to submission of bids. Neither the Consultant, nor Owner will be responsible for errors and/or charges for extra work arising from any bidder's failure to become familiar with existing conditions of the site, requirements of the work and the results to be produced. By submitting a bid, the bidder further agrees that the descriptions contained herein are adequate and that the bidder will produce the desired results (i.e. remove ACM/presumed ACM/non-ACM in the indicated areas). No claims for extra payment due to incorrect quantities will be considered. By submitting a bid, a bidder agrees and warrants that he is familiar with and will perform all the work required, including all items indicated herein.

1.6 SCHEDULING

- A. The schedule is subject to change based on availability of the work areas and actual scheduling by Warwick Public Schools.

1.7 COORDINATION AND PHASING OF WORK

- A. Owner and General Contractor shall coordinate all work in this Section with all other work of this Project. Where additional regulatory requirements apply to the work in this Section, the Abatement Contractor shall ensure compliance with all requirements.

- B. Abatement Contractor's work schedule must be coordinated with, and acceptable to the Owner and General Contractor. Abatement Contractor shall work continuously and diligently in the work areas on the days and during the hours indicated on their work schedule.
- C. Abatement Contractor shall cooperate fully with other Contractors at the facility.

1.8 SPECIAL CONSIDERATIONS

1.8.1 Final Air Clearance Tests

- A. All final air clearance tests will be performed by the Consultant in accordance with Rhode Island Department of Health (RIDOH) regulations at 216-RICR-50-15-1, this Section, and other applicable Rulings. In the event that these air tests do not pass the clearance criteria, any subsequent air tests that need to be performed shall be paid for by Abatement Contractor.
- B. Air will be agitated by means of a small leaf blower prior to the test, and kept agitated by means of a small electric fan. The results of all samples must be equal to or less than 0.010 fibers per cubic centimeter for PCM clearance testing or shall average less than or equal to 70 structures per square millimeter for TEM analysis to be in compliance with clearance criteria as described in this Specification and Rhode Island Department of Health regulations. In addition, TEM Analysis for any single inside work area sample shall not exceed 70 structures per square millimeter. Should any single inside work area TEM air sample exceed 70 structures per millimeter, then the work area shall be recleaned by the Abatement Contractor. PCM analysis air samples shall not exceed 0.01 f/cc of sampled air. If these levels are not met, cleaning operations shall resume until these levels are achieved. In the event that these air tests do not pass the clearance criteria, any subsequent air tests that need to be performed shall be paid for by Abatement Contractor.
- C. If the Abatement Contractor fails to meet the criterion, the Abatement Contractor will be required to re-clean the designated work site and the Consultant shall repeat the final air clearance testing. Cleaning and testing will be repeated until the specified criterion is met. Abatement Contractor shall bear the costs of correcting such rejected Work, including additional testing and inspections and compensation of Consultant's services and expenses made necessary thereby and any costs, loss or damages to Owner resulting from such defect or failure.

PART 2 — PERFORMANCE STANDARDS

2.1 Training and Qualifications

2.11 Worker Training

- A. All workers who work on this project shall be provided training, at a minimum, on the following topics:
- B. The health hazards of asbestos including the nature of asbestos related diseases, routes of exposure, known dose-response relationships, the synergistic relationship between asbestos exposure and cigarette smoking, latency periods for and health basis for standards.
- C. Personal protective equipment including the types and characteristics of respirator classes, limitations of respirators, proper selection, inspection, donning, use maintenance and storage of respirators, field testing the face piece-to-face seal (positive and negative pressure fitting tests),

qualitative and quantitative fit testing procedures, variations between laboratory and field fit factors, factors that affect respirator fit (e.g. facial hair), selection and use of disposable clothing, use and handling of launderable clothing, non-skid shoes, gloves, eye protection, and hard hats.

- D. Medical monitoring requirements for workers including required and recommended tests, reasons for medical monitoring and employee access to records.
- E. Air monitoring procedures and requirements for workers including description of equipment and procedures, reasons for monitoring, types of samples and current standards with recommended changes.
- F. Work practices for asbestos abatement including purpose, proper construction and maintenance of air-tight plastic barriers, job set-up of airlocks, worker decontamination systems and waste transfer airlocks, posting of warning signs, engineering controls, electrical and ventilation system lockout, proper working techniques, waste clean-up, storage and disposal.
- G. Personal hygiene including entry and exit procedures for the work area, use of showers and prohibition of eating, drinking, smoking, and chewing in the work area.
- H. Special safety hazards that may be encountered including electrical hazards, air contaminants (CO, wetting agents, encapsulants, material from Owner's operation), fire and explosion hazards, scaffold and ladder hazards, slippery surfaces, confined spaces, heat stress, and noise.
- I. Workshops affording both supervisory personnel and abatement workers the opportunity to see (and experience) the construction of containment barriers and decontamination facilities.

2.1.2 Site Supervisor Qualifications

- A. The Abatement Contractor shall provide one site supervisor, whose responsibilities include coordination, safety, security and execution of all phases of the asbestos removal project. The Site Supervisor will not be used as an asbestos removal worker, and will be assigned full time to the project. The Site Supervisor shall be fully qualified in all aspects of asbestos abatement practices and procedures, and have a one-week asbestos training course within the previous year prior to the commencement of asbestos related work. This asbestos training course will cover all topics listed above as well as training in contract specifications, liability insurance and bonding, legal considerations related to abatement, establishing respiratory protection medical surveillance programs, EPA, OSHA, record-keeping programs, as well as any other topics requested by the General Contractor and Owner.

2.1.3 CPR/First Aid Training

- A. At least one person per building should be on site at all times who is certified in CPR and Emergency First Aid by an appropriate authority.

2.2 Regulatory Submittals

2.2.1 Regulatory Submittals

- A. The Abatement Contractor shall notify the following agencies in appropriate manner and place of impending work, and shall provide evidence of notifications at the pre-construction conference:

1. U.S. Environmental Protection Agency
J. F. Kennedy Federal Building
Boston, Massachusetts 02203
(10 working days in advance)
2. Rhode Island Department of Health
Center for Healthy Homes & Environment
Division of Environmental Health
Room 206
Three Capitol Hill
Providence, Rhode Island 02908-5097
(10 working days in advance)
3. City of Warwick Fire Department, Inspectional Services Department, and Other state or city agencies as required by law or ordinance.

2.2.2 Permits

- A. The Abatement Contractor shall be responsible for securing all necessary permits for asbestos related work, including hauling, removal, and disposal, fire, and materials usage, or any other permits required to perform the specified work.

2.3 Safety Considerations

- A. This project is subject to compliance with Public Law 91-596, "Occupational Safety and Health Act of 1970" (OSHA), with respect to all Rules and Regulations pertaining to construction, including Volume 36, Numbers 75 and 105, of the Federal Register, as amended, and as published by the U.S. Department of Labor.
- B. In addition to any detailed requirements of the Specification, the Abatement Contractor shall at his own cost and expense comply with all laws, ordinances, rules and regulations of Federal, State, Regional and Local Authorities regarding handling and storing of asbestos waste material.
- C. All staging and scaffolding shall be furnished and erected by the Abatement Contractor in accordance with all applicable requirements, and be maintained in safe condition by the Abatement Contractor at no additional cost to the Owner.
- D. The Abatement Contractor is responsible for using safe procedures to avoid electrical hazards. When a hazard exists, work will be stopped and power will be shut off and checked before work begins again (e.g. water use near electrical boxes.) All electrical panels and exposed wires within the work site shall be de-energized prior to the commencement of any wetting or removal operations. All extension cords and power tools used within the work area shall be attached to Ground Fault Circuit Interrupters (G.F.C.I.).

2.4 Respirators and Protective Clothing

- A. Personal protection, in the form of disposable Tyvek suits, and NIOSH approved respirators, are required for workers, Abatement Contractor supervision, Consultant and visitors at the work site during the set-up, removal, and cleaning operations. Abatement Contractor shall provide all this protective equipment for workers, General Contractor, Consultant, and authorized personnel to access each work area.
- B. Each worker shall be supplied with a minimum of two complete disposable uniforms every day. Removal workers shall not be limited to two uniforms, and the Abatement

Contractor will be required to supply additional uniforms as is necessary. Under no circumstances will anyone entering the removal area be allowed to reuse a contaminated uniform.

- C. Work clothes shall consist of disposable full body suits, head covers, gloves, footwear, and eye protection.
- D. The Abatement Contractor shall supply workers and supervisory personnel with NIOSH approved protective respirators and HEPA filters. Appropriate respirator selection shall be determined by the daily personnel samples being taken and strictly follow the guidelines set forth in the OSHA respiratory program 29 CFR 1910.134 and the Rhode Island Department of Health Regulations 216-RICR-50-15-1. The respirators shall be sanitized and maintained according to the manufacturer's specifications. Appropriate respirators shall be selected using the information provided in OSHA Title 29 CFR Part 1910.1926 Final Rules. Disposable respirators shall not be considered acceptable in any circumstance. The Abatement Contractor will maintain on site a sufficient supply of disposable HEPA filters to allow workers and supervisory personnel to change contaminated filters at least two (2) times daily. The Abatement Contractor is solely responsible for means and methods used and for compliance with applicable regulations.
- E. Respirators shall be individually assigned to removal workers for their exclusive use. All respiratory protection shall be provided to workers in accordance with the written submitted respiratory protection program, which includes all items in OSHA 29 CFR 1910.134 (b) (1-11). A copy of this program shall be Kept at the work site, and shall be posted in the Clean Room of the Decontamination Unit.
- F. Workers must perform negative and positive pressure fit tests each time a respirator is put on, whenever the respirator design so permits. Powered air purifying respirators shall be tested for adequate flow as specified by the manufacturer.
- G. Workers shall be given a qualitative fit test in accordance with procedures detailed in the OSHA Standard (29 CFR 1910.1025, Appendix D, Qualitative Fit Test Protocols) for all respirators to be used on this abatement project. An appropriately administered quantitative fit test may be substituted for the qualitative fit test.
- H. Upon leaving the active work area, prefilters shall be discarded, cartridges removed, and respirators cleaned in disinfectant solution and clean water rinse. Clean respirators shall be stored in plastic bags when not in use. The Abatement Contractor shall inspect respirators daily for broken, missing, or damaged parts.
- I. Abatement Contractor shall provide daily personal sampling to check personal exposure levels for the purpose of establishing respiratory protection needs. Samples shall be taken for the duration of the work shift or for eight hours, whichever is less. Personal samples need not be taken every day after the first day if working conditions remain invariant, but must be taken every time there is a change in the removal operation, either in terms of the location or the type of work. Sampling will be to determine eight-hour Time-Weighted-Averages (TWA). The Abatement Contractor is responsible for personal sampling as outlined in OSHA requirements.
- J. Sampling personnel shall be proficient in the taking of air samples under NIOSH

7400, and must be supervised by an individual who has completed the training course NIOSH 572 or equivalent.

- K. Air sampling results shall be available at the job site in written form no more than twenty- four (24) hours after the completion of a sampling cycle. The document shall list each sample's result, sampling time and date, person monitored, flow rate, sample duration, microscope field area, number of fibers per fields counted, cassette size and analysts name and company. Air sample analysis results will be reported in fibers per cubic centimeter.

2.5 Security

- A. The General Contractor and Owner will provide specific access as required during the project to the Abatement Contractor and personnel assigned to the project. It will be the Abatement Contractor's responsibility to allow only authorized personnel into the work areas, and to secure all assigned entrances and exits at the end of the work day.
- B. Any person entering or leaving the contained area must sign the Abatement Contractor's bound log book and enter the date and time. The log book must be located immediately outside the entrance to the Decontamination Unit at all times, and be open for inspection by the General Contractor, Owner and Consultant.
- C. Abatement contractor shall be responsible to secure openings where negative air machines are exhausted to prevent unauthorized building access during non-working hours.

2.6 References

- A. The following references are cited as applicable publications:
 - 29 CFR, Part 1910.1000 — Air Contaminants (Table Z-1)
 - 29 CFR 1910:1001 Construction Industry Standard
 - 29 CFR 1910.134: Respiratory Protection Standard
 - 29 CFR 1910.145: Accident Prevention Standard
 - 29 CFR 1910.22: Surfaces
 - 29 CFR 1910.27: Ladders
 - 29 CFR 1910.28: Scaffolding
 - 29 CFR 1910.38: Asbestos Abatement Projects
 - 29 CFR 1910.146 Confined Space
 - 1910 Subpart J 1910.146 Confined Space
 - 29 CFR, Part 1910.1200 - Hazard Communication
 - 29 CFR, Part 1926.20 - General Health and Safety Provisions
 - 29 CFR, Part 1926.57 - Ventilation
 - 29 CFR, Part 1926.59 - Hazard Communication Program
 - 29 CFR, Part 1926.62 - Lead Exposure in Construction
 - 29 CFR, Part 1926.95 - Criteria for Personal Protective Equipment
 - 29 CFR, Part 1926, Subpart H - Materials Handling, Storage, Use and Disposal
 - 29 CFR, Part 1926, Subpart L - Scaffolding
 - 29 CFR, Part 1926, Subpart Z - Toxic and Hazardous Substances
 - 29 CFR 1926 Subpart M Fall Protection
 - 40 CFR, Part 50.6 - National Primary and Secondary Ambient Air Quality Standards for Particulate Matter
 - 40 CFR 61 Subparts A, B, & M National Emissions Standard for Hazardous Air Pollutants

40 CFR, Part 260 - Hazardous Waste Management System: General
40 CFR, Part 261 - Identification and Listing of Hazardous Waste
40 CFR, Part 262 - Standards Applicable to Generators of Hazardous Waste
40 CFR, Part 263 - Standards Applicable to Transporters of Hazardous Waste
40 CFR, Part 264 - Standards for Owners and Operators of Hazardous Waste Treatment,
Storage, and Disposal Facilities
40 CFR, Part 265 - Interim Status Standards for Owners and Operators of Hazardous Waste
Treatment, Storage, and Disposal Facilities
40 CFR, Part 268 - Land Disposal Restrictions
40 CFR, Part 700 - Toxic Substances Control Act (TSCA)
40 CFR Part 763; - Asbestos-Containing Materials in Schools; Final Rule and Notice
49 CFR, Part 105 - Hazardous Materials Program Definitions and General Procedures
49 CFR, Part 171 - General Information, Regulations and Definitions
49 CFR Parts 172 and 173 Transportation Regulations
49 CFR, Part 176 - Specifications for Packaging
49 CFR, Part 177 - Carriage by Public Highway
NIOSH Publication Number 87-106 Respiratory Decision Logic
NIOSH /OSHA Booklet 3142 Lead in Construction
ANSI Z9.2-79 Design and Operation of Local Exhaust Systems
ANSI.Z87
ANSI.Z89.1 Personnel Protective Equipment - Protective Headwear for Industrial Worker's
Requirements (Latest Revision)
ANSI Z88.2-80 Practices for Respiratory Protection
29 CFR 1910.1101 OSHA Asbestos Standard
216-RICR-50-15-1 R.I. Rules and Regulations for Asbestos Control latest revision

- B. All regulations by these and other governing agencies in their most recent version are applicable. These Specifications refer to many requirements found in these references, but in no way intend to cite or reiterate all provisions therein or elsewhere. It is the Abatement Contractor's responsibility to know, understand, and abide by all such regulations and common practices. Other provisions contained in these references may from time to time during the execution of this contract be enforced by the General Contractor, Owner and Consultant at their own discretion.

PART 3 - PROJECT EXECUTION

3.1 General Considerations

3.1.1 Approvals and Inspection

- A. All temporary facilities, work procedures, equipment, materials, services, and agreements must strictly adhere to and meet these contract specifications along with EPA, OSHA, NIOSH, regulations and recommendations as well as any other federal, state, and local regulations. Where overlap of these regulations exists, the most stringent one applies. All work performed by the Abatement Contractor is further subject to approval of the General Contractor, Owner and Consultant.
- B. Modifications to these isolation and sealing methods, procedures, and design may be considered if all elements of proper and safe procedures to prevent contamination and exposure can be demonstrated. Written modifications to these Specifications must be made to the General Contractor and Owner for review before they can be used for work on this project.

3.1.2 Damage and Repairs to the Work Site

- A. Asbestos removal and disposal shall be performed without damage to the building, including, but not limited to, structural members, ceilings, suspended ceiling systems, walls, pipes, duct work, insulation, light fixtures, public address speakers, sprinklers, and heat and smoke sensors. Where asbestos abatement activity causes damage, the Abatement Contractor shall patch, repair, replace or otherwise restore same to its original condition at no additional cost to the Owner.

3.1.3 Warning Signs

- A. Warning signs shall be posted on all work area entrances at the commencement of the work area preparation, as required in 1926.1101 of the Occupational Safety and Health Standards Federal Register, Volume 51, Number 119, June 20, 1986. The signs shall display the proper legend in the lower panel, with letter sizes and styles of a visibility at least equal to that specified in OSHA Standard 1926.1101.(k)(1)(ii). The signs will read as follows:

DANGER
ASBESTOS
CANCER AND LUNG DISEASE HAZARD
AUTHORIZED PERSONNEL ONLY
RESPIRATOR AND PROTECTIVE CLOTHING
REQUIRED IN THIS AREA

- B. The signs shall be posted at the perimeters of asbestos removal, demolition or construction areas where the asbestos-containing material to be removed exists.
- C. The Abatement Contractor shall maintain all temporary barriers, facilities and controls as long as needed for the safe and proper completion of the work. Work will not be allowed to commence until all control systems are in place and operable.
- D. No barriers shall be removed until the work areas are thoroughly cleaned and all debris has been properly bagged and removed from the work areas, and the work areas have passed final visual inspections, in accordance with provisions detailed herein.

3.2 ACM Preparation and Removal

3.2.1 Preparation

- A. Critical Barriers - Prior to construction of the asbestos removal area, all primary barriers shall be sealed with a minimum of one layer of six (6) mil plastic sheeting and duct tape. Primary barriers consist of all windows, vents, items remaining in the work areas, closed and locked doors, and openings to adjacent spaces from the work area. HVAC systems shall be sealed, where applicable, as described previously with two layers of six (6) mil polyethylene sheeting.
- B. Critical Barriers - Critical barriers consist of the boundaries of the work area including floors, walls, and any constructed barrier to restrict public access to the work area.
- C. The containment walls shall be constructed using a minimum of two layers of four (4) mil polyethylene sheeting after sealing the floors. With the exception of floor tile removal areas, floors shall be sealed with a minimum of two layers of six (6) mil polyethylene sheeting. There shall be a minimum overlap of two feet (24") at the floor seams and the sheeting will run a minimum of two feet (24") up the walls. Overlaps

between the walls and floors shall be interwoven as follows:

1. The first floor layer shall be taped up the wall a minimum of two feet (24"). The first wall layer shall be sealed to the floor layer at the corner of the floor and wall. The second floor layer shall be sealed to the first wall layer at a minimum of a two foot (24") overlap. The second wall layer shall cover all overlaps and be sealed to the floor.
- D. The enclosure shall be constructed so as to allow the removal of interior layers of plastic without damaging the exterior layer. The exterior layer shall stay intact for the duration of the project and be designated the critical barrier.
- E. Due to outdoor removal of door frame caulking, waiver of full containment, post abatement air testing is requested from RIDOH. Refer to Section 1.4 for preparation details.
- F. Due to possible ACM pipe/elbow/fitting insulation inside wall/ceiling/floor cavities, a waiver of full containment procedures has been requested from the RIDOH. Two layer polyethylene sheeting mini-containment procedures shall be utilized. Refer to Section 1.4 for preparation details.

3.2.2 Decontamination Unit and Procedures

- A. It is the Abatement Contractor's responsibility to provide decontamination chambers consisting of an Equipment Room, Shower, and Clean Room for personnel involved in asbestos removal. Each of the three rooms shall be of sufficient size to accommodate authorized personnel and related equipment. Each room shall be separate of other rooms by a double flap of six (6) mil polyethylene sheeting acting as an airlock. This shall be designed to minimize fiber migration and air flow between the decontamination unit rooms. The rooms shall be framed with 2" x 4" lumber, masked, sealed and attached to the entry/exit ways of asbestos work areas. The three rooms together shall be referred to as the Decontamination Unit. A Decontamination Unit will be required for each separate containment area, if work is to be divided into sections.
- B. The Equipment Room shall serve as a transfer room and an intermediate area between the work area and any decontamination procedures to occur in the shower room. This room shall be vacuumed and washed whenever necessary in order to prevent asbestos dust and debris accumulations or when required by Consultant. The Equipment Room will also serve as an access area to the shower for personnel leaving the work area. Workers leaving the containment shall remove and dispose of disposable protective suits and wear only respirators into the Shower. At the end of each day, bags of asbestos waste and contaminated materials shall be removed after a thorough decontamination procedure as described in the contract specifications. Workers performing this operation will wear respirators and disposable full-body protective suits.
- C. The Shower Room shall have a continuous supply of cold and hot water, and be suitably arranged for complete showering during decontamination. The Shower Room with curtained doorways will comprise an airlock between contaminated and clean areas. All materials being passed from the equipment room to the clean room must pass through the shower and be thoroughly decontaminated. The shower floor will not be allowed to sit at ground level, but must be elevated a minimum of six (6) inches off of the floor with a suitable catch basin for drainage into a filtration system. The shower

will be equipped with a sump pump and an in-line two stage filter. The first stage will efficiently filter fibers greater than twenty (20) microns in length and the second stage will filter bulk material and fibers greater than five (5) microns in length. Alternatively, shower water may be re- routed back into the work area to be bagged and disposed of as asbestos contaminated waste. The Abatement Contractor shall provide disposable towels and soap in the shower area.

- D. The Clean Room shall store asbestos worker's clean protective clothing and clean respirator equipment. Contaminated clothing, respirators, tools, equipment, or other materials shall not be allowed into the Clean Room or beyond. The Clean Room will serve as an access for personnel entering the work area, and for the donning of respiratory protection and protective clothing. The Abatement Contractor shall provide space in the clean room for the worker's personal clothing. This may be in the form of hangers or lockers.
- E. The decontamination enclosure is called a "three-stage" decontamination enclosure and shall be the type constructed and used for this project in the specified area. A "two stage" unit resembles the "three-stage" unit in construction detail, but it is built without a shower section.
- F. Two chamber decontamination units shall be utilized for roofing built-up and flashing work areas.

3.2.3 HEPA Filtration

- A. Adequate negative pressure shall be provided within the enclosure as specified below.
- B. After the work area is totally isolated, and prior to commencement of work, the Consultant will perform a visual inspection of the work area. This will consist of checking the integrity of barriers including smoke testing the containment if deemed necessary by Consultant. This does not in any way relieve the Abatement Contractor's responsibilities to ensure the isolation of the work area. The volume of air within the differential reading contained work area shall be changed a minimum of four (4) times per hour. A pressure of 0.02 inches of water shall be maintained in the negative pressure work area relative to adjacent areas. Equipment used for producing a negative pressure work area shall have a filtering device which is at least 99.97% efficient at a 0.3 micron pore size. Filters meeting these standards are referred to as High Efficiency Particulate Absolute (HEPA) filters.
- C. The HEPA filtration units shall be equipped with the following:
 - 1. Magnehelic gauge to monitor the unit's air pressure difference across the filters and be able to interpret magnehelic reading to cubic feet per minute (CPM).
 - 2. An affixed label, clearly marked and conspicuous, showing the most recent installation date and hour reading of the primary internal HEPA filter.
 - 3. A clock to record the unit's operation time.
 - 4. Automatic shut off for filter failure or absence.
 - 5. Audible alarm for unit shutdown.
 - 6. Amber flashing warning light for filter loading.
 - 7. The unit must be equipped with a safety system which prevents it from being operated with the HEPA filter in an improper orientation.
 - 8. All flexible ducting, vent tubing, adapter plates and other equipment used for the passage of filtered air shall be undamaged, uncontaminated, and free

of air leaks at all points.

- D. Pre-filters shall be changed frequently during the removal.
- E. Air movement will flow uninterrupted from outside the work area through the Decontamination Unit into the work area. There shall be no other openings for air to enter the containment unless approved by the Consultant in writing.
- F. HEPA filtration units shall be placed as far as possible from the air intake to the containment to prevent short-cycling of fresh air.
- G. Containment work areas, along with the decontamination chambers, shall constitute the critical containments of the work area from the surrounding areas. All openings to this critical containment are to be sealed except where air must enter the work-sites due to the use of exhaust equipment. Unless approved by the Consultant, air shall enter the critical containment only through the Decontamination Unit.
- H. Modifications to these isolation and sealing methods, procedures, and design may be considered if all elements of proper and safe procedures to prevent contamination and exposure can be demonstrated. Written modifications to these Specifications must be made to the Consultant for review before they can be used for work on this project.

3.2.4 ACM Removal

- A. Asbestos removal will not begin until the Consultant has given authorization to proceed. This authorization will be given after the removal areas have passed visual inspections by the Consultant based on the criteria presented herein.
- B. All asbestos-containing material must be soaked with amended water before removal. The material shall be sufficiently saturated to reduce fiber release so that the airborne fiber concentration does not exceed the established OSHA Permissible Exposure Limits, (PELs). The amended water shall not be applied in amounts that will cause leakage or runoff of contaminated water from the removal area. Dry removal will not be permitted during this project.
- C. Asbestos-containing material shall be carefully removed and placed immediately into bags. Bags must be filled with water to the point where all asbestos is adequately wetted as defined by Federal Regulations 40 CFR 61 Subpart M. Asbestos will not be permitted to let fall or sit on the ground before being bagged.
- D. Fine cleaning of residual asbestos-containing material shall consist of carefully scraping or brushing the material from surfaces. The recommended method for brushing a substrate after gross removal has taken place is to use a nylon brush. Wetting of the substrate shall also occur while this brushing is performed, since the chance of airborne fiber generation during fine cleaning still exists.
- E. Asbestos waste must be double bagged before it is removed from the contained areas. The inner bag will be HEPA vacuumed and showered before being placed in the outer bag. Vacuuming must take place in the Equipment Room of the Decontamination Unit. Washing must take place in the Shower Room of the Decontamination Unit. Bags will normally be removed at the end of each working day and transported from the job site.

- F. Any materials considered contaminated by the General Contractor, Owner or the Consultant that cannot be double bagged shall be wrapped airtight in two layers of six (6) mil polyethylene sheeting. Materials with sharp or protruding edges shall be double bagged and placed in disposable drums, at the direction of the Consultant.
- G. All bags, containers or wrapped materials transported out of the work areas shall be labeled with preprinted labels required by Federal EPA, OSHA and the Department of Transportation regulations. Any carts used to transport asbestos waste to the on-site holding dumpster should be HEPA vacuumed and wet wiped each day, and may be inspected by the General Contractor, Owner or Consultant every day.
- H. Carts that are not made of an impermeable material shall be lined with a minimum of one layer of six (6) mil polyethylene sheeting to be removed after each shift and disposed of as contaminated waste. The transport route and the transport of waste out of the work areas shall be coordinated with the General Contractor.
- I. Waste shall not be transported through the inside of the building.
- J. The work areas shall be cleaned of residual asbestos debris on a daily basis. The Decontamination Unit floor (top layer) shall be picked up and replaced on a daily basis, if required by Consultant.
- K. Air testing may be performed continuously inside the buildings. If fiber concentrations exceed 0.010 fibers/cc or background levels, work shall stop and the Abatement Contractor shall perform cleanup activities in the affected areas and check the integrity of the critical barriers. Clean up activities shall include but not be limited to wet wiping and vacuuming surfaces with a HEPA equipped vacuum. Work may continue only after the source of contamination is identified, corrected and proper cleaning activities are implemented. Air testing will be performed by the Consultant on site in the affected areas. If the results of these air tests are not below 0.010 fibers/cc, the Abatement Contractor shall perform a thorough decontamination of the affected areas.
- L. After brushing and scraping, surfaces shall be free of visible debris and fibers. A final wipe-down of the substrate with wet, lint-free rags shall take place in order to ensure proper cleaning. All surfaces including floors, walls, and ceilings shall also be HEPA vacuumed clean. All visible asbestos-containing material is to be removed by the Abatement Contractor before post abatement visual inspections are allowed to begin. The Consultant will perform an inspection of each work area. Removal substrate must be clean and bare, and the entire work area must be free and clear of any suspect material for the Abatement Contractor to pass the visual inspections.

3.3 Spray Encapsulation Procedures

- A. After the substrate has been cleaned and all polyethylene barriers of each work area are cleaned of all visible debris, the Abatement Contractor shall request a visual inspection of the work area by the Consultant.
- B. Workers performing lock-down must wear disposable protective clothing and respirators suitable for asbestos. The spray encapsulation process shall not be treated any differently from the removal process in this respect.
- C. The lock-down material shall be applied with a low pressure (less than 500 p.s.i.),

airless spray-type mechanism.

- D. All removed surfaces in the work area will be encapsulated. A minimum of one coat of lock-down encapsulant will be applied to prevent the generation of airborne residual fibers. The lock-down encapsulant will be applied to both the substrate and the polyethylene sheeting. If the lock-down material is being applied to irregular, grooved, or corrugated surfaces, it shall be administered from the opposing side, or at a right angle to the direction of the previous application. The encapsulant shall be left to dry before the commencement of final air testing.

3.4 Final Air Clearance Monitoring

- A. Final clearance air samples will be collected by the Consultant inside the contained removal work area after clearance, of visual inspection criteria that the area is free and clear of any suspect material, (the insulation substrate, if any, must be clean and bare).
- B. Air will be agitated by means of a small leaf blower prior to the test, and kept agitated by means of a small electric fan. The results of all samples must be equal to or less than 0.010 fibers per cubic centimeter (f/cc) for PCM analysis or equal to or less than an average of 70 structures per square millimeter for TEM clearance testing, to be in compliance with clearance criteria as described in this Specification, Federal and Rhode Island Department of Health regulations. In addition, TEM Analysis for any single inside work area sample shall not exceed 70 structures per square millimeter. Should any single inside work area TEM air sample exceed 70 structures per millimeter, then the work area shall be recleaned by the Abatement Contractor.
- C. If the Abatement Contractor fails to meet the final clearance criterion, the Abatement Contractor will be required to re-clean the designated work site and the Consultant shall repeat the final air clearance testing. Cleaning and testing will be repeated until the specified criterion is met. Abatement Contractor shall bear the costs of correcting such rejected Work, including additional testing and inspections and compensation of Consultant's services and expenses made necessary thereby and any costs, loss or damages to Owner resulting from such defect or failure.

3.5 Removal of Barriers

- A. Containment barriers shall not be taken down until the final visual inspections and final air clearance criteria are met.
- B. After successful final visual inspections and final air clearances, Abatement Contractor shall perform post abatement take-down.
- C. All polyethylene sheeting used in the construction of the Decontamination Unit and Containment Area shall be bagged and disposed of as asbestos contaminated waste. Areas exposed during this process shall be examined for traces of suspect material. If any is found, it will be picked up by HEPA vacuuming and wet cleaning.

3.6 Disposal of Asbestos Waste

- A. Waste removal procedure shall be done in accordance with all regulations as set forth by the agencies having authority to regulate. The Abatement Contractor shall provide proof that disposal sites for the waste materials have current and valid permits to dump asbestos waste at the time of the pre-construction meeting.

- B. Receipts shall be obtained by the Abatement Contractor from the dumping site(s) and submitted to the General Contractor upon request for final payment. Faxed waste receipts for this project shall not be accepted by the Owner. All waste receipts must be submitted to the Owner on RIDOH Form ASB-23, "Confirmation of Receipt of Asbestos For Disposal."
- C. Warning labels having permanent, waterproof print and adhesive shall be affixed to all bags, trucks, drums (lids and sides), and other containers used to store and/or transport asbestos-containing material. Labels must be conspicuous and legible and contain the following warning:

**CONTAINS ASBESTOS FIBERS
AVOID CREATING DUST
CANCER AND LUNG DISEASE HAZARD**

- D. The Abatement Contractor shall be responsible for all necessary precautions to prevent pollution by spilling during the performance of services and shall assume full responsibility for all Abatement Contractor caused spills, which shall be cleaned up at the Abatement Contractor's expense.

3.7 Housekeeping

- A. Throughout the work period, the Abatement Contractor shall maintain the building and site in a standard of cleanliness as specified throughout these Specifications.
 - 1. Contaminated disposable clothing, respirator filters, and other debris shall be bagged and sealed at the end of each work day.
 - 2. All asbestos generated by removal shall be bagged or barreled immediately and not allowed to be left exposed at any time.
 - 3. Respirators shall be thoroughly cleaned at the end of each work day and stored for the next day's use.
 - 4. The Abatement Contractor shall retain all stored items in an orderly arrangement allowing maximum access, not impeding traffic, and providing the required protection materials.
 - 5. The Abatement Contractor shall not allow the accumulation of scrap, debris, waste material, and other items not required for completion of the work.
 - 6. The Abatement Contractor shall provide adequate storage for all items awaiting removal from the job sites, observing all requirements for fire protection and protection of the ecology.
 - 7. The Abatement Contractor shall maintain the site in a neat and orderly condition at all times.

END OF SPECIFICATION

SECTION 02 82 15

HOXSIE ELEMENTARY SCHOOL

ABATEMENT PLAN

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**ASBESTOS ABATEMENT PLAN
FOR
WARWICK PUBLIC SCHOOLS
HOXSIE ELEMENTARY SCHOOL
WARWICK, RHODE ISLAND**

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**RHODE ISLAND DEPARTMENT OF HEALTH
NOTARIZED CERTIFICATION OF ASBESTOS ABATEMENT PLAN**

Facility: Warwick Public Schools – Hoxsie Elementary School

Address: 55 Glenwood Drive

City/Town: Warwick Zip: 02889 Amendment Phase No: n/a

Abatement Plan Written By: Phillip A. Ricchiuti Certification No: APD-00171

Summary of specific waivers/variances being requested: Due to some limited abatement areas of pipe/elbow/fitting insulation, two layer mini-containment procedures is requested. All other 1.14.2, 1.14.3 procedures shall be utilized. Due to limited removal methods of non-friable sink waterproofing, alternate work practices requested for containment procedures and post abatement air testing. See Attachment #9 Project Plan of Action B, C, D.

Type of Asbestos Abatement (X) Removal () Enclosure () Encapsulation
() Demolition (X) Glovebag () Asphalt Roofing
() Other (specify)

Is this plan being submitted in response to a Notice of Violation and/or a Notice of Requirement to Submit an Asbestos Abatement Plan? () Yes (X) No

If yes, Indicate Notice/Building Evaluation No(s):

Contractor: to be selected by owner or GC License No: LAC-

Estimated Starting Date: June, 2022

Pre-Abatement Sampling Information

Bulk Samples Collected By: C. Clay/P. Ricchiuti Certification No: AAC-245IS/00171

Bulk Samples Analyzed By: Vortex Inc./RI Analytical Certification No: AAL-087C3/008C3

Air Samples Analyzed By: ECM Certification No: AAL-131

Clearance Air Sampling Information

Air Samples to be Collected By: ECM

Air Samples to be Analyzed By: SanAir/ECM Certification No: AAL-126/131

CERTIFICATION

I certify that: this asbestos abatement plan is prepared and submitted under the provisions of Section 23-24.5-6 of the RI Asbestos Control Act and Parts A and C of the RI Rules and Regulations for Asbestos Control; all abatement/management activities performed in conjunction with this plan must be in compliance with the specifications prescribed in this plan (when approved) and the most current revision of all applicable federal and state regulations; and the asbestos abatement/management activities described in this plan must be performed by a RI licensed asbestos abatement contractor.

Certified by: _____ Title: Director of Facilities, Maintenance & Operations
(Signature of Building Owner or Agent)

Kevin Oliver Date: _____
(Typed/Printed Name of Certifier)

Subscribed and sworn before me this _____ day of _____, 20_____

(Notary Public) My Commission Expires: _____

AFFIX NOTARY SEAL HERE

STATE OF RHODE ISLAND AND PROVIDENCE PLANTATIONS

Department of Health

Office of Occupational & Radiological Health

APPLICATION FOR APPROVAL OF AN ASBESTOS ABATEMENT PLAN

1. Building Owner's Name:

Warwick Public Schools

2. Application Prepared By:

Phillip A. Ricchiuti

RI certification No: APD-00171

Telephone No: (401) 734-3407
(Area code, No., Ext.)

3. Building Owner's Mailing Address and Telephone Number:

Buildings and Grounds Dept.

Street: 150 Draper Avenue

City/Town: Warwick

Zip: 02889

Telephone No.: (401) 734-3400

(Area Code, No., Ext.)

4. Person to be contacted regarding this application:

Name: Phillip A. Ricchiuti

Telephone No: (401) 734-3407

(Area Code, No., Ext.)

5. Location where abatement work will be performed:

Name (if applicable): Hoxsie Elementary School

Street: 55 Glenwood Drive

City/Town: Warwick Zip: 02889

6. Is this application being submitted in response to a "Notice of Requirement to Submit an Asbestos Abatement plan"? () Yes (X) No

If Yes, what is the due date for submittal of Abatement plan? _____
(Mo.) (Day) (Yr.)

Evaluation Number on the Notice: _____

7. Contractor who will be performing abatement work (if selected):

Name: to be selected by owner or GC R.I. License No.: LAC-_____

8. Estimated Starting Date of Abatement Work: June, 2022
(Month) (Day) (Year)

9. Estimated Completion Date of Abatement Work: August, 2022
(Month) (Day) (Year)

10. Type of Asbestos Abatement: **(Check all that apply)**

- ☒ Removal ☐ Enclosure
☐ Encapsulation ☐ Demolition
☐ Operations and Maintenance Only
☐ Other (Specify)
-

11. Type of Building: ☒ School
☐ Privately Owned Building
☐ Publicly Owned Building
☐ Residence
☐ Other (Specify)
12. Building Access: ☒ Public Access (> 25% of Building Area)
☐ Limited Public Access (< 25% of Building Area)
☐ No Public Access
-

13. Bulk Sample Collection and Analysis:

A). Person collecting bulk samples:

Name: C. Clay/P. Ricchiuti Certification No: AAC-245IS/00171

B). Sampling Methodology:

☒ EPA AHERA Sampling requirements [40 CFR 763.86].

☐ EPA's Asbestos Containing Material in School Buildings: A Guidance Document (EPA-405/2-78-014) or Guidance for Controlling Asbestos Containing Materials – 1985 Edition (EPA-560-5-85-024)

☐ Other (Specify) representative samples

C.) Laboratory performing the analysis of the bulk samples

Name: Vortex Inc./RI Analytical Certification No: AAL-087C3/008C3

D.) Analytical Methodology:

☒ EPA Interim Method for the Determination of Asbestos in Bulk Insulation Samples [PLM method only].

☐ Other (Specify)

14. Pre-Abatement Air Sample Collection and Analysis:

A). Person collecting pre-abatement air samples:

Name: ECM Representative Affiliation: ECM

B). Laboratory performing analysis of pre-abatement air samples.

Name: ECM RI Certification No: AAL-131

C). Methodology used in the collection and analysis of pre-abatement samples:

(X) NIOSH Method 7400 [Most Current Revision]

() OSHA 29 CFR 1926.1101 – Appendix A & B

() Other (Specify)

-
15. A. Indicate how the regulated asbestos containing material (RACM) will be removed from the abatement site. If a hauler or broker will be used to transport the RACM to a disposal site, they must also be identified.

Materials shall be containerized and transported to an authorized disposal site.

- B. Provide the name and location of the authorized asbestos waste facility to which the removed material will be transferred for disposal (if known).

Not known at this time.

16. Person designated as compliance monitor for abatement work. **[NOT REQUIRED]**

Name: ECM representative

Affiliation: ECM

17. In-Process & Clearance Air Sampling: See Attachment A In-Process & Clearance Air Sampling

- A. Describe on an attachment the type, number and location of air samples that will be collected outside the work area during the abatement project.
 - B. Describe on an attachment the plan of action to be followed if the Indoor Non-Occupational Air Exposure Standard for Asbestos (0.01 fibers per cubic centimeter) is exceeded outside the work area during the abatement project.
 - C. Describe on an attachment the type, number and location of air samples that will be collected as part of the final clearance testing.
 - D. Describe on an attachment the plan of action to be followed if the Indoor Non-Occupational Air Exposure Standard for Asbestos (0.01 fiber per cubic centimeter) is exceed during final clearance testing.
-

18. A separate and fully completed Form ASB-16A must be submitted for each area to be abated. List below the entry in Item 1 from each attached ASB-16A.

- a. Boiler Room _____
 - b. Ground Floor - Pipe/elbow/fitting insulation _____
 - c. Rooms 2, 3, 4, 15, Faculty Kitchen _____
 - d. Ground Floor - Inside wall/ceiling/floor cavities _____
-

19. I certify that this plan was prepared by me and I am responsible for its content.

Signature: _____ Date _____
(Month) (Day) (Year)

Affiliation: Warwick Public Schools _____

20. ASBESTOS ABATEMENT PLAN APPLICATION FEE:

() Operation & Maintenance Only	\$ 75
() Up to One (1) NESHAP Unit	\$ 75
(X) Between One (1) & Ten (10) NESHAP Units	\$ 300
() Between Ten (10) & Fifty (50) NESHAP Units	\$ 600
() Over Fifty (50) NESHAP Units	\$ 900

Hoxsie Elementary School

STATE OF RHODE ISLAND AND PROVIDENCE PLANTATIONS

Department of Health

Office of Occupational & Radiological Health

APPLICATION FOR APPROVAL OF AN ASBESTOS ABATEMENT PLAN

SUPPLEMENTAL INFORMATION: AREA DESCRIPTION AND PROPOSED REMEDY

BUILDING LOCATION: 55 Glenwood Drive, Warwick

INSTRUCTIONS: All items on this form must be addressed. All references to attachments must be clearly identified. All attachments must be marked with the specific item numbers on this form to which they pertain.

(1) Area Location/Identification (Room Name/No., Evaluation Number, etc.):

a. Boiler Room - refer to Attachment #3 Annotated Floor Plans

(2) Attach a description of each type (e.g. pipe, ceiling, etc.) of regulated asbestos containing material (RACM) in this area, including condition, location, quantity and asbestos content. Attach a copy of the laboratory report(s) for all samples. (NOTE: All laboratory reports must include the name of the building(s) and the location(s) of the sample(s).

See Attachment #1 for Project Scope of Work.

See Attachment #4 for Bulk Sample Laboratory Results.

(3) Attach a current scale drawing of this area, showing direction of North and East, which has been clearly annotated to show the type, location and quantity of all RACM in this area. This drawing must include a legend which acts as a guide to the scale, symbols and nomenclature used in the drawing. If a master plan or multiple drawings are provided, indicate the specific location(s) and drawing number(s) which depict this area. The location of the decontamination chamber must also be so indicated on the appropriate drawing(s).

See Attachment #3, Annotated Floor Plans.

(4) PROPOSED REMEDIES:

Attach a description of the interim Operations and Maintenance Plan that will be implemented in accordance with C.1.2 (b).

See Attachment #5, Operations and Maintenance Plan.

(4) PROPOSED REMEDIES (cont.):

A). Will any portion of this area be abated by use of B.8 work procedures?

☒ Yes ☐ No

If Yes, indicate below which RACM in this area will be abated by use of the following B.8 work procedures:

B.8.2 & B.8.3	[REMOVAL] <u>boiler breeching insulation, pipe/elbow/fitting insulation, boiler cement/gaskets</u>
B.8.2 & B.8.4	[ENCAPSULATION] _____
B.8.2 & B.8.5	[ENCLOSURE] _____
B.8.6	[DEMOLITION] _____
B.8.7	[GLOVEBAG] _____
B.8.8	[ASPHALT ROOFING] _____

B). Are you requesting any waivers to the above selected B.8 procedure for any of the abatement activities in this area?

☐ Yes ☒ No

If yes, attach a detailed description of the waivers requested you are proposing to utilize. All items must be keyed to the specific section(s) of the regulations for which waivers are requested.

C). Are you proposing alternative procedures under B.11 for any of the abatement activities in this area?

☐ Yes ☒ No

If yes, attach a detailed description of the alternate procedures requested you are proposing to utilize. Alternate procedures must include a justification for not following specific section(s) of the regulations and be as protective of public health.

D). Will any RACM remain in this area after abatement?

☐ Yes ☐ No ☒ Beyond scope of inspection

If Yes, attach a description of the RACM that will remain and the details of the on-going Operations and Maintenance Plan that will be implemented in accordance with C.1.2(b).
See Attachment #5, Operations and Maintenance Plan.

AGENCY USE ONLY

STATE OF RHODE ISLAND AND PROVIDENCE PLANTATIONS

Department of Health

Office of Occupational & Radiological Health

APPLICATION FOR APPROVAL OF AN ASBESTOS ABATEMENT PLAN

SUPPLEMENTAL INFORMATION: AREA DESCRIPTION AND PROPOSED REMEDY

BUILDING LOCATION: 55 Glenwood Drive, Warwick

INSTRUCTIONS: All items on this form must be addressed. All references to attachments must be clearly identified. All attachments must be marked with the specific item numbers on this form to which they pertain.

(1) Area Location/Identification (Room Name/No., Evaluation Number, etc.):

a. Ground Floor - Pipe/elbow/fitting insulation - refer to Attachment #3 Annotated Floor Plans

(2) Attach a description of each type (e.g. pipe, ceiling, etc.) of regulated asbestos containing material (RACM) in this area, including condition, location, quantity and asbestos content. Attach a copy of the laboratory report(s) for all samples. (NOTE: All laboratory reports must include the name of the building(s) and the location(s) of the sample(s).

See Attachment #1 for Project Scope of Work.

See Attachment #4 for Bulk Sample Laboratory Results.

(3) Attach a current scale drawing of this area, showing direction of North and East, which has been clearly annotated to show the type, location and quantity of all RACM in this area. This drawing must include a legend which acts as a guide to the scale, symbols and nomenclature used in the drawing. If a master plan or multiple drawings are provided, indicate the specific location(s) and drawing number(s) which depict this area. The location of the decontamination chamber must also be so indicated on the appropriate drawing(s).

See Attachment #3, Annotated Floor Plans.

(4) PROPOSED REMEDIES:

Attach a description of the interim Operations and Maintenance Plan that will be implemented in accordance with C.1.2 (b).

See Attachment #5, Operations and Maintenance Plan.

(4) PROPOSED REMEDIES (cont.):

E). Will any portion of this area be abated by use of B.8 work procedures?

☒ Yes ☐ No

If Yes, indicate below which RACM in this area will be abated by use of the following B.8 work procedures:

B.8.2 & B.8.3 [REMOVAL] pipe/elbow/fitting insulation

B.8.2 & B.8.4 [ENCAPSULATION] _____

B.8.2 & B.8.5 [ENCLOSURE] _____

B.8.6 [DEMOLITION] _____

B.8.7 [GLOVEBAG] pipe/elbow/fitting insulation

B.8.8 [ASPHALT ROOFING] _____

F). Are you requesting any waivers to the above selected B.8 procedure for any of the abatement activities in this area?

☐ Yes ☒ No

If yes, attach a detailed description of the waivers requested you are proposing to utilize. All items must be keyed to the specific section(s) of the regulations for which waivers are requested. Due to some limited abatement areas of pipe/elbow/fitting insulation, two layer mini-containment procedures is requested. All other 1.14.2, 1.14.3 procedures shall be utilized. See Attachment #9 Project Plan of Action B.

G). Are you proposing alternative procedures under B.11 for any of the abatement activities in this area?

☐ Yes ☒ No

If yes, attach a detailed description of the alternate procedures requested you are proposing to utilize. Alternate procedures must include a justification for not following specific section(s) of the regulations and be as protective of public health.

H). Will any RACM remain in this area after abatement?

☐ Yes ☐ No ☒ Beyond scope of inspection

If Yes, attach a description of the RACM that will remain and the details of the on-going Operations and Maintenance Plan that will be implemented in accordance with C.1.2(b).
See Attachment #5, Operations and Maintenance Plan.

AGENCY USE ONLY

STATE OF RHODE ISLAND AND PROVIDENCE PLANTATIONS

Department of Health

Office of Occupational & Radiological Health

APPLICATION FOR APPROVAL OF AN ASBESTOS ABATEMENT PLAN

SUPPLEMENTAL INFORMATION: AREA DESCRIPTION AND PROPOSED REMEDY

BUILDING LOCATION: 55 Glenwood Drive, Warwick

INSTRUCTIONS: All items on this form must be addressed. All references to attachments must be clearly identified. All attachments must be marked with the specific item numbers on this form to which they pertain.

(1) Area Location/Identification (Room Name/No., Evaluation Number, etc.):

a. Rooms 2, 3, 4, 15, Faculty Kitchen

(2) Attach a description of each type (e.g. pipe, ceiling, etc.) of regulated asbestos containing material (RACM) in this area, including condition, location, quantity and asbestos content. Attach a copy of the laboratory report(s) for all samples. (NOTE: All laboratory reports must include the name of the building(s) and the location(s) of the sample(s).

See Attachment #1 for Project Scope of Work.
See Attachment #4 for Bulk Sample Laboratory Results.

(3) Attach a current scale drawing of this area, showing direction of North and East, which has been clearly annotated to show the type, location and quantity of all RACM in this area. This drawing must include a legend which acts as a guide to the scale, symbols and nomenclature used in the drawing. If a master plan or multiple drawings are provided, indicate the specific location(s) and drawing number(s) which depict this area. The location of the decontamination chamber must also be so indicated on the appropriate drawing(s).

See Attachment #3, Annotated Floor Plans.

(4) PROPOSED REMEDIES:

Attach a description of the interim Operations and Maintenance Plan that will be implemented in accordance with C.1.2 (b).

See Attachment #5, Operations and Maintenance Plan.

(4) PROPOSED REMEDIES (cont.):

A). Will any portion of this area be abated by use of B.8 work procedures?

(X) Yes () No

If Yes, indicate below which RACM in this area will be abated by use of the following B.8 work procedures:

B.8.2 & B.8.3 [REMOVAL] sink waterproofing on underside

B.8.2 & B.8.4 [ENCAPSULATION] _____

B.8.2 & B.8.5 [ENCLOSURE] _____

B.8.6 [DEMOLITION] _____

B.8.7 [GLOVEBAG] _____

B.8.8 [ASPHALT ROOFING] _____

B). Are you requesting any waivers to the above selected B.8 procedure for any of the abatement activities in this area?

(X) Yes () No

If yes, attach a detailed description of the waivers requested you are proposing to utilize. All items must be keyed to the specific section(s) of the regulations for which waivers are requested. Due to limited intact removal methods waivers of containment procedures and post abatement air testing requested. Entire sinks shall be removed intact. See Attachment #9 Project Plan of Action, C. for proposed work procedures.

C). Are you proposing alternative procedures under B.11 for any of the abatement activities in this area?

(X) Yes () No

If yes, attach a detailed description of the alternate procedures requested you are proposing to utilize. Alternate procedures must include a justification for not following specific section(s) of the regulations and be as protective of public health. See Attachment #9 Project Plan of Action, C. for proposed work procedures.

D). Will any RACM remain in this area after abatement?

() Yes () No (X) Beyond scope of inspection

If Yes, attach a description of the RACM that will remain and the details of the on-going Operations and Maintenance Plan that will be implemented in accordance with C.1.2(b).
See Attachment #5, Operations and Maintenance Plan.

STATE OF RHODE ISLAND AND PROVIDENCE PLANTATIONS

Department of Health

Office of Occupational & Radiological Health

APPLICATION FOR APPROVAL OF AN ASBESTOS ABATEMENT PLAN

SUPPLEMENTAL INFORMATION: AREA DESCRIPTION AND PROPOSED REMEDY

BUILDING LOCATION: 55 Glenwood Drive, Warwick

INSTRUCTIONS: All items on this form must be addressed. All references to attachments must be clearly identified. All attachments must be marked with the specific item numbers on this form to which they pertain.

(1) Area Location/Identification (Room Name/No., Evaluation Number, etc.):

a. Ground Floor - Inside Wall, Ceiling, Floor Cavities - Refer to Attachment #3 Annotated Floor Plans for areas to be abated.

(2) Attach a description of each type (e.g. pipe, ceiling, etc.) of regulated asbestos containing material (RACM) in this area, including condition, location, quantity and asbestos content. Attach a copy of the laboratory report(s) for all samples. (NOTE: All laboratory reports must include the name of the building(s) and the location(s) of the sample(s).

See Attachment #1 for Project Scope of Work.
See Attachment #4 for Bulk Sample Laboratory Results.

(3) Attach a current scale drawing of this area, showing direction of North and East, which has been clearly annotated to show the type, location and quantity of all RACM in this area. This drawing must include a legend which acts as a guide to the scale, symbols and nomenclature used in the drawing. If a master plan or multiple drawings are provided, indicate the specific location(s) and drawing number(s) which depict this area. The location of the decontamination chamber must also be so indicated on the appropriate drawing(s).
See Attachment #3, Annotated Floor Plans.

(4) PROPOSED REMEDIES:

Attach a description of the interim Operations and Maintenance Plan that will be implemented in accordance with C.1.2 (b).

See Attachment #5, Operations and Maintenance Plan.

(4) PROPOSED REMEDIES (cont.):

A). Will any portion of this area be abated by use of B.8 work procedures?

(X) Yes () No

If Yes, indicate below which RACM in this area will be abated by use of the following B.8 work procedures:

B.8.2 & B.8.3 [REMOVAL] pipe/elbow/fitting insulation

B.8.2 & B.8.4 [ENCAPSULATION] _____

B.8.2 & B.8.5 [ENCLOSURE] _____

B.8.6 [DEMOLITION] _____

B.8.7 [GLOVEBAG] _____

B.8.8 [ASPHALT ROOFING] _____

B). Are you requesting any waivers to the above selected B.8 procedure for any of the abatement activities in this area?

(X) Yes () No

If yes, attach a detailed description of the waivers requested you are proposing to utilize. All items must be keyed to the specific section(s) of the regulations for which waivers are requested.

Due to limited access inside wall/ceiling/floor cavities, two layer mini-containment procedures is requested. All other 1.14.2, 1.14.3 procedures shall be utilized. See Attachment #9 Project Plan of Action, D.

C). Are you proposing alternative procedures under B.11 for any of the abatement activities in this area?

() Yes (X) No

If yes, attach a detailed description of the alternate procedures requested you are proposing to utilize. Alternate procedures must include a justification for not following specific section(s) of the regulations and be as protective of public health.

D). Will any RACM remain in this area after abatement?

() Yes () No (X) Beyond scope of inspection

If Yes, attach a description of the RACM that will remain and the details of the on-going Operations and Maintenance Plan that will be implemented in accordance with C.1.2(b).
See Attachment #5, Operations and Maintenance Plan.

AGENCY USE ONLY

Attachment A

IN PROCESS & CLEARANCE AIR SAMPLING

- A.1. The abatement contractor shall collect daily personal air samples, in compliance with OSHA 29 CFR Regulations.
2. The personal monitoring must be installed on the body of the laborer who will spend the entire sample collection time working inside containment barriers. That laborer must be engaged in the primary type of work involved in that phase of the project.
3. A record shall be taken of the name of the worker who wears each personal monitor into the work zone.
4. The personal monitor shall be operated for 20 to 30 minutes, adjusted for filter loading. The exact time and amount of collected air will be governed by prevailing conditions and consultation between the contractor and hygienist.

The owner shall utilize an Industrial Hygienist to supervise the collection of all samples. The Hygienist will perform the following sample collection and testing procedures:

5. n/a area air sample shall be collected daily at the following location(s):

6. Other than daily air sampling: one (1) area sample

outside containment/decon clean room

7. No less than 1,000 liters of air shall be collected for any station sample outside the work zone. The final documentations station sample collected inside the work zone shall be 1,000 liters.

- B.1. Outside containment airborne fiber concentrations must not exceed 0.01 fibers per cubic centimeter (f/cc) or work must be stopped, conditions reviewed as to the probable cause and corrected.

Attachment A

IN PROCESS & CLEARANCE AIR SAMPLING (continued)

- C.1. Final clearance air samples will be taken at the following location(s):

A minimum of five (5) area TEM samples shall be collected and analyzed inside the work area and a minimum of five (5) TEM samples shall be collected outside the work area, two (2) field blanks, one (1) sealed blank where greater than 160 square feet/260 linear feet of ACBM is removed, as stipulated by EPA AHERA Regulations 40 CFR Part 763.

A minimum of five (5) area PCM air samples inside the work area, one (1) outside the work area shall be collected and analyzed, plus two (2) field blanks where less than 160 square feet/260 linear feet of ACBM is removed, as stipulated by EPA AHERA Regulations 40 CFR Part 763.

Due to limited and intact removal methods for non-friable sink waterproofing removal, a waiver of post abatement air testing is requested. Contractor shall conduct personal air testing during the sink removals in lieu of post abatement air testing.

2. While the polyethylene covering on the walls and floors can be removed to facilitate final cleanup operations, the work area shall remain sealed off from the rest of the building. The work area shall remain sealed until final tests document that the air is safe and that All asbestos containing material has been removed.
 3. Air cleaning with negative air HEPA filtration units and mopping and wet wiping of structural surfaces shall continue at periodic intervals until all other requirements are met.
 4. Final air samples shall be collected within 24 hours after cleanup operations have ceased inside the work area.
 5. Analysis shall document that final station samples collected outside the work areas have a fiber count which does not exceed the 0.01 f/cc level. If this level was exceeded during the pre-work survey, provisions shall have to be made for filtering of the air here as well. Air testing fails if any results are above 0.01 f/cc. All tests on finals are performed aggressively.
- D.1. Analysis shall document that final station samples collected inside the work areas shall average less than or equal to 70 structures per square millimeter or does not exceed 0.01 f/cc of sampled air. If these levels are not met, cleaning operations shall resume until these levels are achieved.

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**ASBESTOS ABATEMENT PLAN
FOR
WARWICK PUBLIC SCHOOLS
HOXSIE ELEMENTARY SCHOOL
WARWICK, RHODE ISLAND**

**PREPARED BY:
WARWICK PUBLIC SCHOOLS
BUILDINGS & GROUNDS DEPARTMENT
150 DRAPER AVENUE
WARWICK, RHODE ISLAND 02889
(401) 734-3400**

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ATTACHMENTS

Attachment #1.	Project Scope of Work
Attachment #2.	Pre-Abatement Air Samples
Attachment #3.	Annotated Floor Plans
Attachment #4.	Bulk Sample Laboratory Results
Attachment #5.	Operations & Maintenance Plan
Attachment #6.	In Process Air Sampling (Space Reserved)
Attachment #7.	Post Abatement Air Samples (Space Reserved)
Attachment #8.	Confirmation of Asbestos Receipt (Space Reserved)
Attachment #9.	Project Plan of Action

ATTACHMENT #1

Project Scope of Work

Project Scope of Work

A. Boiler Room: Approximately 60 linear feet of asbestos pipe, elbow, fitting insulation, 220 square feet of boiler breeching insulation, 100 square feet of boiler cement and gaskets in good-fair condition shall be removed. Encapsulation of surfaces with a spray encapsulant.

B. Ground Floor - Pipe/elbow/fitting insulation: Approximately 400 each of asbestos pipe/elbow/fitting insulation in good condition shall be removed. Encapsulation of surfaces with a spray encapsulant.

C. Rooms 2, 3, 4, 15, Faculty Kitchen: Approximately 10 square feet of asbestos-containing waterproofing on sink undersides in good condition shall be removed intact.

D. Ground Floor - Inside Wall, Ceiling, Floor Cavities: Approximately 100 linear feet of asbestos pipe, elbow, fitting insulation assumed in wall/ceiling/floor cavities in good condition shall be removed. Encapsulation of surfaces with a spray encapsulant.

ATTACHMENT #2

Pre-Abatement Air Samples

ATTACHMENT #3

Annotated Floor Plans

ATTACHMENT #4

Bulk Sample Laboratory Results

ATTACHMENT #5

Operations and Maintenance Plan

Operations and Maintenance Plan

1. Monitoring

The physical condition of the asbestos-containing materials are inspected per USEPA AHERA regulations. Inspection reports are on file in each building and at the Dept. of Buildings and Grounds.

2. Education

The building is used as a public school. Personnel are notified annually of the presence of ACM and its potential hazards to minimize exposures. Identified ACM should be kept in good repair until removed from the building. Outside contractors shall be notified of the presence of asbestos-containing materials in the building. Warning labels have been installed in routine maintenance areas that contain ACM.

3. Fiber Release

Due to the generally good-fair condition and inaccessibility of some of the ACM above suspended ceilings, fiber release should not be a concern. Maintenance activities have been modified to prevent any damage to the identified ACMs. Should asbestos-containing materials become damaged, custodial and maintenance personnel have been instructed to notify the Dept. of Buildings and Grounds. Projects that qualify as spot repairs shall be addressed by RIDOH Asbestos Program licensed Competent Persons.

4. Human Exposure

Custodial and maintenance personnel receive annual training regarding asbestos-containing materials existing in the buildings and are informed that the materials should not be damaged or disturbed, to prevent fiber release.

ATTACHMENT #6

In-Process Air Sampling (Space Reserved)

ATTACHMENT #7

Post Abatement Air Samples (Space Reserved)

ATTACHMENT #8

Confirmation of Asbestos Receipt (Space Reserved)

ATTACHMENT #9

Project Plan of Action

PROJECT PLAN OF ACTION
HOXSIE ELEMENTARY SCHOOL
WARWICK, RHODE ISLAND

This project shall be performed by a Rhode Island licensed asbestos abatement contractor, in strict accordance with the State of Rhode Island Rules and Regulations for Asbestos Control 216-RICR-50-15-1, latest revision, and subject to applicable state, local, and federal regulations for asbestos abatement and transportation.

Scope of Work:

A. Boiler Room: Approximately 60 linear feet of asbestos pipe, elbow, fitting insulation, 220 square feet of boiler breeching insulation, 100 square feet of boiler cement and gaskets shall be removed. Encapsulation of surfaces with a spray encapsulant.

- A.1 The abatement contractor shall adhere to the warning sign provisions of OSHA and RIDOH. Warwick Schools shall shutdown and lockout HVAC prior to commencement of work and remove movable objects from the work area.
- A.2 Abatement personnel shall utilize proper respiratory and clothing protection, in strict compliance with OSHA 29 CFR 1926.1101 for the duration of the project.
- A.3 Critical barriers consisting of a minimum of one (1) layer of six (6.0) mil polyethylene sheeting sealed airtight with duct tape are required on all openings, including but not limited to: ductwork, electrical panels, wires, ceiling openings, windows, doors, air handler vents, diffusers, etc. inside the work area.
- A.4 Dividing walls that will separate work areas from non-work areas shall be constructed of a minimum of two (2) layers of six (6.0) mil polyethylene sheeting secured airtight with bracing strips, 2 x 4 wood framing and duct tape to the existing floor, wall and ceiling surfaces.
- A.5 Two (2) layer full containment procedures shall be utilized. Wall surfaces shall be protected with a minimum of two (2) layers of four (4.0) mil polyethylene secured with duct tape. Floor surfaces shall be protected with a minimum of two (2) layers of six (6.0) mil polyethylene sheeting secured with duct tape. This containment may also include adjacent abatement areas (custodian office, hallway) depending on the phasing of the project.
- A.6 Egress and ingress to the work area shall be through a three (3) chamber decontamination unit, consisting of a dirty room, operating shower room, and clean room. The decontamination unit shall be contiguous to the work area.
- A.7 Safety equipment located on-site shall include a stocked first-aid kit and approved fire extinguisher. Ground Fault Circuit Interrupters (GFCI) shall be utilized on all electrical cords.

PROJECT PLAN OF ACTION
HOXSIE ELEMENTARY SCHOOL
WARWICK, RHODE ISLAND

A. Boiler Room

- A.8 Continuous, localized negative pressure with intake in the work area shall be required. Microtrap units shall be properly exhausted to the outside of the building. Abatement contractor shall be responsible to secure openings where negative air machines are exhausted to prevent unauthorized building access during non-working hours.
- A.9 Non-ACM contaminated fiberglass pipe insulation in the work area shall be disposed of as non-ACM waste prior to ACM removal commencement.
- A.10 Removal shall commence upon approval of the containment and decontamination unit by the project Industrial Hygienist.
- A.11 Asbestos-containing materials shall be adequately wetted prior to removal. Contractor shall demolish boilers and breeching to access cement and gaskets and to ensure complete cement and gasket removal/final cleaning. Contractor shall dispose of ACM contaminated boiler/breeching components as ACM waste.
- A.12 Asbestos waste shall be transported and disposed of in accordance with the provisions of the Rhode Island Rules and Regulations for Asbestos Control, 40 CFR 763 Appendix D, Subpart E and U.S.D.O.T. 49 CFR 173.1300.
- A.13 Abatement contractor shall remedially clean via HEPA vacuums and wet wiping all surfaces including wall surfaces, floor surfaces, pipe surfaces, polyethylene surfaces free of dust, debris, and residue, as part of the final cleaning procedures, to the satisfaction of the project Industrial Hygienist.
- A.14 Abatement equipment no longer needed inside the work area shall be wet wiped and/or HEPA vacuumed upon completion of abatement activities and prior to the post abatement air sampling. Asbestos waste barrels/bags inside the containment shall be removed prior to the visual inspections. Abatement contractor shall spray removed surfaces and polyethylene sheeting with lockdown encapsulant after satisfactory visual inspections by the abatement contractor's supervisor and project Industrial Hygienist.
- A.15 Abatement contractor shall be responsible for cleaning surfaces free of duct tape spray glue residue during teardown procedures.

**PROJECT PLAN OF ACTION
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WARWICK, RHODE ISLAND**

This project shall be performed by a Rhode Island licensed asbestos abatement contractor, in strict accordance with the State of Rhode Island Rules and Regulations for Asbestos Control 216-RICR-50-15-1, latest revision, and subject to applicable state, local, and federal regulations for asbestos abatement and transportation.

Scope of Work:

B. Ground Floor - Pipe/elbow/fitting insulation: Refer to Attachment #3 Annotated Floor Plans. Approximately 400 each of asbestos pipe/elbow/fitting insulation shall be removed. Encapsulation of surfaces with a spray encapsulant.

- B.1 The abatement contractor shall adhere to the warning sign provisions of OSHA and RIDOH. Warwick Schools shall shutdown and lockout HVAC prior to commencement of work.
- B.2 Abatement personnel shall utilize proper respiratory and clothing protection, in strict compliance with OSHA 29 CFR 1926.1101 for the duration of the project.
- B.3 Critical barriers consisting of a minimum of one (1) layer of six (6.0) mil polyethylene sheeting sealed airtight with duct tape are required on all openings, ductwork, electrical panels, wires, lockers, openings located above the suspended ceilings, windows, doors, air handler vents, diffusers, grilles etc. inside the work areas. Contractor shall be responsible for sealing any openings that lead outside the abatement work areas located above the suspended ceilings with critical barriers a consisting of a minimum of one (1) layer of six (6.0) mil polyethylene sheeting sealed airtight with duct tape.
- B.4 Rooms/areas where removal is to limited only a portion of the room/area full containments shall not be required. Mini-containment procedures shall be utilized where glove bag removal procedures are not feasible. Walls, ceilings and floors shall be protected and sealed with a minimum of two (2) layers of four (4.0) mil polyethylene sheeting secured with duct tape. Polyethylene walls shall be secured airtight with bracing where needed to support the polyethylene walls. Connecting tunnel walls/floors shall be constructed of a minimum of two (2) layers of six (6.0) mil polyethylene sheeting secured with duct tape.

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WARWICK, RHODE ISLAND

B. Ground Floor - Pipe/Elbow/Fitting Insulation.

- B.5 Glove bag removal procedures 1.14.7 (A1-3) for work areas involving less than 260 linear feet/160 square feet of pipe/elbow/fitting insulation shall be utilized in areas where glove bag removal is feasible. All doors, windows, vents and other openings to the outside of the building and areas that do not contain asbestos shall be sealed off with a minimum of one (1) layer of six (6.0) mil polyethylene sheeting secured with duct tape. HVAC equipment in the abatement area or passing through it and servicing other areas shall be shut down, locked out and sealed with six (6.0) polyethylene sheeting secured with duct tape. Floors shall consist of a minimum of one (1) layer of six (6.0) mil polyethylene sheeting. Floor sheeting shall be placed underneath the glove bags and extend at least ten (10) feet horizontally in all directions. If any wall is less than ten (10) feet from the glove bag, the floor sheeting shall extend up that wall to at least the height of the glove bag. A two chamber decontamination unit shall be utilized if shower facilities are otherwise available on the project site. The decontamination unit shall be immediately adjacent to the abatement area. Continuous, localized negative pressure with intake in the work areas shall be required. Microtrap units shall be properly exhausted to the outside of the building. Abatement contractor shall be responsible to secure openings where negative air machines are exhausted to prevent unauthorized building access during non-working hours. Glove bag removal involving more than 260 linear feet/160 square feet of ACM shall comply with glove bag removal requirements 1.14.7 (4).
- B.6 Full containment procedures shall be utilized rooms/areas where entire rooms/areas require abatement and glove bag procedures are not feasible. Two (2) layer full containment procedures shall be utilized. Wall surfaces shall be protected with a minimum of two (2) layers of four (4.0) mil polyethylene secured with duct tape. Floor surfaces shall be protected with a minimum of two (2) layers of six (6.0) mil polyethylene sheeting secured with duct tape. Critical barriers consisting of a minimum of one (1) layer of six (6.0) mil polyethylene sheeting sealed airtight with duct tape are required on all openings, ductwork, electrical panels, wires, lockers, openings located above the suspended ceilings, windows, doors, air handler vents, diffusers, grilles etc. inside the work areas.
- B.7 Egress and ingress to each full containment or mini-containment work area, shall be through a three (3) chamber decontamination unit, consisting of a dirty room, operating shower room, and clean room. Decontamination units shall be contiguous to each work area.

PROJECT PLAN OF ACTION
HOXSIE ELEMENTARY SCHOOL
WARWICK, RHODE ISLAND

B. Ground Floor - Pipe/Elbow/Fitting Insulation.

- B.8 Continuous, localized negative pressure with intake in the work areas shall be required. Microtrap units shall be properly exhausted to the outside of the building. Abatement contractor shall be responsible to secure openings where negative air machines are exhausted to prevent unauthorized building access during non-working hours.
- B.9 Safety equipment located on-site shall include a stocked first-aid kit and approved fire extinguisher. Ground Fault Circuit Interrupters (GFCI) shall be utilized on all electrical cords.
- B.10 Removal shall commence upon approval of the containments and decontamination units by the project Industrial Hygienist.
- B.11 ACM shall be adequately wetted prior to removal. Contaminated fiberglass pipe cover located inside the containments shall be removed and disposed of as ACM waste.
- B.12 Abatement contractor shall remedially clean via HEPA vacuums and wet wiping all surfaces including wall surfaces, floor surfaces, pipe surfaces, polyethylene surfaces, ceiling tile gridwork and associated hangers, surfaces located above the suspended ceiling areas, free of dust, debris, and residue, as part of the final cleaning procedures, to the satisfaction of the project Industrial Hygienist.
- B.13 Asbestos waste shall be transported and disposed of in accordance with the provisions of the Rhode Island Rules and Regulations for Asbestos Control, 40 CFR 763 Appendix D, Subpart E and U.S.D.O.T. 49 CFR 173.1300.
- B.14 Abatement equipment no longer needed inside the containment areas shall be wet wiped and/or HEPA vacuumed upon completion of abatement activities and prior to the post abatement air sampling. Asbestos waste bags inside the containments shall be removed prior to the visual inspections. Abatement contractor shall spray removed surfaces and polyethylene sheeting with lockdown encapsulant after satisfactory visual inspections by the abatement contractor's supervisor and project Industrial Hygienist.
- B.15 Abatement contractor shall be responsible for cleaning surfaces free of duct tape and spray glue residue during teardown procedures.

PROJECT PLAN OF ACTION
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WARWICK, RHODE ISLAND

Scope of Work:

- C. Rooms 2, 3, 4, 15, Faculty Kitchen: Approximately 10 square feet of asbestos-containing waterproofing on sink undersides shall be removed intact.
- C.1 Due to limited quantity of non-friable ACM and intact removal methods, a waiver of containment is requested. Contractor shall remove entire sinks intact to avoid ACM disturbance.
- C.2 Abatement personnel shall utilize proper respiratory and clothing protection, in strict compliance with OSHA 29 CFR 1926.1101 for the duration of the project.
- C.3 “Drop cloths” on floors shall consist of a minimum of one (1) layer of six (6.0) mil polyethylene sheeting.
- C.4 Intact sinks shall be wrapped and labelled on site in a minimum of two (2) layers of six (6.0) mil polyethylene sheeting sealed with duct tape. Contractor shall utilize HEPA vacuums for cleaning purposes.
- C.5 After work completion, due to limited and intact removal methods, a waiver of post abatement air testing is requested. Contractor shall conduct personal air testing during the sink removals in lieu of post abatement air testing.
- C.6 Final visual inspections in each sink removal room shall be conducted by the abatement contractor’s supervisor and project Industrial Hygienist.
- C.7 Asbestos waste shall be transported and disposed of in accordance with the provisions of the Rhode Island Rules and Regulations for Asbestos Control 40 CFR 763 Appendix D, Subpart E and U.S.D.O.T. 49 CFR 173.1300.

PROJECT PLAN OF ACTION
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Scope of Work:

D. Ground Floor - Inside Wall, Ceiling, Floor Cavities: Approximately 100 linear feet of asbestos pipe, elbow, fitting insulation assumed in wall/ceiling/floor cavities shall be removed. Encapsulation of surfaces with a spray encapsulant.

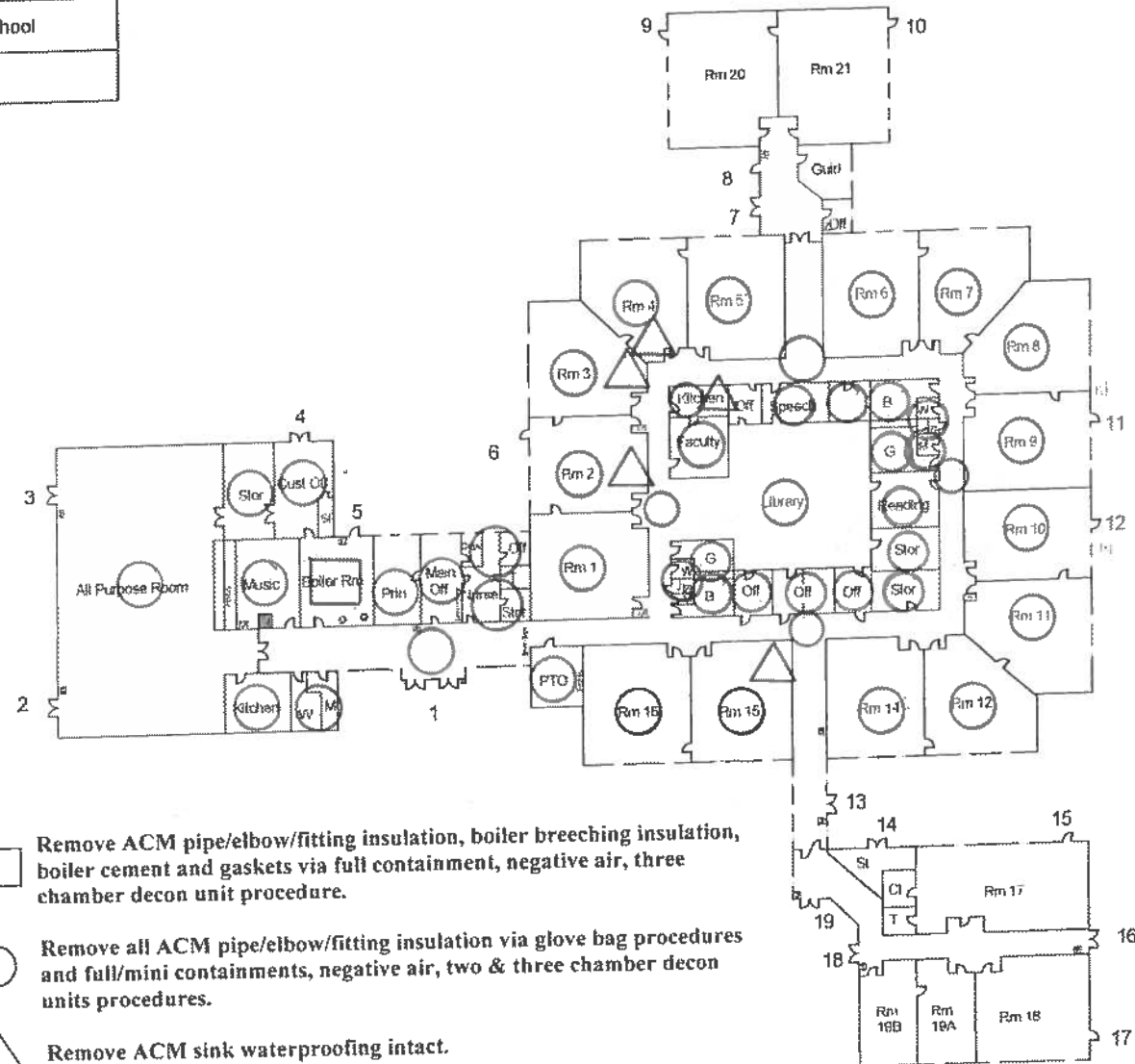
- D.1 The abatement contractor shall adhere to the warning sign provisions of OSHA and RIDOH.
- D.2 Abatement personnel shall utilize proper respiratory and clothing protection, in strict compliance with OSHA 29 CFR 1926.1101 for the duration of the project.
- D.3 Critical barriers consisting of a minimum of one (1) layer of six (6.0) mil polyethylene sheeting sealed airtight with duct tape are required on all openings, including but not limited to: electrical panels, wires, ceiling openings, windows, doors, air handler vents, diffusers, etc. inside each mini-containment work area. Contractor shall be responsible for sealing any openings that lead outside the abatement work areas located above the suspended ceilings with critical barriers a consisting of a minimum of one (1) layer of six (6.0) mil polyethylene sheeting sealed airtight with duct tape.
- D.4 Dividing walls that will separate work areas from non-work areas shall be constructed of a minimum of two (2) layers of six (6.0) mil polyethylene sheeting secured airtight with bracing strips, 2 x 4 wood framing and duct tape to the existing floor, wall and ceiling surfaces.
- D.5 Due to limited access abatement areas, full containment of the areas shall not be required. Mini-containment procedures shall be utilized. Walls and floors inside the mini-containment work areas shall be protected and sealed with a minimum of two (2) layers of six (6.0) mil polyethylene sheeting secured airtight with duct tape to existing floor, wall and ceiling surfaces.
- D.6 Egress and ingress to the mini-containment work areas shall be through a three (3) chamber decontamination units, consisting of a dirty room, operating shower room, and clean room. The decontamination units shall be contiguous to each mini-containment work area.
- D.7 Safety equipment located on-site shall include a stocked first-aid kit and approved fire extinguisher. Ground Fault Circuit Interrupters (GFCI) shall be utilized on all electrical cords.

PROJECT PLAN OF ACTION
HOXSIE ELEMENTARY SCHOOL
WARWICK, RHODE ISLAND

- D. Ground Floor - Inside Wall, Ceiling, Floor Cavities.
- D.8 Continuous, localized negative pressure with intake in the mini-containment work areas shall be required. Microtrap units shall be properly exhausted to the outside of the building. Abatement contractor shall be responsible to secure openings where negative air machines are exhausted to prevent unauthorized building access during non-working hours.
- D.9 Removal shall commence upon approval of the mini-containments and decontamination units by the project Industrial Hygienist.
- D.10 Asbestos-containing materials shall be adequately wetted prior to removal.
- D.11 Pipe insulation, pipe elbow, pipe fitting insulation exposed pipe ends that remain in the work areas shall be completely sealed with rewettable fiberglass wrap prior to the collection of the post abatement air samples.
- D.12 Asbestos waste shall be transported and disposed of in accordance with the provisions of the Rhode Island Rules and Regulations for Asbestos Control, 40 CFR 763 Appendix D, Subpart E and U.S.D.O.T. 49 CFR 173.1300.
- D.13 Abatement contractor shall remedially clean via HEPA vacuums and wet wiping all surfaces including wall surfaces, floor surfaces, pipe surfaces, polyethylene surfaces, ceiling tile gridwork and associated hangers, surfaces located above the suspended ceiling areas, free of dust, debris, and residue, as part of the final cleaning procedures, to the satisfaction of the project Industrial Hygienist.
- D.14 Abatement equipment no longer needed inside the work areas shall be wet wiped and/or HEPA vacuumed upon completion of abatement activities and prior to the post abatement air sampling. Asbestos waste barrels/bags inside the mini-containment shall be removed prior to the visual inspections. Abatement contractor shall spray removed surfaces and polyethylene sheeting with lockdown encapsulant after satisfactory visual inspections by the abatement contractor's supervisor and project Industrial Hygienist.
- D.15 Abatement contractor shall be responsible for cleaning surfaces free of duct tape and spray glue residue during teardown procedures.

School Name:	Warwick Public Schools
Building Name:	Hoxsle Elementary School
Address:	55 Glenwood Drive Warwick, RI 02889

Floor 1



Date Received: Mar. 15, 1995

Date Analyzed: Mar. 15, 1995

Project # WB95-2-007

The following shows results for submitted bulk samples:

Vortex Inc.
20 Altieri Way
Unit #4
Warwick, RI 02886

Samples Submitted by: Charma Clay

Att: Charma Clay

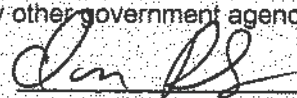
Enclosed please find the results of bulk material samples, analyzed for asbestos content using EPA Method 600/R-93/116.

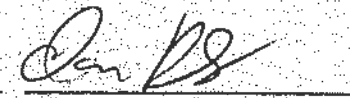
Method for the determination of asbestos in bulk materials". Quantitation of results is completed by visual estimating techniques unless otherwise noted. Results pertain only to those bulk material samples received at V Lab.

Materials that contain greater than 1% asbestos are considered asbestos containing. The EPA recognizes the following as asbestos: Chrysotile, Crocidolite, Amosite, Tremolite, Anthophyllite and Actinolite.

Unless the customer requests otherwise inhomogeneous samples are homogenized using representative material from each component and analyzed as a single sample.

This report must not be used by the client to claim product endorsement by NVLAP or any other government agency. If you have any questions please do not hesitate to call.


Analyst
Donald Pellegrino


Lab Director
Donald Pellegrino

Project Location: Hoxsie Elementary School
55 Glenwood Drive
Vortex Project 95014

KEY FOR ABBREVIATIONS:

Chrysotile (CHR), Amosite (AMO), Tremolite (TRE), Anthophyllite (ANT), Actinolite (ACT)
Fiber Glass (FBG), Synthetic Fibers (SYN), Cellulose (CEL), Hair (HAR), Other (OTH)
Non-fibrous material (NON)

CLIENT SAMPLE IDENTIFICATION	V Lab sample#	Homogeneous Application	COLOR	POS/NEG	% Asbestos						% Non-Asbestos					
					CHR	AMO	CRO	TRE	ANT	ACT	CEL	FBG	SYN	HAR	OTH	NON
CONCRETE BLOCK AND MORTAR ALL PURPOSE ROOM	WB326	1	GY	NEG	TR						1					99
CONCRETE BLOCK AND MORTAR MAIN OFFICE AREA	WB327	1	GY	NEG							1					99
CONCRETE BLOCK AND MORTAR ROOM	WB328	1	GY	NEG							1					99

[illegible]

Mar. 15, 1995

Project: WB95-2-007

CLIENT SAMPLE IDENTIFICATION	V Lab sample#	Homogeneous Application	COLOR	POS/NEG	% Asbestos						% Non-Asbestos						
					CHR	AMO	CRO		TRE	ANT	ACT	CEL	FBG	SYN	HAR	OTH	NON
BREECHING INSULATION BOILER ROOM	WB373	25	DNA														
EXHAUST STACK INSULATION BOILER ROOM	WB374	26	GY	POS	3	50											47
EXHAUST STACK INSULATION BOILER ROOM	WB375	26	DNA														
EXHAUST STACK INSULATION BOILER ROOM	WB376	26	W	POS	25	35											40
ROUGH CEILING PALSTER BOILER ROOM	WB377	27	W	NEG								1					99
ROUGH CEILING PLASTER BOILER ROOM	WB378	27	W	NEG								1					99
ROUGH CEILING PLASTER BOILER ROOM	WB379	27	W	NEG								1					99
FLEX CONNECTOR BOILER ROOM	WB380	28	BR	NEG								95					5
SHEETROCK CEILING TILE HALL 1	WB381	29	W/TAN	NEG								20					80
SHEETROCK CEILING TILE HALL 2	WB382	29	W/TAN	NEG								20					80
SHEETROCK CEILING TILE HALL 4	WB383	29	W/TAN	NEG								20					80



LABORATORY REPORT

Warwick Public Schools
Attn: David Small, Director
150 Draper Avenue
Warwick, RI 02889

Date Received: 2/14/2022
Date Reported: 2/14/2022
Work Order #: 2202-02279

Site Location: Hoxie Elementary

Enclosed please find your sample(s) analysis results for asbestos content. The six asbestos types include amosite, chrysotile, crocidolite, anthophyllite, tremolite, and actinolite.

Analysis by Polarized Light Microscopy (PLM) was performed in accordance with EPA 40 CFR Appendix E to Subpart E of Part 763 and/or EPA 600/R-93/116.

R.I. Analytical Laboratories, Inc. maintains bulk asbestos fiber NVLAP accreditation under Lab Code 101440-0. This report does not serve as a product certification, approval, and/or endorsement by NVLAP, NIST, or any federal agency.

The sample(s) submitted for analysis were accepted by R.I. Analytical unless otherwise noted in the report. If a sample is found to be inhomogeneous, individual components will be analyzed separately. If individual components cannot be separated, the sample will be homogenized and a single result will be provided. These results only pertain to the samples submitted for this Work Order # and this report shall not be reproduced except in its entirety.

Samples submitted for analysis will be retained for three months for future reference.

We certify that the following results are true and accurate to the best of our knowledge. If you have questions or need further assistance, please contact our Customer Service Department.

Approved by:

Asbestos Signatory

R.I. Analytical Laboratories, Inc.
LABORATORY REPORT

Warwick Public Schools
Date Received: 2/14/2022
Work Order #: 2202-02279
Site Location: Hoxie Elementary

METHOD: EPA 600/R-93/116

SAMPLE NO.	SAMPLE DESCRIPTION	PARAMETER	SAMPLE RESULTS / UNITS	DATE ANALYZED	ANALYST
001	01A Room 2 Gray Sink Waterproofing	PLM Fiber Analysis			
		Asbestos	Detected	2/14/2022	EDN
		Chrysotile	5-15 %	2/14/2022	EDN
		Non-fibrous	85-95 %	2/14/2022	EDN
		Sample Color	Gray	2/14/2022	EDN
002	01B Room 15 Gray Sink Waterproofing	PLM Fiber Analysis			

Positive stop to previous sample.

216-50-15 R.I. Code R. § 1.14

Section 216-RICR-50-15-1.14 - Work Practice Requirements

1.14.1 Applicability

Any Asbestos Contractor that engages in any Asbestos Abatement Project that involves greater than ten (10) linear feet (three (3) meters) of pipe covered or coated with asbestos containing material or twenty five (25) square feet (three (3) square meters) of asbestos containing material used to cover or coat any surface other than pipe shall comply with the work practices contained in § 1.14 of this Part and any additional work practice requirements contained in the asbestos abatement plan approved for that project by the Director of Health. Specific requirements for Category I and Category II Nonfriable ACM that is not Regulated Asbestos Containing Material (RACM) are contained in §§ 1.14.8 and 1.15 of this Part.

1.14.2 General Requirements for Removal, Encapsulation and/or Enclosure of Regulated Asbestos Containing Material (RACM)

A. Barriers to isolate contaminated from uncontaminated areas shall be constructed of polyethylene sheeting attached securely in place.

B. All surfaces shall be wet cleaned of dust or debris. Wet cleaning of contaminated items shall be performed if necessary. All movable objects shall be removed from the work area. All nonmovable objects in the work area shall be covered with 6-mil polyethylene sheeting secured in place. All openings or penetrations between the work area and uncontaminated areas shall be sealed, including windows, doorways, elevator openings, corridor entrances, drains, ducts, grills, grates, diffusers and skylights.

C. Floor sheeting shall consist of two (2) layers of 6-mil polyethylene sheeting. Floor sheeting shall extend up sidewalls at least twelve (12) inches and be sized to minimize seams. No seams shall be located at wall/floor joints. Floors being abated of resilient floor coverings and associated mastics/adhesives shall be exempt from this requirement.

D. Wall sheeting shall consist of two (2) layers of 4-mil polyethylene sheeting. It shall be installed to minimize joints and shall extend beyond wall/floor joint at least twelve (12) inches. No seams shall be located at wall/wall joints.

E. A worker decontamination enclosure system, consisting of a clean room, shower room and equipment room, each separated from each other and from the work area by airlocks and accessible through doorways protected with two (2) overlapping polyethylene sheets, shall be provided in accordance with OSHA 29 C.F.R. § 1926.1101(j) incorporated by reference at § 1.2(A) of this Part. Procedures for the utilization of this system shall be established which prevent contamination of areas outside the work area.

F. All HVAC equipment in or passing through the work area shall be shut down and locked out. All intake and exhaust openings, as well as any seams in system components shall be sealed with 6-mil polyethylene sheeting and/or tape. All system filters shall be

replaced after the abatement and disposed of as asbestos waste. The ventilation system ductwork interiors shall be decontaminated whenever necessary.

G. Posting

1. Warning signs in accordance with OSHA 29 C.F.R. § 1926.1101(k)(7) incorporated by reference at § 1.2(A) of this Part shall be displayed at all approaches to any location where airborne fiber levels can be expected to exceed the Indoor Non-Occupational Air Exposure Standard established by § 1.5 of this Part.

2. Warning signs to advise the public of the location(s) within the building where any asbestos abatement activity is in progress shall be posted at all building entrances and at least one other conspicuous place per floor. These signs shall be of the same dimensions as the Warning/Danger signs required in § 1.14.2(G)(1) of this Part.

3. Warning signs shall be posted on vehicles used to transport Asbestos Containing Waste Materials during loading and unloading of the waste.

H. Clean-up procedures using HEPA vacuuming and wet cleaning techniques shall be performed following abatement. Wet cleaning shall be followed by HEPA vacuuming after surfaces have been allowed to dry. The sequence of wet cleaning and vacuuming shall be repeated at twenty-four (24) hour intervals until no visible residue is observed in the work area.

I. Negative pressure ventilation units with HEPA filtration, in sufficient number to provide one (1) workplace air change every fifteen (15) minutes, shall be operated continuously from the time of barrier construction through the time acceptable final clearance air-monitoring results are obtained. These units shall exhaust filtered air to the outside of the building. Filtered air shall not be exhausted to uncontaminated interior spaces.

J. All Asbestos Containing Waste Materials shall be adequately wetted before being placed into containers for disposal.

K. Asbestos Containing Waste Materials shall be placed in impermeable containers for disposal. Metal or fiber drums with locking-ring tops shall be used when asbestos waste contains sharp edged components. Double polyethylene bags of at least 6-mil thickness and which can be securely sealed may be used for waste. Large components or structural members may be removed intact and contained in leak-tight wrapping, equivalent to at least two (2) layers of 6-mil polyethylene sheeting, secured with tape for disposal.

L. All containers, bags, drums and wrapped components shall be labeled so that labels have the appearance of or are constructed in accordance with USDOT 49 C.F.R. 172, Subpart E incorporated by reference at § 1.2(D) of this Part and OSHA 29 C.F.R. § 1926.1101(k)(8) incorporated by reference at § 1.2(A) of this Part. Each container, bag, drum or wrapped component shall also be labeled or tagged with the name and license number of the asbestos contractor generating the waste, as well as the asbestos abatement project number and location at which the waste was generated.

M. Storage of asbestos waste containers awaiting transport to an authorized disposal facility shall be in a secured location to prevent access by unauthorized personnel.

N. Transport and disposal of asbestos waste shall be in accordance with the provisions of Appendix D to 40 C.F.R. 763, Subpart E incorporated by reference at § 1.2(E) of this Part and USDOT 49 C.F.R. § 173.1300 incorporated by reference at § 1.2(F) of this Part.

O. Disposal of Asbestos Containing Waste Materials. All Asbestos Containing Waste Materials shall be deposited as soon as is practical by the waste generator at:

1. A waste disposal site operated in accordance with the provisions of 40 C.F.R. § 61.154, or equivalent regulations promulgated by a state or local NESHAP designee; or
2. An EPA-approved site that converts RACM and Asbestos Containing Waste Materials into nonasbestos (asbestos-free) material according to the provisions of 40 C.F.R. § 61.155.

P. Access to work areas shall be controlled and posting requirements shall remain in effect until compliance with the air exposure standard has been verified by procedures outlined below:

1. Samples shall be collected and analyzed in accordance with the procedures specified by NIOSH Method 7400 (most current Revision) for asbestos fibers in air or equivalent method;
2. Air volumes shall be sufficient to accurately determine fiber concentrations to 0.01 fibers/ cubic centimeter of air (f/cc) for fibers greater than five (5) microns in length or 300 nanograms per cubic meter. A minimum air volume of 1000 liters shall be sampled;
3. Air sampling shall be conducted in representative locations with portable fans circulating air to simulate actual use conditions;
4. An acceptable airborne fiber concentration, as established by clearance air monitoring shall not exceed 0.01 f/cc for fibers greater than five (5) microns in length or 300 nanograms per cubic meter; and
5. Air sampling shall be conducted by a representative of the building owner who is not subject to the control or supervision of the Asbestos Contractor for the asbestos abatement plan.
6. Notwithstanding the requirements contained in § 1.14.2(P) of this Part above, control of access and posting requirements for buildings subject to the AHERA regulations shall remain in effect until compliance with §§ 1.17.3(A)(5) through (8) of this Part has been demonstrated.

1.14.3 Specific Requirements for Removal of Regulated Asbestos Containing Material (RACM)

A. All RACM shall be adequately wetted prior to removal. In addition, all RACM exposed during cutting and disjoining operations shall be adequately wet and all RACM shall be kept adequately wet during stripping operations.

B. Components shall be removed intact or in large sections whenever possible and carefully lowered to the floor.

C. RACM shall be removed in small sections and containerized when adequately wet. At no time shall material be allowed to accumulate or become dry. Structural components shall be adequately wetted prior to being contained in leak-tight wrapping for disposal.

D. Material shall not be dropped or thrown to the floor level. For materials located at heights greater than fifty (50) feet above the floor, a dust-tight, enclosed chute shall be constructed to transport removed material to containers on the floor. RACM may be dropped to a raised scaffold or containerized at elevated levels for disposal. Materials greater than fifteen (15) feet above the floor shall be dropped onto inclined chutes or scaffolding or containerized at elevated levels for eventual disposal.

E. A coating of encapsulating agent shall be applied to any porous surfaces that have been stripped of RACM to securely seal any residual fibers that may be present. The encapsulating agent should be chosen to be compatible with subsequent coverings.

F. RACM is not required to be stripped from large facility components such as reactor vessels, large tanks, and steam generators if the following requirements are met:

1. The component is removed, transported, stored, disposed of, or reused without disturbing or damaging the RACM.
2. The component is encased in a leak-tight wrapping.
3. The leak-tight wrapping is labeled during all loading and unloading operations and during storage.

G. When the temperature at the point of wetting is below 0°C (32°F):

1. The Asbestos Contractor need not comply with the wetting provisions of §§ 1.14.3(A) and (C) of this Part.
2. The Asbestos Contractor shall remove facility components containing, coated with, or covered with RACM as units or in sections to the maximum extent possible.
3. During periods when wetting operations are suspended due to freezing temperatures, the Asbestos Contractor must record the temperature in the area containing the facility components at the beginning, middle, and end of each workday and keep daily temperature records available for inspection by the Department during normal business hours at the asbestos abatement project site. The Asbestos Contractor shall retain temperature records for at least two years.

1.14.4 Specific Requirements for Encapsulation of Regulated Asbestos Containing Material (RACM)

A. All loose and hanging RACM shall be removed in accordance with § 1.14.3 of this Part.

- B.** Filler material applied to gaps in existing material shall contain no asbestos, adhere well to the substrate and provide an adequate base for the encapsulating agent.
- C.** Encapsulants shall be applied using only airless spray equipment with nozzle pressure adjustable between four hundred (400) and fifteen hundred (1500) PSI and in accordance with the manufacturer's recommendations for a particular encapsulant.
- D.** Encapsulated materials shall be specially designated by signs, labels, color coding or some mechanism to warn individuals who may be required to disturb the material.
- E.** Encapsulants shall not be solvent-based or utilize a vehicle consisting of hydrocarbons.

1.14.5 Specific Requirements for Enclosure of Regulated Asbestos Containing Material (RACM)

- A.** All areas of RACM shall be adequately wetted with wetting agents if they are to be disturbed during the installation of hangers, brackets or other portions of the enclosure.
- B.** All loose and hanging RACM shall be removed in accordance with § 1.14.3 of this Part.
- C.** Non-asbestos containing substitutes shall be used to patch thermal insulation and fireproofing materials when required and where appropriate.
- D.** Enclosures for RACM shall be specially designated by signs, labels, color coding or some mechanism to warn individuals who may be required to disturb or enter the enclosure.

1.14.6 Specific Requirements for Demolition of Structures Containing Asbestos

- A.** Any demolition of a structure or portion of a structure which contains structural members, building materials or structural components composed of or covered by RACM shall be preceded by a removal of all such materials in accordance with §§ 1.14.2 and 1.14.3 of this Part. Said removal must be completed before any activity begins that would break up, dislodge, or similarly disturb the material or preclude access to the material for subsequent removal. Notwithstanding the foregoing, RACM need not be removed before demolition if:
 - 1.** It is Category I nonfriable ACM that is not in poor condition and is not friable; or
 - 2.** It is on a facility component that is encased in concrete or other similarly hard material and is adequately wet whenever exposed during demolition; or
 - 3.** It was not accessible for testing and was, therefore, not discovered until after demolition began and, because of the demolition, the material cannot be safely removed. If not removed for safety reasons, the exposed RACM and any asbestos contaminated debris must be treated as Asbestos Containing Waste Material and adequately wet at all times until disposed of; or
 - 4.** It is Category II nonfriable ACM and the probability is low that the materials will become crumbled, pulverized, or reduced to powder during demolition.

B. For Emergency Asbestos Abatement Projects described in § 1.6.2(C) of this Part, adequately wet the portion of the facility that contains RACM during the wrecking operation.

C. If a facility is demolished by intentional burning, all RACM, including Category I and Category II nonfriable ACM, must be removed in accordance with this Part before burning.

D. In lieu of the requirements specified in §§ 1.14.2(B), (C), (D), (F) and 1.14.3(E) of this Part, Asbestos Contractors engaging in demolition activities shall comply with the following:

- 1.** Prior to beginning a demolition project, all doors, windows, floor drains, vents and other openings to the outside of the building and to areas within the building that do not contain asbestos materials shall be sealed off with 6-mil polyethylene sheeting and waterproof tape or equivalent acceptable to the Department.
- 2.** If a structure is to be partially demolished, HVAC equipment in the demolition area or passing through it but servicing areas of the building which will remain, shall be shut down and locked out and thoroughly sealed with 6-mil polyethylene sheeting and waterproof tape.
- 3.** If the building owner proposes not to conduct clearance air sampling following asbestos abatement activities conducted for demolition purposes, the building owner must submit written justification to the Department which describes how personnel who must occupy the building prior to demolition will be protected.
- 4.** All other requirements of §§ 1.14.2 and 1.14.3 of this Part, unless specified in § 1.14.6(D) of this Part, shall apply to demolition abatement activities.

1.14.7 General Requirements for Use of Glove Bags During Removal and/or Encapsulation of Regulated Asbestos Containing Material (RACM)

A. In lieu of the requirements specified in §§ 1.14.2(A) through (F), (H), and (I) of this Part, Asbestos Contractors using glove bags during removal and/or encapsulation of RACM shall comply with the following:

- 1.** All glove bags must remain stationary during asbestos abatement activities. The use of moving and/or sliding glove bag techniques are prohibited.
- 2.** Abatement projects which do not exceed the scope of Spot Repairs, as defined by this Part, and which can be contained within one stationary glove bag may be performed in accordance with the glove bag procedures contained in 29 C.F.R. § 1926.1101(g)(5) incorporated by reference at § 1.2(A) of this Part without the use of additional containment or negative pressure ventilation. The clearance air monitoring provisions of § 1.14.2(P) of this Part are waived unless there has been a breach of the glove bag containment.
- 3.** All other abatement projects that involve less than two hundred and sixty (260) linear feet [eighty (80) meters] of pipe covered or coated with RACM or one hundred and

sixty (160) square feet [fifteen (15) square meters] of RACM used to cover or coat any surface other than pipe shall comply with the following requirements:

- a.** All doors, windows, floor drains, vents and other openings to the outside of the building and to areas within the building that do not contain asbestos materials shall be sealed off with 6-mil polyethylene sheeting and waterproof tape or equivalent acceptable to the Department.
- b.** Floor sheeting shall consist of at least one (1) layer of 6-mil polyethylene sheeting. Floor sheeting shall be placed directly beneath the glove bag and shall extend at least ten (10) feet in all horizontal directions. If any wall is less than ten (10) feet from the glove bag, the floor sheeting shall be extended up that wall to at least the height of the glove bag.
- c.** HVAC equipment in the abatement area or passing through it but servicing other areas of the building shall be shut down and locked out and thoroughly sealed with 6-mil polyethylene sheeting and waterproof tape.
- d.** Negative pressure ventilation units with HEPA filtration shall be operated continuously from the time of barrier construction through the time acceptable final clearance air-monitoring results are obtained. These units shall exhaust filtered air to the outside of the building. Filtered air shall not be exhausted to uncontaminated interior spaces.
- e.** Manufacturer's instructions concerning preparation, sealing, utilization and removal of glove bags must be followed unless the abatement plan and/or this Part specify more restrictive requirements.
- f.** A worker decontamination enclosure system must be available immediately adjacent to the abatement area. A two-chamber decontamination system may be used if shower facilities are otherwise available on the project site.

4. All abatement projects that involve more than two hundred and sixty (260) linear feet [eighty (80) meters] of pipe covered or coated with RACM or one hundred and sixty (160) square feet [fifteen (15) square meters] of RACM used to cover or coat any surface other than pipe shall comply with the following requirements:

- a.** All doors, windows, floor drains, vents and other openings to the outside of the building and to areas within the building that do not contain asbestos materials shall be sealed off with 6-mil polyethylene sheeting and waterproof tape or equivalent acceptable to the Department.
- b.** Floor sheeting shall consist of at least one (1) layer of 6-mil polyethylene sheeting. Floor sheeting shall extend up sidewalls at least twelve (12) inches and be sized to minimize seams. No seams shall be located at wall/floor joints.
- c.** Wall sheeting shall consist of at least one (1) layer of 4-mil polyethylene sheeting. It shall be installed to minimize joints and shall extend from the wall/ ceiling joint to at

least twelve (12) inches beyond the wall/floor joint. No seams shall be located at wall/wall joints.

d. HVAC equipment in the abatement area or passing through it but servicing other areas of the building shall be shut down and locked out and thoroughly sealed with 6-mil polyethylene sheeting and waterproof tape.

e. Negative pressure ventilation units with HEPA filtration shall be operated continuously from the time of barrier construction through the time acceptable final clearance air monitoring results are obtained. These units shall exhaust filtered air to the outside of the building. Filtered air shall not be exhausted to uncontaminated interior spaces.

f. Manufacturer's instructions concerning preparation, sealing, utilization and removal of glove bags must be followed unless the abatement plan and/or this Part specify more restrictive requirements.

g. A three-chamber worker decontamination enclosure system, in accordance with 29 C.F.R. § 1926.1101(j) incorporated by reference at § 1.2(A) of this Part, must be available immediately adjacent to the abatement area.

5. All other requirements of §§ 1.14.2 and 1.14.3 of this Part, unless specifically deleted in § 1.14.7(A) of this Part, shall apply to use of glove bags during removal and/or encapsulation of asbestos.

B. Any requests for additional waivers and/or alternative procedures must be submitted for Department review and approval in accordance with § 1.16 of this Part.

1.14.8 Specific Requirements for Removal of Category I Nonfriable ACM - Asphalt Roofing Products

A. All surfaces shall be wet cleaned of dust or debris. All movable objects shall be removed from the roof area. All openings or penetrations on the roof area and at least one level below the roof area shall be sealed, including windows, doorways, drains, ducts, grills, grates, diffusers and skylights.

B. Floor/ground sheeting shall consist of at least two (2) layers of 6-mil polyethylene sheeting and shall be utilized as follows:

1. If the roof is pitched, sheeting shall be applied to the first horizontal surface below the work area and shall extend from the edge of the building to at least ten (10) feet away from the building. All material being abated shall be confined to the roof area.

2. If the roof is flat, sheeting shall extend at least ten (10) feet away from the perimeter of the work area. When the edge of the roof is less than ten (10) feet from the perimeter of the work area, sheeting shall be applied such that the outer edge of the sheeting is at least ten (10) feet from the perimeter of the work area.

C. All HVAC intake or exhaust vents on the roof area and at least one level below the roof area shall be shut down and locked out. All intake and exhaust openings, as well as any

seams in system components shall be sealed with 6-mil polyethylene sheeting and/or tape.

D. A minimum of a two-chambered worker decontamination enclosure system shall be provided on site. Procedures for the utilization of this system shall be established which prevent contamination of areas outside the roof area.

E. Warning signs shall be posted in accordance with § 1.14.2(G) of this Part.

F. Category I Nonfriable ACM shall be removed in small sections and containerized when wet. At no time shall material be allowed to accumulate or become dry.

G. Category I Nonfriable ACM shall not be dropped or thrown to the floor/ground level. For roofs at heights greater than fifty (50) feet above the floor/ground, a dust-tight, enclosed chute shall be constructed to transport removed Category I Nonfriable ACM to containers on the floor/ground. Category I Nonfriable ACM may be dropped to a raised scaffold or containerized at elevated levels for disposal.

H. All Category I Nonfriable ACM shall be adequately wetted before being placed into containers for disposal. Disposal shall be in accordance with §§ 1.14.2(K) through (O) of this Part.

I. A coating of encapsulating agent shall be applied to any porous surfaces that have been stripped of Category I Nonfriable ACM to securely seal any residual fibers that may be present. The encapsulating agent should be chosen to be compatible with subsequent coverings.

J. Clean-up procedures using HEPA vacuuming and wet cleaning techniques shall be performed following abatement.

K. Personnel air monitoring of Asbestos Supervisors and Asbestos Workers, which demonstrates compliance with the provisions of OSHA 29 C.F.R. § 1926.1101(f) incorporated by reference at § 1.2(A) of this Part, may be used in lieu of the clearance air sampling requirements contained in § 1.14.2(P) of this Part.

216 R.I. Code R. § 216-RICR-50-15-1.14

Amended effective January 1, 2019

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SECTION 0301 30

FLOOR PATCH AND SKIMCOAT

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Provision and installation of floor patch and skimcoat in all areas where necessary under new flooring and at demolished existing partitions to create a level subfloor in accordance with these specifications.

1.02 PERFORMANCE REQUIREMENTS

- A. ASTM C-109 - Compressive strength = more than 4000 PSI after 28 days.
- B. VOC: 0 g/L, calculated SCAQMD 1168

1.03 SUBMITTALS

- A. Submit product data under provisions of Section 0133 00.
- B. Shop Drawings: Plans indicating substrates, and locations.

1.04 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing the products specified in this section with minimum 5 years of experience.
- B. Installer: Company specializing in performing the work of this section with minimum five years documented experience.

1.05 DELIVERY, STORAGE AND HANDLING

- A. Deliver, store, protect and handle products to site under provisions of Section 0160 00.

1.06 SAFETY PRECAUTIONS

- A. Follow all safety precautions by the manufacturer and required all Federal, State and Local Codes.

1.07 ENVIRONMENTAL REQUIREMENTS

- A. Do not install material in interior air temperature below 50 degrees. This temperature must be maintained two days prior and two days after installation.
- B. Comply with manufacturer's written instructions for substrate temperature, ambient temperature and humidity, ventilation, and other conditions affecting underlayment performance.

1.08 COORDINATION

- A. Verify that the floor patch and skimcoat material specified in this section is compatible with the existing substrate it is covering and the floor finish that will be installed to its surface.
- B. If any inconsistencies exist, inform the Architect prior to installation.

PART 2 - PRODUCTS

2.01 MANUFACTURER

- A. Ardex Engineered Cements
ARDEX GPSTTM General Patch & Skimcoat
- B. Substitutions: Under provisions of Section 0160 00.

2.02 MATERIALS

- A. The material is a trowelable patch and skim coat for use over interior concrete and wood subfloors.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Verify the existing substrate is in satisfactory condition and properly cleaned to meet the manufacturer's recommendations.

3.02 INSTALLATION

- A. Install the floor patch and skimcoat material in accordance with the manufacturer's requirements, instructions and recommendations.
- B. Cure according to manufacturer's written instructions. Prevent contamination during application and curing processes.
- C. Do not install floor coverings over floor patch and skimcoat material until after time period recommended in writing by manufacturer.
- D. Remove and replace areas of floor patch and skimcoat material that show evidence of lack of bond with substrate, including areas that emit a "hollow" sound when tapped.
- E. Install under all areas receiving new vinyl tile and carpet tile flooring as required to provide a level subfloor meeting the minimum requirements of the flooring manufacturer. See drawings for locations.

3.03 CLEANING

- A. Clean work under provisions of Section 0170 00.

END OF SECTION

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SECTION 03 31 00

CONCRETE CONSTRUCTION

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Description for the complete installation of standard concrete construction.

1.02 REFERENCES

- A. ASTM C150 - Specification for Portland Cement
- B. ASTM C33 - Specification for concrete aggregates
- C. ASTM A-15 - Standard metal reinforcement
- D. ASTM A-305 - Minimum requirements for the deformation of deformed steel bars for concrete reinforcement
- E. ASTM A-185 - Standard specifications for welded steel wire fabric for concrete reinforcement.
- F. ASTM C-192 - Method of making and curing concrete compression and flexure test specimens in the laboratory.
- G. ASTM C-31 - Method of making and curing concrete compression and flexure test specimens in the field.
- H. ASTM C-39 - Test for compressive strength of cylindrical strength of cylindrical concrete specimens.
- I. ASTM C-143 - Test for slump of Portland Cement Concrete
- J. ASTM C-42 - Method of obtaining and testing drilled cores and sawed beams of concrete
- K. ASTM C-94 - Standard Specifications for Ready-Mix concrete.

1.03 SUBMITTALS

- A. Submit under provisions of Section 01 33 00.
- B. Test reports shall be submitted for approval and the results distributed as follows: Copy to field office, 1 copy to contractor's office and 4 copies to Architect's office
- C. Shop drawings shall indicate dimensions, bar schedules, bending details and placing diagrams and details for all reinforcement.
- D. Design data shall be by the architect 30 days prior to commencing any concrete operations.

- E. Record documents regarding concrete pours shall be kept by the contractor and submitted to the Architect, upon request including the following data: date of pour, starting time, mean temperature, total yardage pour location, time of finish and curing duration.

1.04 QUALITY ASSURANCE

- A. Concrete Quality: When there is any question as to the quality of the concrete of the structure, the Architect may require the Contractor, at the Contractor's expense, to have tests made in an approved independent testing and inspection laboratory. Such tests shall be in accordance with ASTM C-42 or Section 201 and 202 of the current A.C.I. Building code for Reinforced Concrete (A.C.I. 318) as may be required. The criteria for acceptability of the concrete under the latter shall be that given therein. If tested concrete is below contract requirements, the Architect may condemn such concrete already installed. Remove such condemned concrete and replace with new concrete that meets the proper criteria.

1.05 QUALIFICATIONS

- A. All companies involved in performing the work of this section shall have documented experience specializing in such work for a minimum of five years.

1.06 REGULATORY REQUIREMENTS

- A. All concrete construction shall meet state and local code requirements.

1.07 MEASUREMENT OF MATERIALS

- A. Measurement shall be by weight by weighing devices accurate within 1% except that water may be measured by either weight or volume and the water measuring device shall be controllable to one-half of one percent.

PART 2 - PRODUCTS

2.01 MATERIALS:

- A. Cement: Cement shall be Portland cement Type I, conforming to ASTM Specification C-150. Type III High Early Cement shall be used between December 1st and April 1st.
- B. Only one brand of cement shall be used for all structural concrete to be left exposed, so that even coloring is assured for all such surfaces.
- C. Fine Aggregate: Sand for concrete work shall conform to ASTM Specification C-33, and shall be composed of clean, hard, durable, uncoated grains free from silt, loam and clay.
- D. Coarse Aggregate: Coarse aggregate shall be gravel or crushed stone conforming to ASTM Specification C-33 and shall be composed of clean, hard, durable, uncoated grains of strong material. Maximum size of aggregate shall be 1 inch.
- E. Water: Water used in mixing concrete shall be clean and free from injurious amounts of oils, acids, alkalis, organic materials, or other deleterious substances.

- F. Metal Reinforcement: Reinforcing bars shall conform to (ASTM Designation: A 615/A 615M, Grade 60, deformed.
- G. Wire Fabric: Welded wire fabric for concrete reinforcement shall conform to ASTM Designation A-185.
- H. Metal Accessories: Include all spacers, chairs, ties and other devices necessary for properly placing, spacing, supporting and fastening reinforcement in place.
- I. Floor Hardener: Floor Hardener in all areas where floor finish is exposed concrete, not otherwise covered or given floor coating shall be Lapidolith as manufactured by L. Sonneborn Sons, Inc., Flintox Liquid manufactured by Toch Bros., Inc., Hornolith manufactured by A.C. Horn Products of Dewey and Almy Chemical Division, W.R. Grace & Co., or Agatex manufactured by Devoe-Truscon. Number of coats and application procedure shall be in strict accordance with applicable manufacturers specification.
- J. Inserts: Inserts shall be either adjustable, threaded or wedge types depending on use as manufactured by Hohmann & Barnard, Inc., 205 East 53rd Street, New York, New York.
- K. Admixtures: The use of any admixtures other than those which may be specified, shall be used only when and as approved in writing by the Architect. Anti-freeze admixtures shall not be used. All exposed concrete shall have Pozzo-lith additive and Dorex air entraining additive.

2.02 MIXES

- A. Concrete details, plain or reinforced to conform to the current provisions of the A.C.I. Code. Design and strength of concrete 3000 lbs. per sq. inch at 28 days; minimum cement content 6 bags per cu. yd. of concrete and not more than 6-1/2 gallons of water per bag of cement shall be used to maintain proper strength, workability and consistency. Maximum slump shall be 5" however, exposed concrete shall have a maximum slump of 4" plus or minus 2".
- B. Design of Mixes: The testing laboratory, selected by the Architect shall prepare the designs of mixes for the strength of concrete specified to be used. For trial mixes, use identical proportions of cement and aggregate that will be used for job mix. Tests shall be in accordance with ASTM C-192 and C-39. Laboratory trial mix shall develop concrete comprehensive strength 15% higher than required minimum. Prepare mix design for each type of cement.

2.03 MIXING OF CONCRETE:

- A. Equipment: The mixing equipment shall be capable of combining the aggregates, cement and water within the specified time into a thoroughly mixed and uniform mass and of discharging the mixture without separation.
- B. Truck Mixing: Truck mixers shall be of the revolving drum type, watertight, and so constructed that the concrete can be mixed to insure a uniform distribution of materials. All solid materials for the concrete shall be accurately measured in accordance with section on measuring and charged into the drum at the proportioning plant. The truck mixer shall be equipped with a tank for carrying water, and the tank equipped with a device by which the quantity of water added can be readily verified. Only the predetermined amount of water shall be added to the dry mixture at the site. Truck mixing shall be continued for not less than fifty revolutions after all ingredients,

including the water, are in the drum and shall not continue for more than ten minutes before being used.

- C. Ready-mixed concrete shall be mixed and delivered in accordance with ASTM Designation C-94.
- D. Hand Mixing: When hand mixing is authorized, it shall be done on a watertight platform and in such a manner as to insure a uniform distribution of the materials throughout the mass. Mixing shall be continued until a homogeneous mixture of the required consistency is obtained.
- E. Retempering: The retempering of concrete or mortar which has partially hardened will not be permitted.

2.04 QUALITY CONTROL

- A. Concrete Tests: Tests of concrete shall be made by the testing laboratory. Not less than one test, or as may be directed by the Architect, for each 100 cu. yd. of concrete for each strength of concrete placed will be required with a minimum of one test for each day's pour. Not less than four specimens will be made and stored by the Contractor for each test. All specimen shall be cured and tested by the Laboratory. Specimen shall be made and tested in accordance with current ASTM Specifications C-39 and C-31. Slump tests shall be made on each batch tested in accordance with current ASTM Specification C-143.
- B. Each test shall consist of four specimens of which one cylinder shall be tested after 7 days; two cylinders shall be tested after 28 days; fourth cylinder shall be tested at 45 days only when 28 day tests are below specified strength. In all cases where strength of specimen falls below required minimum ultimate compressive strength, the Architect shall have the right to make whatever changes are necessary to secure the required strength.

2.05 CEMENT FINISHES:

- A. Concrete Floor Slab Finishes: Finished floor slab surfaces shall be true plane surfaces with a tolerance of 1/8" in 10' unless otherwise indicated. Surfaces shall be pitched to drains. The dusting of finished surfaces with dry materials will not be permitted.
- B. Monolithic Finish: Floor slabs shall be finished by tamping the concrete with special tools to force the coarse aggregate away from the surface then screeding and floating with straight edges to bring the surface to the required finish level. While the concrete is still green but sufficiently hardened to bear a man's weight without deep imprint, it shall be wood-floated to a true, even plane with no coarse aggregate visible. Sufficient pressure shall be used on the wood float to bring moisture to the surface. After surface moisture has disappeared, surfaces shall be steel-troweled to a smooth, even, impervious finish free from trowel marks.
- E. Steel-Trowel Finish: shall be provided for floor slabs in rooms and spaces to have exposed concrete floor finish and floor slabs that are to receive vinyl tile floor finishes and where thin set quarry tile floors are indicated.

PART 3 - EXECUTION

3.01 PLACING OF CONCRETE:

- A. Concrete shall be handled from the mixer and in the case of truck-mixed concrete, from the transporting vehicles to the place of final deposit as rapidly as practicable by methods which shall prevent the separation or loss of the ingredients. Under no circumstances shall concrete that has partly hardened be deposited in the work.
- B. Forms for walls or thin section of considerable height shall be provided with opening or other devices that will permit the placing of concrete without segregation. Concrete, during and immediately after deposit, shall be thoroughly compacted by spading, rodding, or by mechanical vibration.
- C. Concrete shall be deposited continuously or in layers of such thickness that no concrete will be deposited on concrete which has hardened sufficiently to cause a formation of seams and planes of weakness within the section. If a section cannot be placed continuously, construction joints may be located at points as provided for in the drawings, or approved by the Architect. Do not secure vibrator, to forms or reinforcement, operate in place not less than fifteen (15) seconds and of sufficient duration to produce concrete of uniform and maximum density with even distributing of ingredients and complete embedment of reinforcement. 1-1/2" head vibrators shall be provided for wall and column pours.
- D. Approved external mechanical vibrating equipment applied lightly to exterior studs and walls when such vibration is necessary to secure surfaces that are even, dense, free from aggregate pockets and honeycomb. Vibration shall be carried on continuously with the placing of concrete. Vibration shall not be used in partly set concrete.
- E. No concrete to be placed when temperatures are below 32 degrees F.
- F. Concrete shall not be deposited during rains unless adequately protected, and in any case shall be protected from rain until it has hardened sufficiently to resist the formation of seams and planes of weakness within the section. The top surface shall be generally level.

3.02 CURING AND PROTECTION:

- A. Protect all concrete work against injury from elements and defacement of any nature during construction operations, which included protection of mechanical rooms with plywood prior and during mechanical installation.
- B. When the temperature is below 30 degrees F., or is likely to fall below 35 degrees F., adequate equipment shall be provided for heating the concrete materials and maintaining the concrete at not less than 50 degrees F. for at least 72 hours for Type I, or for as much time as is necessary to insure proper rate of curing of the concrete. Temperature of the separate materials, including the mixing water, when placed in the mixer, shall not exceed 140 degrees F. When placed in forms, the concrete shall have a temperature between 60 degrees F., and 90 degrees F. The use of salts, chemicals to prevent freezing or accelerating agents shall not be permitted.

- C. Keep exposed surfaces of concrete moist for a period of at least seven (7) days after being placed. Protect all concrete except slabs on ground, placed during hot weather, from rays of sun and air currents, cover with two layers of wet burlap and keep wet for seven (7) days.
- D. Keep concrete, except slabs, as moist as practicable during curing period in temperatures below 40 degrees F.
- E. Curing of slabs shall be done by spraying Demicoin Cure-Hard in accordance with manufacturer's directions.

3.03 FLOOR SLABS:

- A. Slabs on Grade: concrete base slabs shall be installed over 8 inch bank run gravel fill and shall be reinforced with wire mesh lapped 6". Prior to starting the floor work, verify completion of all piping and any mechanical equipment occurring below the floor level. Electrical conduit, if occurring, shall be installed prior to installation of wire mesh.
- B. Provide depressions in slabs required to receive various floor finishes.
- C. Concrete shall be firmly tamped and the surface of slabs to be screeded and floated true and level, (the mixing water content in the concrete to be kept uniform to avoid slump irregularity in the slab surfaces). Pipe screeds shall be installed in ground or on forms, wet screeds prohibited.
- D. Slab surfaces shall be finished and steel troweled to receive specified finished floor material directly. Floor showing trowel marks, swirls, depressions, etc. will be rejected. All exposed slabs shall not have any deviations exceeding 1/8" in 16'. Finish shall have a hard surface without air pockets or other defects. In the event that finishing workmanship is deemed inadequate by the Architect, the contractor shall modify his methods to improve the resulting finish.
- E. Floor slabs to be poured before interior partitions are erected.
- F. Perimeter Filler: Cleavage joints between vertical concrete or other surfaces and floor slabs on grade shall be 1/2" wide and shall extend the full depth of slab. The joints shall be filled with premoulded expansion joint filler to within 1/2" of top of slab. The top of the joint shall be filled with an approved joint sealer.
- G. INTEGRAL DAMPPROOFING: The contractor shall use in slabs on grade "Anti-Hydro" dampproofing or an approved equal integral dampproofing done in strict accordance with manufacturer's printed instructions.

- 3.04 ANCHOR BOLTS:** The structural steel contractor will furnish an approved anchor bolt location plan. General Contractor shall set anchor bolts and be responsible for position and height of bolt projection. Modification to steel due to incorrect position of anchor bolts will be borne by the General Contractor.

3.05 CONCRETE FLOOR SLAB INFILL:

- A. Following cutting and removing existing concrete floor slab and installation of under-slab utilities provide and install new reinforced concrete infill as follows.
- B. See drawings for location of concrete floor slab infill.

- C. Concrete infill is to be 4" thick of 4000 psi concrete on an 8 inch thick compacted gravel base course. (Unless thicknesses of concrete and base are noted otherwise on the drawings)
- D. Provide reinforcing of w.w.f. 6x6 – w4 x w4 with a 2 inch minimum cover.
- E. Provide new 15 mil vapor barrier above new gravel base.
- F. Pin new concrete infill to existing concrete floor slab using 5/8" diameter 12 inch long steel rods inserted into existing core-drilled slab minimum of 6 inches. Install maximum of 2 feet o.c. around perimeter of infilled area.
- G. Surface of new concrete infill to match level with existing surrounding concrete slab.
- H. New slab surface is to be finished and steel troweled to match finish of surrounding concrete slab or as required to accept new floor finish.
Floor showing trowel marks, swirls, depressions, etc. will be rejected.
All exposed slabs shall not have any deviations exceeding 1/8" in 10'.
Finish shall have a hard surface without air pockets or other defects.
In the event that finishing workmanship is deemed inadequate by the Architect, the contractor shall modify his methods to improve the resulting finish.

3.06 CONCRETE EQUIPMENT PADS:

- A. Concrete equipment pads are to be constructed in the locations, to the sizes and details indicated on the drawings.
- B. Pads are to be 1'-4" thick of 4000 psi concrete on a 12 inch thick compacted gravel base course. (Unless thicknesses are noted otherwise on the drawings)
- C. Provide reinforcing as shown on drawings with a 3 inch minimum cover.
- D. Surface to have a 1:50 pitch for drainage. The surface shall drain so that no water stands on the surface.
- E. Concrete shall be struck off with a wood screed and then floated with a wood float and broom to produce an even, gritty surface.
- F. All exposed corners of slabs shall be edged with a 3/4" chamfer.
- G. Concrete pads shall be cured by covering with wetted burlap kept damp for 7 days or other approved method.

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SECTION 04 22 23

REINFORCED MASONRY

PART 1 - GENERAL

1.01 SUMMARY

A. Related Documents:

The Drawings and general provisions of the Contract, including General and Supplementary General Conditions, and Division 1 Requirements, apply to the work in this Section.

1.02 SECTION INCLUDES

A. This Section includes unit masonry assemblies consisting of the following:

1. Concrete masonry units.
2. Mortar and grout.
3. Reinforcing steel.
4. Masonry joint reinforcement.
5. Ties and anchors.
6. Miscellaneous masonry accessories.

B. Products furnished, but not installed, under this Section include the following:

1. Adjustable masonry anchors welded to structural steel frame.

C. Products installed, but not furnished, under this Section include the following:

1. Steel lintels for unit masonry.
2. Steel door frame anchors.

1.03 RELATED SECTIONS

A. Related Sections include the following:

1. Section 03 31 00 – Concrete Construction
2. Section 04 22 24 - Reinforced Masonry - Interior
3. Section 04 26 13 - Veneer Masonry
4. Section 05 50 00 - Miscellaneous Metal Work
5. Section 07 11 13 - Bituminous Dampproofing
6. Section 07 21 13 – Board Insulation
7. Section 07 92 13 – Joint Sealants
8. Section 08 12 13 – Steel Door Frames

1.04 PERFORMANCE REQUIREMENTS

A. Provide unit masonry that develops the following net-area compressive strengths (f'm) at 28 days.

Determine compressive strength of masonry by testing masonry prisms according to ASTM C 1314.

1. For Concrete Unit Masonry: f'm = 1500 psi.

B. Masonry Grout: 2000 psi compressive strength at 28 days.

1.05 SUBMITTALS

A. Comply with provisions of Section 01 33 00.

B. Product Data: For each different masonry unit, accessory, and other manufactured product specified.

C. Shop Drawings: Show fabrication and installation details for the following:

1. Reinforcing Steel: Detail bending and placement of unit masonry reinforcing bars. Comply with ACI 315, "Details and Detailing of Concrete Reinforcement." Show elevations of reinforced walls.
2. Fabricated Flashing: Detail corner units, end-dam units, and other special applications.

D. Samples for Verification: For the following:

1. Full-size units for each different exposed masonry unit required, showing the full range of exposed colors, textures, and dimensions to be expected in the completed construction.
 2. Colored mortar Samples for each color required, showing the full range of colors expected in the finished construction. Make samples using the same sand and mortar ingredients to be used on Project. Label Samples to indicate types and amounts of pigments used.
 3. Accessories embedded in the masonry.
 - E. Qualification Data: For firms and persons specified in "Quality Assurance" Article.
 - F. Material Test Reports: From a qualified testing agency indicating and interpreting test results of the following for compliance with requirements indicated:
 1. Each type of masonry unit required.
 - a. Include size-variation data for cmu, verifying that actual range of sizes falls within specified tolerances.
 - b. Include test results, measurements, and calculations establishing net-area compressive strength of masonry units.
 2. Mortar complying with property requirements of ASTM C 270.
 3. Grout mixes complying with compressive strength requirements of ASTM C 476. Include description of type and proportions of grout ingredients.
 - G. Material Certificates: Signed by manufacturers certifying that each of the following items complies with requirements:
 1. Each type of masonry unit required.
 - a. Include size-variation data for cmu, verifying that actual range of sizes falls within specified tolerances.
 - b. Include test data, measurements, and calculations establishing net-area compressive strength of masonry units.
 2. Each cement product required for mortar and grout, including name of manufacturer, brand, type, and weight slips at time of delivery.
 3. Each combination of masonry unit type and mortar type. Include statement of net-area compressive strength of masonry units, mortar type, and net-area compressive strength of masonry determined according to Tables 1 and 2 in ACI 530.1/ASCE 6/TMS 602.
 4. Each material and grade indicated for reinforcing bars.
 5. Each type and size of joint reinforcement.
 6. Each type and size of anchor, tie, and metal accessory.
 - H. Cold-Weather Procedures: Detailed description of methods, materials, and equipment to be used to comply with cold-weather requirements.
 - I. Hot-Weather Procedures: Detailed description of methods, materials, and equipment to be used to comply with hot-weather requirements.
- 1.06 QUALITY ASSURANCE
- A. Comply with provisions of Section 01 45 00.
 - B. Testing Agency Qualifications: An independent testing agency, acceptable to authorities having jurisdiction, qualified according to ASTM C 1093 to conduct the testing indicated, as documented according to ASTM E 548.
 - C. Source Limitations for Masonry Units: Obtain exposed masonry units of a uniform texture and color, or a uniform blend within the ranges accepted for these characteristics, through one source from a single manufacturer for each product required.
 - D. Source Limitations for Mortar Materials: Obtain mortar ingredients of a uniform quality, including color for exposed masonry, from one manufacturer for each cementitious component and from one source or producer for each aggregate.
 - E. Preconstruction Testing Service: Engage a qualified independent testing agency to perform the following preconstruction testing:

1. Concrete Masonry Unit Test: For each concrete masonry unit indicated, per ASTM C 140.
2. Prism Test: For each type of wall construction indicated, per ASTM C 1314.
3. Mortar Test: For mortar properties per ASTM C 270.
4. Grout Test: For compressive strength per ASTM C 1019.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Comply with Section 01 60 00.
- B. Store masonry units on elevated platforms in a dry location. If units are not stored in an enclosed location, cover tops and sides of stacks with waterproof sheeting, securely tied. If units become wet, do not install until they are dry.
 1. Protect Type I concrete masonry units from moisture absorption so that, at the time of installation, the moisture content is not more than the maximum allowed at the time of delivery.
- C. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.
- D. Store aggregates where grading and other required characteristics can be maintained and contamination avoided.
- E. Deliver preblended, dry mortar mix in moisture-resistant containers designed for lifting and emptying into dispensing silo. Store preblended, dry mortar mix in delivery containers on elevated platforms, under cover, and in a dry location or in a metal dispensing silo with weatherproof cover.
- F. Store masonry accessories, including metal items, to prevent corrosion and accumulation of dirt and oil.

1.08 PROJECT CONDITIONS

- A. Protection of Masonry: During construction, cover tops of walls, projections, and sills with waterproof sheeting at end of each day's work as necessary. Cover partially completed masonry when construction is not in progress.
- B. Stain Prevention: Prevent grout, mortar, and soil from staining the face of masonry to be left exposed or painted. Immediately remove grout, mortar, and soil that come in contact with such masonry.
 1. Protect base of walls from rain-splashed mud and from mortar splatter by coverings spread on ground and over wall surface.
 2. Protect sills, ledges, and projections from mortar droppings.
 3. Protect surfaces of window and door frames, as well as similar products with painted and integral finishes, from mortar droppings.
 4. Turn scaffold boards near the wall on edge at the end of each day to prevent rain from splashing mortar and dirt onto completed masonry.
- C. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. Remove and replace unit masonry damaged by frost or by freezing conditions. Comply with cold-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.
 1. Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is 40 deg F and above and will remain so until masonry has dried, but not less than 7 days after completing cleaning.
- D. Hot-Weather Requirements: Protect unit masonry work when temperature and humidity conditions produce excessive evaporation of water from mortar and grout. Provide artificial shade and wind breaks and use cooled materials as required. Comply with hot-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.
 1. When ambient temperature exceeds 100 deg F, or 90 deg F with a wind velocity greater than 8 mph, do not spread mortar beds more than 48 inches ahead of masonry. Set masonry units within one minute of spreading mortar.

1.09 REFERENCE STANDARDS

- A. ACI 530/ASCE 5/TMS 402: Building Code Requirements for Masonry Structures
- B. ACI 530.1/ASCE 6/TMS 602: Specification for Masonry Structures
- C. ASTM A82: Standard Specification for Steel Wire, Plain, for Concrete Reinforcement
- D. ASTM C90: Standard Specification for Load bearing Concrete Masonry Units
- E. ASTM C144: Standard Specification for Aggregate for Masonry Mortar
- F. ASTM C150: Standard Specification for Portland Cement
- G. ASTM C207: Standard Specification for Hydrated Lime for Masonry Purposes
- H. ASTM C270: Standard Specification for Mortar for Unit Masonry
- I. ASTM C404: Standard Specification for Aggregates for Masonry Grout
- J. ASTM C476: Standard Specification for Grout for Masonry
- K. ASTM C780: Standard Test Method for Preconstruction and Construction Evaluation of Mortars for Plain and Reinforced Unit Masonry
- L. ASTM C1019: Standard Test Method for Sampling and Testing Grout
- M. ASTM C1314: Standard Test Method for Compressive Strength of Masonry Prisms
- N. AWS D1.4: American Welding Society Structural Welding Code – Reinforcing Steel

PART 2 - PRODUCTS

2.01 CONCRETE MASONRY UNITS

- A. General: Provide shapes indicated and as follows:
 - 1. Provide special shapes for lintels, corners, jambs, sash, control joints, headers, bonding, and other special conditions.
- B. Concrete Masonry Units (Decorative and Standard): ASTM C 90
 - 1. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 1900 psi.
 - 2. Weight Classification: Normal weight, unless otherwise indicated.
 - 3. Provide Type I, moisture-controlled units.
- C. Color
 - 1. Exterior split face CMU color is to be integral as required to match the existing surrounding concrete block and is to be approved by the Architect.
- D. Finish: Exterior single wythe CMU is to have a split face exposed exterior finish with a smooth face on the interior to match existing.
- E. Additives
 - 1. All concrete masonry units shall be Dry-Block made with the integral water-repellent admixture manufactured by W.R. Grace & Co. or equal.
- F. Water resistant mortar and grout to be used with water resistant concrete masonry units.
 - 1. Mortar and grout to be composed and meet the same requirements of the mortar and grout noted in paragraph 2.03 except for the color and admixture noted below.
 - 2. Color to be selected by Architect from standard manufacturer colors.
 - 3. Mortar shall contain Dry-Block Mortar Admix as manufactured by W.R. Grace & Co. or equal.

2.02 MORTAR AND GROUT MATERIALS

- A. Portland Cement: ASTM C 150, Type I or II, except Type III may be used for cold-weather construction. Provide natural color or white cement as required to produce mortar color indicated.
- B. Hydrated Lime: ASTM C 207, Type S.
- C. Portland Cement-Lime Mix: Packaged blend of portland cement complying with ASTM C 150, Type I or Type III, and hydrated lime complying with ASTM C 207.
- D. Mortar Cement: ASTM C 1329.

- E. Masonry Cement: ASTM C 91.
 - 1. For pigmented mortar, use a colored cement formulation as required to produce the color indicated or, if not indicated, as selected from manufacturer's standard formulations.
 - 2. For colored-aggregate mortar, use natural color or white cement as necessary to produce required mortar color.
 - F. Aggregate for Mortar: ASTM C 144; except for joints less than 1/4 inch thick, use aggregate graded with 100 percent passing the No. 16 sieve.
 - 1. White-Mortar Aggregates: Natural white sand or ground white stone.
 - 2. Colored-Mortar Aggregates: Natural-colored sand or ground marble, granite, or other sound stone; of color necessary to produce required mortar color.
 - G. Aggregate for Grout: ASTM C 404.
 - H. Mortar Pigments: Natural and synthetic iron oxides and chromium oxides, compounded for use in mortar mixes. Use only pigments with a record of satisfactory performance in masonry mortar.
 - I. Epoxy Pointing Mortar: ASTM C 395, epoxy-resin-based material formulated for use as pointing mortar for structural-clay tile facing units (and approved for such use by manufacturer of the units); in color indicated or, if not otherwise indicated, as selected by Architect from manufacturer's colors.
 - J. Water: Potable.
 - K. Color to be selected by Architect from standard manufacturer colors.
 - L. Mortar shall contain Dry-Block Mortar Admix as manufactured by W.R. Grace & Co. or equal.
- 2.03 REINFORCING STEEL
- A. Comply with reinforcing requirements in Section 03300, Cast-in-Place Concrete.
 - B. Uncoated Steel Reinforcing Bars: ASTM A 615/A 615M; Grade 60.
 - C. Epoxy-Coated Reinforcing Steel: ASTM A 615/A 615M, Grade 60; epoxy coated to comply with ASTM A 775/A 775M.
- 2.04 MASONRY JOINT REINFORCEMENT
- A. General: ASTM A 951 and as follows:
 - 1. Hot-dip galvanized, carbon-steel wire for both interior and exterior walls.
 - 2. Wire Size for Side Rods: W2.8 or 0.188-inch diameter.
 - 3. Wire Size for Cross Rods: W2.8 or 0.188-inch diameter.
 - 4. Provide in lengths of not less than 10 feet, with prefabricated corner and tee units where indicated.
 - B. For single-wythe masonry, provide either ladder or truss type with single pair of side rods and cross rods spaced not more than 16 inches o.c.
- 2.05 TIES AND ANCHORS, GENERAL
- A. General: Provide ties and anchors, specified in subsequent articles, made from materials that comply with this Article, unless otherwise indicated.
 - B. Hot-Dip Galvanized Carbon-Steel Wire: ASTM A 82; with ASTM A 153, Class B-2 coating.
 - C. Steel Sheet, Galvanized after Fabrication: ASTM A 366/A 366M cold-rolled, carbon-steel sheet hot-dip galvanized after fabrication to comply with ASTM A 153.
 - D. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
- 2.06 BENT WIRE TIES
- A. General: Rectangular units with closed ends and not less than 4 inches wide. Z-shaped ties with ends bent 90 degrees to provide hooks not less than 2 inches long may be used for masonry constructed from solid units or hollow units laid with cells horizontal.
 - 1. Where coursing between wythes does not align, use adjustable ties composed of 2 parts; 1 with pintles, the other with eyes; with maximum misalignment of 1-1/4 inches.
 - B. Wire: Fabricate from 3/16-inch- 1/4-inch- diameter, hot-dip galvanized steel wire.

2.07 RIGID ANCHORS

- A. General: Fabricate from steel bars as follows:
 - 1. 1-1/2 inches wide by 1/4 inch thick by 24 inches long, with ends turned up 2 inches or with cross pins.
 - 2. Finish: Hot-dip galvanized to comply with ASTM A 153.
 - 3. Fabricate wire tie sections from 0.1875-inch- diameter, hot-dip galvanized steel wire.

2.08 MISCELLANEOUS MASONRY ACCESSORIES

- A. Compressible Filler: Premolded filler strips complying with ASTM D 1056, Grade 2A1; compressible up to 35 percent; of width and thickness indicated; formulated from PVC.
- B. Preformed Control-Joint Gaskets: Material as indicated below, designed to fit standard sash block and to maintain lateral stability in masonry wall; size and configuration as indicated.
- C. Bond-Breaker Strips: Asphalt-saturated, organic roofing felt complying with ASTM D 226, Type I (No. 15 asphalt felt).
- D. Reinforcing Bar Positioners: Wire units designed to fit into mortar bed joints spanning masonry unit cells with loops for holding reinforcing bars in center of cells. Units are formed from 0.142-inch steel wire, hot-dip galvanized after fabrication.

2.09 MASONRY CLEANERS

- A. Job-Mixed Detergent Solution: Solution of 1/2-cup dry measure tetrasodium polyphosphate and 1/2-cup dry measure laundry detergent dissolved in 1 gal. of water.
- B. Proprietary Acidic Cleaner: Manufacturer's standard-strength cleaner designed for removing mortar/grout stains, efflorescence, and other new construction stains from new masonry without discoloring or damaging masonry surfaces. Use product expressly approved for intended use by cleaner manufacturer and manufacturer of masonry units being cleaned.

2.10 MORTAR AND GROUT MIXES

- A. General: Do not use admixtures, including pigments, air-entraining agents, accelerators, retarders, water-repellent agents, antifreeze compounds, or other admixtures, unless otherwise indicated.
- B. Preblended, Dry Mortar Mix: Furnish dry mortar ingredients in the form of a preblended mix. Measure quantities by weight to ensure accurate proportions, and thoroughly blend ingredients before delivering to Project site.
- C. Mortar for Unit Masonry: Comply with ASTM C 270, Property Specification.
 - 1. For masonry below grade, in contact with earth, and where indicated, use Type M.
 - 2. For reinforced masonry and where indicated, use Type S.
- D. Colored-Aggregate Mortar: Produce required mortar color by using colored aggregates combined with selected cementitious materials.
 - 1. Mix to match Architect's sample.
- E. Grout for Unit Masonry: Comply with ASTM C 476.
 - 1. Use grout of type indicated or, if not otherwise indicated, of type (fine or coarse) that will comply with Table 5 of ACI 530.1/ASCE 6/TMS 602 for dimensions of grout spaces and pour height.
 - 2. Provide grout with a slump of 8 to 10 inches as measured according to ASTM C 143.
- F. Epoxy Pointing Mortar: Mix epoxy pointing mortar to comply with mortar manufacturer's directions.
- G. Mortar shall contain Dry-Block Mortar Admix as manufactured by W.R. Grace & Co. or equal.

2.11 INSULATION

- A. KORFIL U-SHAPED expanded polystyrene insulation inserts as manufactured by Concrete Block Insulating Systems Inc. or equal. Installed into the single wythe CMU by the block manufacturer.

2.12 SOURCE QUALITY CONTROL

- A. Owner will engage a qualified independent testing agency to perform source quality-control testing indicated below:
 - 1. Retesting of materials failing to meet specified requirements shall be done at Contractor's expense.
- B. Concrete Masonry Unit Tests: For each type of concrete masonry unit indicated, units will be tested according to ASTM C 140.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance.
 - 1. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance.
 - 2. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION, GENERAL

- A. Build single-wythe walls to the actual widths of masonry units, using units of widths indicated.
- B. Cut masonry units with motor-driven saws to provide clean, sharp, unchipped edges. Cut units as required to provide a continuous pattern and to fit adjoining construction. Where possible, use full-size units without cutting. Allow units cut with water-cooled saws to dry before placing, unless wetting of units is specified. Install cut units with cut surfaces and, where possible, cut edges concealed.
- C. Select and arrange units for exposed unit masonry to produce a uniform blend of colors and textures.
- D. Matching Existing Masonry: Match coursing, bonding, color, and texture of existing masonry.

3.03 CONSTRUCTION TOLERANCES

- A. Comply with tolerances in ACI 530.1/ASCE 6/TMS 602 and the following:
- B. For conspicuous vertical lines, such as external corners, door jambs, reveals, and expansion and control joints, do not vary from plumb by more than 1/4 inch in 20 feet, nor 1/2 inch maximum.
- C. For vertical alignment of exposed head joints, do not vary from plumb by more than 1/4 inch in 10 feet, nor 1/2 inch maximum.
- D. For conspicuous horizontal lines, such as exposed lintels, sills, parapets, and reveals, do not vary from level by more than 1/4 inch in 20 feet, nor 1/2 inch maximum.
- E. For exposed head joints, do not vary from thickness indicated by more than plus or minus 1/8 inch. Do not vary from adjacent bed-joint and head-joint thicknesses by more than 1/8 inch.

3.04 LAYING MASONRY

- A. Fill space between hollow-metal frames and masonry solidly with mortar, unless otherwise indicated.

3.05 MORTAR BEDDING AND JOINTING

- A. Lay hollow masonry units as follows:
 - 1. With full mortar coverage on horizontal and vertical face shells.
 - 2. Bed webs in mortar.

3.06 CAVITIES

- A. Keep cavities clean of mortar droppings, debris, and other materials during construction. Strike joints facing cavities flush.

3.07 MASONRY JOINT REINFORCEMENT

- A. General: Provide continuous masonry joint reinforcement as indicated. Install entire length of longitudinal side rods in mortar with a minimum cover of 5/8 inch on exterior side of walls, 1/2 inch elsewhere. Lap reinforcement a minimum of 6 inches. Space reinforcing a maximum of 16" on center.

3.08 LINTELS

- A. Install steel lintels where indicated or as required for masonry openings shown on drawings. Lintel sizes to be sufficient to support weight of masonry and deflection requirements.
- B. Provide minimum bearing of 8 inches at each jamb, unless otherwise indicated.

3.09 FIELD QUALITY CONTROL

- A. Owner will engage a qualified independent testing agency to perform field quality-control testing indicated below.
 - 1. Retesting of materials failing to meet specified requirements shall be done at Contractor's expense.
- B. Testing Frequency: Tests and Evaluations listed in this Article will be performed during construction for each 5000 sq. ft. of wall area or portion thereof.
- C. Mortar properties will be tested per ASTM C 780.
- D. Grout will be sampled and tested for compressive strength per ASTM C 1019.
- E. Concrete Masonry Unit Tests: For each type of concrete masonry unit indicated, units will be tested according to ASTM C 140.
- F. Prism-Test Method: For each type of wall construction indicated, masonry prisms will be tested per ASTM C 1314, and as follows:
 - 1. Two prisms for each type of masonry.

3.10 REPAIRING, POINTING, AND CLEANING

- A. In-Progress Cleaning: Clean unit masonry as work progresses by dry brushing to remove mortar fins and smears before tooling joints.
- B. Final Cleaning: After mortar is thoroughly set and cured, clean exposed masonry as follows:
 - 1. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.
 - 2. Test cleaning methods on sample wall panel; leave one-half of panel uncleaned for comparison purposes. Obtain Architect's approval of sample cleaning before proceeding with cleaning of masonry.
 - 3. Protect adjacent stone and nonmasonry surfaces from contact with cleaner by covering them with liquid strippable masking agent, polyethylene film, or waterproof masking tape.
 - 4. Wet wall surfaces with water before applying cleaners; remove cleaners promptly by rinsing the surfaces thoroughly with clear water.
 - 5. Clean masonry with a proprietary acidic cleaner applied according to manufacturer's written instructions.

3.11 MASONRY WASTE DISPOSAL

- A. Recycling: Unless otherwise indicated, excess masonry materials are Contractor's property. At completion of unit masonry work, remove from Project site.
- B. Disposal as Fill Material: Dispose of clean masonry waste, including broken masonry units, waste mortar, and excess or soil-contaminated sand, by crushing and mixing with fill material as fill is placed.
- C. Excess Masonry Waste: Remove excess, clean masonry waste that cannot be used as fill, as described above, and other masonry waste, and legally dispose of off Owner's property.

END OF SECTION

SECTION 04 22 24

REINFORCED MASONRY

(NON-LOAD BEARING INTERIOR PARTITIONS)

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. This Section includes unit masonry assemblies consisting of the following:
 - 1. Concrete masonry units. (To be incorporated in non-load bearing interior partitions)
 - 2. Mortar and grout.
 - 3. Reinforcing steel.
 - 4. Masonry joint reinforcement.
 - 5. Ties and anchors.
 - 6. Miscellaneous masonry accessories.
- B. Products furnished, but not installed, under this Section include the following:
 - 1. Adjustable masonry anchors welded to structural steel frame.
- C. Products installed, but not furnished, under this Section include the following:
 - 1. Steel lintels for unit masonry.
 - 2. Steel door frame anchors.

1.03 RELATED SECTIONS

- A. Related Sections include the following:
 - 1. Section 03 31 00 – Concrete Construction

1.04 PERFORMANCE REQUIREMENTS

- A. Provide unit masonry that develops the following net-area compressive strengths (f'm) at 28 days. Determine compressive strength of masonry by testing masonry prisms according to ASTM C 1314.
 - 1. For Concrete Unit Masonry: f'm = 1500 psi.
- B. Masonry Grout: 3000 psi compressive strength at 28 days.

1.05 SUBMITTALS

- A. Comply with provisions of Section 01 33 00.
- B. Product Data: For each different masonry unit, accessory, and other manufactured product specified.
- C. Shop Drawings: Show fabrication and installation details for the following:
 - 1. Reinforcing Steel: Detail bending and placement of unit masonry reinforcing bars. Comply with ACI 315, "Details and Detailing of Concrete Reinforcement." Show elevations of reinforced walls.
- D. Samples for Verification: For the following:
 - 1. Full-size units for each different exposed masonry unit required, showing the full range of exposed colors, textures, and dimensions to be expected in the completed construction.
 - 2. Colored mortar: Samples for each color required, showing the full range of colors expected in the finished construction. Make samples using the same sand and mortar ingredients to be used on Project. Label Samples to indicate types and amounts of pigments used.
 - 3. Accessories embedded in the masonry.
- E. Qualification Data: For firms and persons specified in "Quality Assurance" Article.

- F. Material Test Reports: From a qualified testing agency indicating and interpreting test results of the following for compliance with requirements indicated:
 - 1. Each type of masonry unit required.
 - a. Include size-variation data for cmu, verifying that actual range of sizes falls within specified tolerances.
 - b. Include test results, measurements, and calculations establishing net-area compressive strength of masonry units.
 - 2. Mortar complying with property requirements of ASTM C 270.
 - 3. Grout mixes complying with compressive strength requirements of ASTM C 476. Include description of type and proportions of grout ingredients.
- G. Material Certificates: Signed by manufacturers certifying that each of the following items complies with requirements:
 - 1. Each type of masonry unit required.
 - a. Include size-variation data for cmu, verifying that actual range of sizes falls within specified tolerances.
 - b. Include test data, measurements, and calculations establishing net-area compressive strength of masonry units.
 - 2. Each cement product required for mortar and grout, including name of manufacturer, brand, type, and weight slips at time of delivery.
 - 3. Each combination of masonry unit type and mortar type. Include statement of net-area compressive strength of masonry units, mortar type, and net-area compressive strength of masonry determined according to Tables 1 and 2 in ACI 530.1/ASCE 6/TMS 602.
 - 4. Each material and grade indicated for reinforcing bars.
 - 5. Each type and size of joint reinforcement.
 - 6. Each type and size of anchor, tie, and metal accessory.

1.06 QUALITY ASSURANCE

- A. Comply with provisions of Section 01 45 00.
- B. Testing Agency Qualifications: An independent testing agency, acceptable to authorities having jurisdiction, qualified according to ASTM C 1093 to conduct the testing indicated, as documented according to ASTM E 548.
- C. Source Limitations for Masonry Units: Obtain exposed masonry units of a uniform texture and color, or a uniform blend within the ranges accepted for these characteristics, through one source from a single manufacturer for each product required.
- D. Source Limitations for Mortar Materials: Obtain mortar ingredients of a uniform quality, including color for exposed masonry, from one manufacturer for each cementitious component and from one source or producer for each aggregate.
- E. Preconstruction Testing Service: Engage a qualified independent testing agency to perform the following preconstruction testing:
 - 1. Concrete Masonry Unit Test: For each concrete masonry unit indicated, per ASTM C 140.
 - 2. Prism Test: For each type of wall construction indicated, per ASTM C 1314.
 - 3. Mortar Test: For mortar properties per ASTM C 270.
 - 4. Grout Test: For compressive strength per ASTM C 1019.
- F. Fire-Resistance Ratings: Where indicated, provide materials and construction identical to those of assemblies with fire-resistance ratings determined per ASTM E 119 by a testing and inspecting agency, by equivalent concrete masonry thickness, or by another means, as acceptable to authorities having jurisdiction.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Comply with Section 01 60 00.

- B. Store masonry units on elevated platforms in a dry location. If units are not stored in an enclosed location, cover tops and sides of stacks with waterproof sheeting, securely tied. If units become wet, do not install until they are dry.
 - 1. Protect Type I concrete masonry units from moisture absorption so that, at the time of installation, the moisture content is not more than the maximum allowed at the time of delivery.
- C. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.
- D. Store aggregates where grading and other required characteristics can be maintained and contamination avoided.
- E. Deliver preblended, dry mortar mix in moisture-resistant containers designed for lifting and emptying into dispensing silo. Store preblended, dry mortar mix in delivery containers on elevated platforms, under cover, and in a dry location or in a metal dispensing silo with weatherproof cover.
- F. Store masonry accessories, including metal items, to prevent corrosion and accumulation of dirt and oil.

1.08 PROJECT CONDITIONS

- A. Stain Prevention: Prevent grout, mortar, and soil from staining the face of masonry to be left exposed or painted. Immediately remove grout, mortar, and soil that come in contact with such masonry.
 - 1. Protect sills, ledges, and projections from mortar droppings.
 - 2. Protect surfaces of window and door frames, as well as similar products with painted and integral finishes, from mortar droppings.
- B. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. Remove and replace unit masonry damaged by frost or by freezing conditions. Comply with cold-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.
 - 1. Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is 40 deg F and above and will remain so until masonry has dried, but not less than 7 days after completing cleaning.
- C. Hot-Weather Requirements: Protect unit masonry work when temperature and humidity conditions produce excessive evaporation of water from mortar and grout. Provide artificial shade and wind breaks and use cooled materials as required. Comply with hot-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.
 - 1. When ambient temperature exceeds 100 deg F, or 90 deg F with a wind velocity greater than 8 mph, do not spread mortar beds more than 48 inches ahead of masonry. Set masonry units within one minute of spreading mortar.

1.09 REFERENCE STANDARDS

- A. ACI 530/ASCE 5/TMS 402: Building Code Requirements for Masonry Structures
- B. ACI 530.1/ASCE 6/TMS 602: Specification for Masonry Structures
- C. ASTM A82: Standard Specification for Steel Wire, Plain, for Concrete Reinforcement
- D. ASTM C90: Standard Specification for Load bearing Concrete Masonry Units
- E. ASTM C144: Standard Specification for Aggregate for Masonry Mortar
- F. ASTM C150: Standard Specification for Portland Cement
- G. ASTM C207: Standard Specification for Hydrated Lime for Masonry Purposes
- H. ASTM C270: Standard Specification for Mortar for Unit Masonry
- I. ASTM C404: Standard Specification for Aggregates for Masonry Grout
- J. ASTM C476: Standard Specification for Grout for Masonry
- K. ASTM C780: Standard Test Method for Preconstruction and Construction Evaluation of Mortars for Plain and Reinforced Unit Masonry
- L. ASTM C1019: Standard Test Method for Sampling and Testing Grout
- M. ASTM C1314: Standard Test Method for Compressive Strength of Masonry Prisms

N. AWS D1.4: American Welding Society Structural Welding Code – Reinforcing Steel

PART 2 - PRODUCTS

2.01 CONCRETE MASONRY UNITS

- A. General: Provide shapes indicated and as follows:
 - 1. Provide special shapes for lintels, corners, jambs, sash, control joints, headers, bonding, and other special conditions.
 - 2. Provide bullnose units for outside corners, unless otherwise indicated.
- B. Concrete Masonry Units (Decorative and Standard): ASTM C 90
 - 1. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 1900 psi.
 - 2. Weight Classification: Normal weight, unless otherwise indicated.
 - 3. Provide Type I, moisture-controlled units.
- C. Color
 - 1. Exposed concrete block to be painted as specified in Section 09 91 00 – Painting. Color to be selected by Architect from manufacturer's standard colors.
- D. Finish
 - 1. Exposed faces are to be smooth faced.

2.02 MORTAR AND GROUT MATERIALS

- A. Portland Cement: ASTM C 150, Type I or II, except Type III may be used for cold-weather construction. Provide natural color or white cement as required to produce mortar color indicated.
- B. Hydrated Lime: ASTM C 207, Type S.
- C. Portland Cement-Lime Mix: Packaged blend of portland cement complying with ASTM C 150, Type I or Type III, and hydrated lime complying with ASTM C 207.
- D. Mortar Cement: ASTM C 1329.
- E. Masonry Cement: ASTM C 91.
- F. Aggregate for Mortar: ASTM C 144; except for joints less than 1/4 inch thick, use aggregate graded with 100 percent passing the No. 16 sieve.
- G. Aggregate for Grout: ASTM C 404.
- H. Water: Potable.

2.03 REINFORCING STEEL

- A. Comply with reinforcing requirements in Section 03 31 00, Cast-in-Place Concrete.
- B. Uncoated Steel Reinforcing Bars: ASTM A 615/A 615M; Grade 60.
- C. Epoxy-Coated Reinforcing Steel: ASTM A 615/A 615M, Grade 60; epoxy coated to comply with ASTM A 775/A 775M.

2.04 MASONRY JOINT REINFORCEMENT

- A. General: ASTM A 951 and as follows:
 - 1. Hot-dip galvanized, carbon-steel wire.
 - 2. Wire Size for Side Rods: W2.8 or 0.188-inch diameter.
 - 3. Wire Size for Cross Rods: W2.8 or 0.188-inch diameter.
 - 4. Provide in lengths of not less than 10 feet, with prefabricated corner and tee units where indicated.
- B. For single-wythe masonry, provide either ladder or truss type with single pair of side rods and cross rods spaced not more than 16 inches o.c.

2.05 TIES AND ANCHORS, GENERAL

- A. General: Provide ties and anchors made from materials that comply with this Article, unless otherwise indicated.
- B. Hot-Dip Galvanized Carbon-Steel Wire: ASTM A 82; with ASTM A 153, Class B-2 coating.
- C. Steel Sheet, Galvanized after Fabrication: ASTM A 366/A 366M cold-rolled, carbon-steel sheet hot-dip galvanized after fabrication to comply with ASTM A 153.
- D. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.

2.06 MISCELLANEOUS ANCHORS

- A. Anchor Bolts: Steel bolts complying with ASTM A 307, Grade A; with ASTM A 563 hex nuts and, where indicated, flat washers; hot-dip galvanized to comply with ASTM A 153, Class C; of diameter and length indicated and in the following configurations:
 - 1. Headed bolts.
 - 2. Nonheaded bolts, bent in manner indicated.
- B. Post-installed Anchors: Anchors as described below, with capability to sustain, without failure, load imposed within factors of safety indicated, as determined by testing per ASTM E 488, conducted by a qualified independent testing agency.
 - 1. Type: Chemical anchors.
 - 2. Type: Expansion anchors only as noted on drawings.
 - 3. For Post installed Anchors in Concrete: Capability to sustain, without failure, a load equal to four times the loads imposed.

2.07 MISCELLANEOUS MASONRY ACCESSORIES

- A. Bond-Breaker Strips: Asphalt-saturated, organic roofing felt complying with ASTM D 226, Type I (No. 15 asphalt felt).
- B. Reinforcing Bar Positioners: Wire units designed to fit into mortar bed joints spanning masonry unit cells with loops for holding reinforcing bars in center of cells. Units are formed from 0.142-inch steel wire, hot-dip galvanized after fabrication.

2.08 MASONRY CLEANERS

- A. Job-Mixed Detergent Solution: Solution of 1/2-cup dry measure tetrasodium polyphosphate and 1/2-cup dry measure laundry detergent dissolved in 1 gal. of water.
- B. Proprietary Acidic Cleaner: Manufacturer's standard-strength cleaner designed for removing mortar/grout stains, efflorescence, and other new construction stains from new masonry without discoloring or damaging masonry surfaces. Use product expressly approved for intended use by cleaner manufacturer and manufacturer of masonry units being cleaned.

2.09 MORTAR AND GROUT MIXES

- A. General: Do not use admixtures, including pigments, air-entraining agents, accelerators, retarders, water-repellent agents, antifreeze compounds, or other admixtures, unless otherwise indicated.
- B. Preblended, Dry Mortar Mix: Furnish dry mortar ingredients in the form of a preblended mix. Measure quantities by weight to ensure accurate proportions, and thoroughly blend ingredients before delivering to Project site.
- C. Mortar for Unit Masonry: Comply with ASTM C 270, Property Specification.
 - 1. For masonry below grade, in contact with earth, and where indicated, use Type M.
 - 2. For reinforced masonry and where indicated, use Type S.
- D. Grout for Unit Masonry: Comply with ASTM C 476.
 - 1. Use grout of type indicated or, if not otherwise indicated, of type (fine or coarse) that will comply with Table 5 of ACI 530.1/ASCE 6/TMS 602 for dimensions of grout spaces and pour height.

2. Provide grout with a slump of 8 to 10 inches as measured according to ASTM C 143.

2.10 SOURCE QUALITY CONTROL

- A. Concrete Masonry Unit Tests: For each type of concrete masonry unit indicated, units will be tested according to ASTM C 140.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance.
- B. Before installation, examine rough-in and built-in construction to verify actual locations of piping connections.

3.02 INSTALLATION, GENERAL

- A. Build single-wythe walls to the actual widths of masonry units, using units of widths indicated.
- B. Build chases and recesses to accommodate items specified in this Section and in other Sections of the Specifications.
- C. Leave openings for equipment to be installed before completing masonry. After installing equipment, complete masonry to match the construction immediately adjacent to the opening.
- D. Cut masonry units with motor-driven saws to provide clean, sharp, unchipped edges. Cut units as required to provide a continuous pattern and to fit adjoining construction. Where possible, use full-size units without cutting. Allow units cut with water-cooled saws to dry before placing, unless wetting of units is specified. Install cut units with cut surfaces and, where possible, cut edges concealed.

3.03 CONSTRUCTION TOLERANCES

- A. Comply with tolerances in ACI 530.1/ASCE 6/TMS 602 and the following:
- B. For conspicuous vertical lines, such as external corners, door jambs, reveals, and expansion and control joints, do not vary from plumb by more than 1/4 inch in 20 feet, nor 1/2 inch maximum.
- C. For vertical alignment of exposed head joints, do not vary from plumb by more than 1/4 inch in 10 feet, nor 1/2 inch maximum.
- D. For conspicuous horizontal lines, such as exposed lintels, sills, parapets, and reveals, do not vary from level by more than 1/4 inch in 20 feet, nor 1/2 inch maximum.
- E. For exposed head joints, do not vary from thickness indicated by more than plus or minus 1/8 inch. Do not vary from adjacent bed-joint and head-joint thicknesses by more than 1/8 inch.

3.04 LAYING MASONRY WALLS

- A. Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint thicknesses and for accurate location of openings, movement-type joints, returns, and offsets. Avoid using less-than-half-size units, particularly at corners, jambs, and, where possible, at other locations.
- B. Bond Pattern for Exposed Masonry: Lay exposed masonry in a running bond pattern unless noted otherwise. Do not use units with less than nominal 4-inch horizontal face dimensions at corners or jambs.
- C. Stopping and Resuming Work: In each course, rack back one-half-unit length for one-half running bond or one-third-unit length for one-third running bond; do not tooth. Clean exposed surfaces of set masonry, wet clay masonry units lightly if required, and remove loose masonry units and mortar before laying fresh masonry.
- D. Built-in Work: As construction progresses, build in items specified under this and other Sections of the Specifications. Fill in solidly with masonry around built-in items.
- E. Fill space between hollow-metal frames and masonry solidly with mortar, unless otherwise indicated.

- F. Where built-in items are to be embedded in cores of hollow masonry units, place a layer of metal lath in the joint below and rod mortar or grout into core.
- G. Fill cores in hollow concrete masonry units with grout 24 inches under anchor bolt locations unless otherwise indicated.

3.05 MORTAR BEDDING AND JOINTING

- A. Lay hollow masonry units as follows:
 - 1. With full mortar coverage on horizontal and vertical face shells.
 - 2. Bed webs in mortar.
 - 3. For starting course on footings where cells are not grouted, spread out full mortar bed, including areas under cells.

3.06 MASONRY JOINT REINFORCEMENT

- A. General: Provide continuous masonry joint reinforcement as indicated. Install entire length of longitudinal side rods in mortar with a minimum cover of 5/8 inch on exterior side of walls, 1/2 inch elsewhere. Lap reinforcement a minimum of 6 inches. Space reinforcing a maximum of 16" on center.
- B. Cut or interrupt joint reinforcement at control and expansion joints, unless otherwise indicated.
- C. Provide continuity at corners and wall intersections by using prefabricated "L" and "T" sections. Cut and bend reinforcing units as directed by manufacturer for continuity at returns, offsets, column fireproofing, pipe enclosures, and other special conditions.

3.07 LINTELS

- A. Install steel lintels where indicated or as required for masonry openings shown on drawings. Lintel sizes to be sufficient to support weight of masonry and deflection requirements.
- B. Provide masonry lintels where shown and where openings of more than 12 inches for brick-size units and 24 inches for block-size units are shown without structural steel or other supporting lintels.
 - 1. Provide prefabricated or built-in-place masonry lintels. Use specially formed bond beam units with reinforcing bars placed as indicated and filled with coarse grout. Cure precast lintels before handling and installing. Temporarily support built-in-place lintels until cured.
- C. Provide minimum bearing of 8 inches at each jamb, unless otherwise indicated.

3.08 REINFORCED UNIT MASONRY INSTALLATION

- A. Temporary Formwork and Shores: Construct formwork and shores to support reinforced masonry elements during construction.
 - 1. Construct formwork to conform to shape, line, and dimensions shown. Make it sufficiently tight to prevent leakage of mortar and grout. Brace, tie, and support forms to maintain position and shape during construction and curing of reinforced masonry.
 - 2. Do not remove forms and shores until reinforced masonry members have hardened sufficiently to carry their own weight and other temporary loads that may be placed on them during construction.
- B. Placing Reinforcement: Comply with requirements of ACI 530.1/ASCE 6/TMS 602.
- C. Grouting: Do not place grout until entire height of masonry to be grouted has attained sufficient strength to resist grout pressure.
 - 1. Comply with requirements of ACI 530.1/ASCE 6/TMS 602 for cleanouts and for grout placement, including minimum grout space and maximum pour height.

3.09 FIELD QUALITY CONTROL

- A. Testing Frequency: Tests and Evaluations listed in this Article will be performed during construction for each 5000 sq. ft. of wall area or portion thereof.
- B. Mortar properties will be tested per ASTM C 780.
- C. Grout will be sampled and tested for compressive strength per ASTM C 1019.

- D. Concrete Masonry Unit Tests: For each type of concrete masonry unit indicated, units will be tested according to ASTM C 140.
- E. Prism-Test Method: For each type of wall construction indicated, masonry prisms will be tested per ASTM C 1314, and as follows:
 - 1. Two prisms for each type of masonry.

3.10 REPAIRING, POINTING, AND CLEANING

- A. In-Progress Cleaning: Clean unit masonry as work progresses by dry brushing to remove mortar fins and smears before tooling joints.
- B. Final Cleaning: After mortar is thoroughly set and cured, clean exposed masonry as follows:
 - 1. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.
 - 2. Test cleaning methods on sample wall panel; leave one-half of panel uncleaned for comparison purposes. Obtain Architect's approval of sample cleaning before proceeding with cleaning of masonry.
 - 3. Protect adjacent stone and nonmasonry surfaces from contact with cleaner by covering them with liquid strippable masking agent, polyethylene film, or waterproof masking tape.
 - 4. Wet wall surfaces with water before applying cleaners; remove cleaners promptly by rinsing the surfaces thoroughly with clear water.
 - 5. Clean masonry with a proprietary acidic cleaner applied according to manufacturer's written instructions.

3.11 MASONRY WASTE DISPOSAL

- A. Recycling: Unless otherwise indicated, excess masonry materials are Contractor's property. At completion of unit masonry work, remove from Project site.
- B. Excess Masonry Waste: Remove excess, clean masonry waste that cannot be used as fill, as described above, and other masonry waste, and legally dispose of off Owner's property.

END OF SECTION

SECTION 04 26 13

VENEER MASONRY

PART 1 - GENERAL

1.01 SUMMARY

- A. Related Documents:
The Drawings and general provisions of the Contract, including General and Supplementary General Conditions, and Division 1 Requirements, apply to the work in this Section.

1.01 SCOPE: Furnish and install masonry veneer work complete in accordance with Specifications and Drawings.

1.02 GENERAL REQUIREMENTS: Lay all masonry veneer with one of the specified mortars, using the same materials throughout. Mix mortars in batches that will be used before initial set takes place, and in no case longer than 45 minutes before use. No re-tempering will be permitted. Do mixing in power-operated drum-type mixers (except as otherwise approved for small batches), allowing at least 2 minutes for dry mixing and 3 minutes after water has been added. Do not lay masonry in freezing weather unless suitable means are provided to heat material. Protect work from cold and frost with enclosures to insure that mortar will harden without freezing. No antifreeze ingredient shall be used. Facing material shall be protected against staining and top of walls shall be kept covered with non-staining waterproof covering when work is in progress. When work is resumed, top surface of work shall be cleaned of all loose mortar and in drying weather shall be kept damp.

1.03 WORK INCLUDED:

- A. All masonry veneer.

1.04 MATERIALS INSTALLED IN THIS SECTION BUT SUPPLIED BY OTHERS: This Contractor shall build into masonry the following materials which are furnished by other trades and shall erect, bed and secure same.

- A. Loose lintels.

1.05 RELATED SECTIONS

- A. Section 05 50 00 - Miscellaneous Metal Work

1.06 SUBMITTALS

- A. Submit under provisions of Section 01 33 00.
- B. Product Data: Provide data on the following.
1. Masonry veneer
 2. Wall reinforcement
 3. Sill flashings
 4. Anchors, inserts, metal ties.

1.07 CERTIFICATES

- A. Submit manufacturer's certificates under provisions of Section 01 33 00.
- B. Submit manufacturer's certificate that materials meet or exceed specified requirements.

1.08 ENVIRONMENTAL REQUIREMENTS

- A. Maintain materials and surrounding air temperature to minimum 50 degrees F prior to, during, and 48 hours after completion of masonry work.

1.09 PROTECTION

- A. Maintain protective boards at exposed external corners that may be damaged by construction activities. Provide such protection without damaging completed work.
- B. Keep control joint voids clear of mortar.
- C. Provide temporary bracing during masonry veneer erection. Maintain in place until building structure provides permanent bracing.
- D. Protect finished installation.

PART 2 - PRODUCTS

2.01 MATERIALS:

- A. Face Brick: The Contractor shall include in their base bid all costs for the purchase and delivery of exterior face brick. New brick's color, size and texture to match the existing surrounding brick and is to be approved by the Architect. Provide all special shapes and sizes as required to provide the work complete.
- B. Concrete masonry veneer: All concrete masonry veneer units are to meet ASTM C-90 standard specification for loadbearing concrete masonry units. Exposed faces shall be free of chips, cracks and other imperfections.
 - 1. Face unit size to be 8 inches by 16 inches by bed depth required or as indicted on the drawings.
 - 2. Exposed finish to be split face
 - 3. Color to be integral as required to match the existing surrounding concrete block and is to be approved by the Architect.
- C. Mortar
 - 1. Mortar Materials:
 - a. Portland Cement: ASTM C 150, Type I; natural or white except where required for color match.
 - b. Masonry Cement: ASTM C 91.
 - c. Lime: Hydrated Lime, ASTM C 207, Type S.
 - d. Sand for Mortar: ASTM C 144, or finer if needed for joint sizes less than 1/4".
 - e. Water: clean and potable.

2. Mortar Mixes
 - a. Mortar for Brick Exterior Walls: ASTM C270, color added as required to match existing.
 - b. Pre-Mixed Mortar Cement for Concrete veneer: 1 part cement with 3 parts above described sand. Mortar cement equal to Lee Bond, manufactured by Lee Lime Corp., Lee, Mass., shall be composed of 1 part light-colored Portland cement and 2 parts hydrated lime by volume interground by manufacturer. No insert fillers, such as ground limestone shall be used. It shall not contain soluble salts deleterious to the strength or appearance of the mortar, nor air-entraining agents.
 1. Mortar for CMU shall contain Dry-Block Mortar Admix as manufactured by W.R. Grace & Co. or equal.
 3. Mortar Color
 - a. Mortar Color: mineral oxide pigment compounded for use in mortar mixes. Do not exceed pigment-to-cement ratios recommended by pigment manufacturer. Color to match existing and by approved by the Architect.
- D. Wall Ties for studded back-up wall:
Hohmann & Barnard, Inc., HB-200 (or equal), 14 gauge thickness, plate length to be as required to accommodate thickness of rigid insulation, 3/16" tie diameter, tie length to be as required, metal to be carbon steel, finish to be hot dip galvanized. Attach using Buildex Climaseal (or equal) cadmium plate screws with neoprene washers.
- E. Wall Ties for masonry back-up wall:
Hohmann & Barnard, Inc., HB-170 – 2X Truss Eye-Wire (or equal).
Eye-wire size to be extra heavy, 3/16" dia. side rods with 9 gauge cross rods.
Leg Hook wire to be 3/16" dia.
All metal to be carbon steel, finish to be hot dip galvanized.
Length of leg hooks and width of truss to be coordinated with cavity wall construction design.
Use prefabricated corners and tees as required.

PART 3 - EXECUTION

3.01 CONSTRUCTION:

- A. General: Masonry shall be handled so that their edges and faces will not chip, spall or crack. All beds on which masonry is laid will be clean and properly wetted. Wetting of brick, when required, shall be done the night before they are laid. Units shall be damp but free of any surface water. The work shall be built level, square, plumb and true. All drilling cutting and fitting required by other work shall be done as necessary. Bolts, anchors, plugs, ties, lintels, carpentry items, flashings and other metal work specified elsewhere shall, where practicable, be placed in position as the work progresses. Bonding and coursing for masonry work shall be established before the work is started. Masonry shall not be erected when, in the opinion of the Architect, the sun, heat, wind or limitations of facilities furnished by the contractor prevent setting and curing of mortar joints or obtaining proper bond in the mortar. Spaces around metal or wood door frames, window frames and other built-in items shall be solidly filled with mortar.
- B. Joints:
 1. Exposed joints shall be uniform in thickness.
 2. Joints in exposed masonry shall be tooled slightly concave to squeeze the mortar into the joints.

3. Horizontal joints shall be tooled first. Tooling shall be done after the mortar has taken its initial set. Vertical joints shall be plumb from top to bottom of wall.
4. Exposed mortar joints in brick work shall be approximately 3/8" in width, except mortar bed joints in brick work shall have a thickness so that 3 courses of brick work together with 3 joints shall measure 8" in height and be equal to one course of concrete unit masonry.

C. Face Brick:

1. Brick work shall be laid in a bond to match existing.
2. Bats shall be used only for closures. Joints shall be formed of a thick layer of mortar that shall be smoothed or furrowed slightly. Head joints shall be formed by applying to the brick to be laid a full coat of mortar on the entire end of on the entire side as the case requires, and then shoving the mortar-covered end or side of the brick tightly against the brick laid previously. Buttering at the corners of brick and then filling the empty joints will not be permitted. Longitudinal joints within walls shall be formed as specified for head joints or by applying the mortar to the surfaces of the bricks previously laid and then shoving the brick into place. Closure brick shall be laid with a bed joint and with head joints. Dry or butt joints will not be permitted. Grouting shall be done only where directed.

D. Concrete Masonry Veneer:

1. Concrete masonry veneer units shall be laid in a bond to match existing.
2. Concrete-masonry units shall not be wetted before laying. Where indicated and where anchors, bolts and other ties occur within the cells of the units, cells shall be filled with mortar or concrete as the work progresses.
3. Cutting: Cutting of block by hand will not be permitted. Dry carborundum blade is recommended. When wet cutting is employed, cut block shall be thoroughly rinsed of all saw mud before being set into wall.

E. Cavity-wall Construction: Except as otherwise indicated, the inner wythe and outer wythe (backup wall and the masonry veneer) shall be completely separated by a continuous air space. The exterior face of the interior wythe shall be damp-proofed as specified in Division 7 unless noted otherwise on drawings. The two wythes (backup wall and the masonry veneer) shall be securely connected together using the wall ties specified. Flashings shall be provided as indicated and required and shall be built in as the work progresses.

1. The air space between the outer wythe and the inner wythe is to be kept clear and clean of mortar droppings.
2. All masonry veneer is to be returned at the exterior corners of all window and door openings to abut backup wall. Verify exact detail with Architect prior to start of installation.

3.03 ANCHORING MASONRY VENEERS

A. Anchor masonry veneers to concrete and masonry backup with masonry-veneer anchors to comply with the following requirements:

1. Fasten each anchor section with two metal fasteners of type indicated.
2. Space anchors as indicated, but not more than 16 inches o.c. vertically and 16 inches o.c. horizontally, with not less than 1 anchor for each 2 sq. ft. of wall area. Install additional anchors within 12 inches of openings and at intervals, not exceeding 8 inches, around the perimeter.

3.04 LOOSE LINTELS:

- A. Lintels shall be of the sizes indicated. Where sizes are not indicated they shall be of sizes sufficient to support the superimposed loads. Lintels shall have a bearing of not less than 8" unless otherwise indicated. Set lintels and bearing plates in mortar to the proper lines and levels.

3.05 CLEANING

- A. Upon completion, the work shall be pointed where necessary. Exposed surfaces of masonry shall be scrubbed with warm water and soap and rinsed thoroughly with clean water. All work that has been damaged, stained or discolored shall be replaced at no additional expense to the Owner.
- B. Finishing of CMU Walls: On completion of each wall, blocks and joints shall be lightly stoned down to remove excess mortar and aggregate projections.

3.06 EFFLORESCENCE

- A. Efflorescence test on face brick shall meet the requirements of ASTM C-67-61.

3.07 STORAGE OF MATERIAL

- A. Handling and storing of material shall be performed in such a manner to prevent damage.
- B. Cement shall be stored in watertight sheds with elevated floors.
- C. Store brick in such a manner to permit wetting within 36 hours prior to laying.

END OF SECTION

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SECTION 05 12 00

STRUCTURAL STEEL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Structural steel.
 - 2. Grout.
- B. Related Sections include the following:
 - 1. Division 1 Section "Quality Requirements" for independent testing agency procedures and administrative requirements.
 - 2. Division 9 Painting and Coatings for surface preparation and priming requirements.

1.3 DEFINITIONS

- A. Structural Steel: Elements of structural-steel frame, as classified by AISC's "Code of Standard Practice for Steel Buildings and Bridges," that support design loads.

1.4 PERFORMANCE REQUIREMENTS

- A. Connections: Provide details of simple connections required by the Contract Documents to be selected or completed by structural-steel fabricator to withstand loads indicated and comply with other information and restrictions indicated.
 - 1. Select and complete connections using AISC's "Steel Construction Manual, 14th Edition."

1.5 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: Show fabrication of structural-steel components.
 - 1. Include details of cuts, connections, splices, holes, and other pertinent data.

2. Include embedment drawings.
3. Indicate welds by standard AWS symbols, distinguishing between shop and field welds, and show size, length, and type of each weld.
4. Indicate type, size, and length of bolts, distinguishing between shop and field bolts. Identify pre-tensioned and slip-critical high-strength bolted connections.
5. For structural-steel connections indicated to comply with design loads.

C. Welding certificates.

D. Qualification Data: For testing agency.

E. Mill Test Reports: Signed by manufacturers certifying that the following products comply with requirements:

1. Structural steel including chemical and physical properties.
2. Bolts, nuts, and washers including mechanical properties and chemical analysis.
3. Direct-tension indicators.
4. Tension-control, high-strength bolt-nut-washer assemblies.
5. Shear stud connectors.
6. Shop primers.
7. Non-shrink grout.

F. Source quality-control test reports.

1.6 QUALITY ASSURANCE

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

B. Comply with applicable provisions of the following specifications and documents:

1. AISC's "Code of Standard Practice for Steel Buildings and Bridges."
2. AISC's "Seismic Provisions for Structural Steel Buildings" and "Supplement No. 2."
3. AISC's "Specification for Structural Steel Buildings, 14th Edition.
4. AISC's "Specification for the Design of Steel Hollow Structural Sections."
5. RCSC's "Specification for Structural Joints Using High Strength Bolts."

1.7 DELIVERY, STORAGE, AND HANDLING

A. Store materials to permit easy access for inspection and identification. Keep steel members off ground and spaced by using pallets, dunnage, or other supports and spacers. Protect steel members and packaged materials from erosion and deterioration.

1. Store fasteners in a protected place. Clean and re-lubricate bolts and nuts that become dry or rusty before use.
2. Do not store materials on structure in a manner that might cause distortion, damage, or overload to members or supporting structures. Repair or replace damaged materials or structures as directed.

1.8 COORDINATION

- A. Furnish anchorage items to be embedded in or attached to other construction without delaying the Work. Provide setting diagrams, sheet metal templates, instructions, and directions for installation.

PART 2 - PRODUCTS

2.1 STRUCTURAL-STEEL MATERIALS

- A. Wide Flange Section Structural Beams (w): ASTM A992
- B. Channel, Plate, and Bar: ASTM A 36.
- C. Cold-Formed Hollow Structural Sections: ASTM A 500, Grade C, structural tubing.
- D. Welding Electrodes: Comply with AWS requirements.

2.2 BOLTS, CONNECTORS, AND ANCHORS

- A. High-Strength Bolts, Nuts, and Washers: ASTM A 325 or ASTM F 1852, Type 1, heavy hex steel structural bolts; ASTM A 563 heavy hex carbon-steel nuts; and ASTM F 436 hardened carbon-steel washers.
 - a. Finish: Plain.
- B. Unheaded Anchor Rods: ASTM F 1554.
 - 1. Configuration: Straight and Hooked, as shown.
 - 2. Nuts: ASTM A 563 (ASTM A 563M) hex carbon steel.
 - 3. Plate Washers: ASTM A 36/A 36M carbon steel.
 - 4. Washers: ASTM F 436 hardened carbon steel.
 - 5. Finish: Plain.
- C. Headed Anchor Rods: ASTM F 1554.
 - 1. Nuts: ASTM A 563 hex carbon steel.
 - 2. Plate Washers: ASTM A 36/A 36M carbon steel.
 - 3. Washers: ASTM F 436 (ASTM F 436M) hardened carbon steel.
 - 4. Finish: Plain.
- D. Threaded Rods: ASTM F 1554.
 - 1. Nuts: ASTM A 563 hex carbon steel.
 - 2. Washers: ASTM F 436 hardened carbon steel.
 - 3. Finish: Plain.

2.3 PRIMER

- A. Primer: Fabricator's standard lead- and chromate-free, non-asphaltic, rust-inhibiting primer.

2.4 GROUT

- A. Nonmetallic, Shrinkage-Resistant Grout: ASTM C 1107, factory-packaged, nonmetallic aggregate grout, noncorrosive, non-staining, mixed with water to consistency suitable for application and a 30-minute working time.

2.5 FABRICATION

- 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."

- 1. Mark and match-mark materials for field assembly.
 - 2. Complete structural-steel assemblies, including welding of units, before starting shop-priming operations.

- B. Thermal Cutting: Perform thermal cutting by machine to greatest extent possible.

- 1. Plane thermally cut edges to be welded to comply with requirements in AWS D1.1.

- C. Bolt Holes: Cut, drill, or punch standard bolt holes perpendicular to metal surfaces.

- D. Finishing: Accurately finish ends of columns and other members transmitting bearing loads.

- E. Cleaning: Clean and prepare steel surfaces according to SSPC-SP 3, "Power Tool Cleaning."

2.6 SHOP CONNECTIONS

- A. Weld Connections: Comply with AWS D1.1 for welding procedure specifications, tolerances, appearance, and quality of welds and for methods used in correcting welding work.

- 1. Remove backing bars or runoff tabs, back gouge, and grind steel smooth.
 - 2. Assemble and weld built-up sections by methods that will maintain true alignment of axes without exceeding tolerances of AISC's "Code of Standard Practice for Steel Buildings and Bridges" for mill material.

2.7 SHOP PRIMING

- A. Shop prime steel surfaces.

- B. Surface Preparation: Clean surfaces to be painted. Remove loose rust and mill scale and spatter, slag, or flux deposits. Prepare surfaces according to the following specifications and standards:

1. SSPC-SP 3, "Power Tool Cleaning."

- C. Priming: Immediately after surface preparation, apply primer according to manufacturer's written instructions and at rate recommended by SSPC to provide a dry film thickness of not less than 1.5 mils (0.038 mm). Use priming methods that result in full coverage of joints, corners, edges, and exposed surfaces.
1. Stripe paint corners, crevices, bolts, welds, and sharp edges.
 2. Apply two coats of shop paint to inaccessible surfaces after assembly or erection. Change color of second coat to distinguish it from first.
- D. Painting: Apply a 1-coat, non-asphaltic primer complying with SSPC-PS Guide 7.00, "Painting System Guide 7.00: Guide for Selecting One-Coat Shop Painting Systems," to provide a dry film thickness of not less than 1.5 mils (0.038 mm).

2.8 GALVANIZING

- A. Hot-Dip Galvanized Finish: Apply zinc coating by the hot-dip process to structural steel according to ASTM A 123/ A 123M.
1. Fill vent holes and grind smooth after galvanizing.
 2. Galvanize lintels and shelf angles.

2.9 SOURCE QUALITY CONTROL

- A. Owner will engage an independent testing and inspecting agency to perform shop tests and inspections and prepare test reports.
1. Provide testing agency with access to places where structural-steel work is being fabricated or produced to perform tests and inspections.
- B. Correct deficiencies in Work that test reports and inspections indicate does not comply with the Contract Documents.
- C. Welded Connections: Shop-welded connections will be visually inspected.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify elevations of concrete-bearing surfaces and locations of anchor rods, bearing plates, and other embedments, with steel erector present, for compliance with requirements.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Provide temporary shores, guys, braces, and other supports during erection to keep structural steel secure, plumb, and in alignment against temporary construction loads and loads equal in intensity to design loads. Remove temporary supports when permanent structural steel, connections, and bracing are in place, unless otherwise indicated.

3.3 ERECTION

- A. Set structural steel accurately in locations and to elevations indicated and according to AISC's "Code of Standard Practice for Steel Buildings and Bridges" and "Specification for Structural Steel Buildings."
- B. Base Plates: Clean concrete- and masonry-bearing surfaces of bond-reducing materials, and roughen surfaces prior to setting base plates. Clean bottom surface of base plates.
 - 1. Set base plates for structural members on wedges, shims, or setting nuts as required.
 - 2. Snug-tighten anchor rods after supported members have been positioned and plumbed. Do not remove wedges or shims but, if protruding, cut off flush with edge of base plate before packing with grout.
 - 3. Promptly pack grout solidly between bearing surfaces and base plates so no voids remain. Neatly finish exposed surfaces; protect grout and allow to cure. Comply with manufacturer's written installation instructions for shrinkage-resistant grouts.
- C. Maintain erection tolerances of structural steel within AISC's "Code of Standard Practice for Steel Buildings and Bridges."
- D. Align and adjust various members forming part of complete frame or structure before permanently fastening. Before assembly, clean bearing surfaces and other surfaces that will be in permanent contact with members. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.
 - 1. Level and plumb individual members of structure.
- E. Do not use thermal cutting during erection unless approved by Architect.
- F. Do not enlarge unfair holes in members by burning or using drift pins. Ream holes that must be enlarged to admit bolts.

3.4 FIELD CONNECTIONS

- A. High-Strength Bolts: Install high-strength bolts according to RCSC's "Specification for Structural Joints Using High-Strength Bolts" for type of bolt and type of joint specified.
 - 1. Joint Type: Snug tightened.
- B. Weld Connections: Comply with AWS D1.1 for welding procedure specifications, tolerances, appearance, and quality of welds and for methods used in correcting welding work.

1. Comply with AISC's "Code of Standard Practice for Steel Buildings and Bridges" and "Specification for Structural Steel Buildings" for bearing, adequacy of temporary connections, alignment, and removal of paint on surfaces adjacent to field welds.
2. Remove backing bars or runoff tabs, back gouge, and grind steel smooth.
3. Assemble and weld built-up sections by methods that will maintain true alignment of axes without exceeding tolerances of AISC's "Code of Standard Practice for Steel Buildings and Bridges" for mill material.

3.5 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to inspect field welds and high-strength bolted connections.
- B. Bolted Connections: Shop-bolted connections will be tested and inspected according to RCSC's "Specification for Structural Joints Using High-Strength Bolts."
- C. Welded Connections: Field welds will be visually inspected according to AWS D1.1.
- D. Correct deficiencies in Work that test reports and inspections indicate does not comply with the Contract Documents.

3.6 REPAIRS AND PROTECTION

- A. Touchup Painting: After installation, promptly clean, prepare, and prime or re-prime field connections, rust spots, and abraded surfaces of prime-painted joists and accessories, base plates, and abutting structural steel.
 1. Clean and prepare surfaces by SSPC-SP 3 power-tool cleaning.
 2. Apply a compatible primer of same type as shop primer used on adjacent surfaces.

END OF SECTION 05 12 00

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SECTION 05 50 00

MISCELLANEOUS METAL WORK

PART 1 - GENERAL

1.01 SUMMARY

- A. Related Documents:
The Drawings and general provisions of the Contract, including General and Supplementary General Conditions, and Division 1 Requirements, apply to the work in this Section.

1.02 SECTION INCLUDES

- A. Miscellaneous metal work items as described in this Specification Section.
- B. Section includes, without limitation, providing and installing:
 - 1. Shop applied ferrous metals priming paint for miscellaneous metals.
 - 2. Anchorages, brackets, supports, inserts and backing required for a complete job but not included in other sections.
 - 3. All other ferrous or non-ferrous metal work not specifically given to other Sections and necessary for a complete job, but including:
 - a. Galvanized steel framing and supports for mechanical and electrical equipment.
- C. Items To Be Furnished Only: Furnish the following items for installation by the designated Sections
 - 1. Section 04 22 24 Reinforced Masonry-Interior:
Miscellaneous metal and iron sleeves, anchors, inserts, plates and lintels to be built into masonry walls, including:
 - a. Steel lintels with shop applied zinc-rich primer at interior locations.
 - 2. Miscellaneous items
 - a. Miscellaneous steel trim, galvanized at exterior locations.
 - b. All plates, threaded rods and angles required to support suspended HVAC units from building structure.

1.03 RELATED SECTIONS

- A. Section 04 22 24 - Reinforced Masonry-Interior
- B. Section 09 90 10 – Painting

1.03 SUBMITTALS

- A. Submit shop drawings, product data under provisions of Section 01 33 00. Include plans, elevations, sections, details, and attachments to other work. Show anchorage and accessory items.
- B. Submit samples of product as requested by the architect. Submit 8" square samples of each metal shop or factory finish (final surface treatment) required. Prepare samples on metal of same alloy and gauge to be used for the work. Label each sample to identify substrate material and finish. Provide hardware samples.

- C. Manufacturer's Data: Submit manufacturer's specifications, anchor details and installation instructions for any prefabricated products to be used in the work of this section

1.04 REGULATORY REQUIREMENTS

- A. Conform to all federal, state, and local codes.

1.05 QUALITY ASSURANCE

- A. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- B. Engineering Calculations: Calculations stamped by a registered professional engineer are required for load bearing fabrications. The Structural Engineer's written approval of such calculations shall be obtained before commencing fabrication

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, protect and handle products to site under provisions of Section 01 60 00.

1.07 FIELD MEASUREMENTS

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

PART 2 - PRODUCTS

2.01 GENERAL FABRICATION REQUIREMENTS

- A. Welding shall conform to the applicable requirements of the American Welding Society. Welding shall be done in a manner that will prevent permanent buckling and all welds exposed in the finished work shall be ground to an architectural quality smooth appearance approved by the Architect.
- B. Exposed surfaces shall have a smooth finish and sharp, well defined lines. Sections shall be formed to shape and size with sharp lines and angles. Curved work shall be sprung evenly.
- C. Necessary rabbets, lugs and brackets shall be provided so that work can be assembled and anchored in a neat and substantial manner. Holes for bolts and screws shall be drilled. Fastenings shall be concealed where practicable.
- D. Work shall be fabricated and installed in a manner that will provide for expansion and contraction, prevent the shearing of bolts, screws and other fastenings, insure rigidity and provide close fitting of sections. Joints exposed to the weather shall be formed to exclude water.
- E. All galvanized metal shall bear a stamp indicating ASTM number and weight of zinc coating in ounces per square foot.

2.02 MATERIALS

- A. Materials shall conform to the latest edition of the specifications or manufacturer's standards.
 - 1. Steel Shapes ASTM A-36 Bars & Plates
 - 2. Anchor Bolts ASTM A-307 Grade A
 - 3. Structural Bolts ASTM A-325 (unless shown or indicated otherwise)
 - 4. Weld Material E70XX Welding Electrodes For manual shielded metal-arc welding, AWS A5.1 or A5.5, E60 or E70 series
 - 5. Galvanizing ASTM A-123, , or A-153 as applicable; 2.0 ounces zinc per square foot, unless otherwise indicated; provide under its section.
 - 6. Stainless Steel Type 304L, ASTM A 276
 - 7. Steel bar gratings ASTM A-569 or A-36
 - 8. Bitumastic Preservative Mil-P-15230 [Where shown and all embedded steel]
 - 9. Galvanized Sheet Steel ASTM A-526 or A-526, G-90
 - 10. Hot-Rolled Carbon Steel Bars (and Bar-Size Shapes): ASTM A-36 or A-529, grade as selected by fabricator.
 - 11. Brackets, flanges and exposed fastenings: Shall be of the same materials, color and finish as the metal to which they are applied, unless shown or specified otherwise.
 - 12. Expansion bolts at concrete: "Redhead" wedge anchors.
 - 13. Expansion bolts at CMU: Hilti epoxy/masonry anchors
- B. Hangers and suspension: Where required, provide "Uni-strut" A1000 or assemblies of types recommended by manufacturer for application.
- C. Galvanizing Repair Paint: High zinc dust content paint, "ZRC", having 95% zinc. by weight. Two coats always are required.

2.03 SHOP PAINTING

- A. All surfaces of ferrous metal except galvanized steel shall be given a shop coat of red lead, zinc-chromate paint or other approved rust-inhibitive primer unless otherwise specified. All surfaces which will be inaccessible for painting after erection, except contact surfaces of riveted or welded connections, shall be given two coats of paint before being assembled or erected. All marred surfaces of shop coats shall be thoroughly recoated. Field painting is specified under Section 09 91 00.

2.04 ANCHORING CEMENT:

- A. Anchoring non-shrink grout shall be Hallemite "Por-rok" or equal.

2.05 CLEANING:

- A. Clean under provisions of Section 01 70 00.
- B. The Contractor shall clean the miscellaneous metal work by removing all excess sealants, dirt and foreign materials, restoring finishes, leaving work in a good and satisfactory condition. The Contractor shall perform the work of cleaning using methods and materials as recommended by the manufacturers of the materials used and as approved.

PART 3 - EXECUTION

3.01 INSPECTION

- A. Review existing field conditions of areas to receive the work of this Section before proceeding with fabrication. Do not proceed with installation of metal fabrications until all unsatisfactory conditions which would impair the strength or appearance of the work have been corrected.

3.02 INSTALLATION OF METAL FABRICATIONS

- A. Fastening to In-Place Construction: Provide anchorage devices and fasteners and furnish all necessary setting drawings, diagrams, and templates where necessary for securing miscellaneous metal items to in-place construction including threaded fasteners for concrete and masonry inserts, toggle bolts, through-bolts, lag bolts, wood screws and other connectors as required. Use galvanized bolts at exterior. Coordinate delivery of such items to project site.
- B. Cutting: Perform cutting, drilling and fitting required for installation of miscellaneous metal items. Do not cut structural members in field to facilitate fitting without written permission of the Architect for each specific condition.
- C. Fitting: Fit exposed connections accurately together to form tight hairline joints. Weld connections which are not to be left as exposed joints, but cannot be shop welded because of shipping size limitations. Grind joints smooth. Do not weld, cut or abrade the surfaces of exterior units which have been hot-dip galvanized after fabrication, and are intended for bolted or screwed field connections.
- D. Placement: Set work accurately in location, alignment and elevation, plumb, level, true and free of rack, measured from established lines and levels. Provide temporary bracing or anchors in formwork for items which are to be built into concrete, masonry or similar construction.
- E. Field Welding: Comply with AWS Code for procedures of manual shielded metal-arc welding, appearance and quality of welds made, and methods used in correcting welding work. Do not field weld stainless steel or aluminum.
- F. Grouting: Set bearing plates required for support of the work of this Section level and to correct elevation using steel shims or wedges and grout solid using specified non-shrink grout.
- G. Touch-Up of Shop Primers: Touch up field welds and unprimed steel using specified shop primers and following procedures specified for shop work.
- H. Existing work: Remove and re-install or re-locate existing metal fabrications as required to complete the work. Drill, tap, or weld existing assemblies as required to complete the work and to attach existing work to new work.
- I. All masonry-carrying lintels are to be galvanized.

3.03 PRODUCTS

- A. Anchors and Bolts:
Anchors and bolts shall be provided where indicated and where necessary for fastening work in place. They shall be embedded in concrete and masonry as the work progresses. Sizes, kinds and spacing of anchors not indicated or specified shall be as necessary for their purpose.
- B. Steel:
Steel for the support of piping and appurtenances shall be provided to the details indicated and as necessary for the complete installation.
- C. Pipe Hangers and Miscellaneous Supports:
Pipe hangers and miscellaneous supports shall be provided as required.
- D. Miscellaneous Framing and Supports:
 - 1. Provide miscellaneous steel framing and supports which are not a part of structural steel framework, as required.
 - 2. Fabricate miscellaneous units to sizes, shapes and profiles shown or, if not shown, of required dimensions to receive work to be supported by framing. Except as otherwise shown, fabricate from structural steel shapes and plates and steel bars, of welded construction using mitered joints for field connection. Cut, drill and tap units to receive hardware and similar items.
 - 3. Equip units with integrally welded anchor straps for casting into poured concrete or building into masonry wherever required. Furnish concrete inserts if units must be installed after concrete is placed.
- E. Metal support framing:
Provide metal framing as necessary to support ceiling-mounted urinal and toilet partition pilasters in accordance with partition manufacturer's instructions and requirements.

3.04 REPAIR OF ZINC COATINGS:

- A. All zinc coatings that have been damaged in handling or transporting or in welding, riveting or bolting shall be repaired by the application of a thick paste made from galvanizing repair compound conforming to Federal Specification 0-G-93 and water. Areas to be repaired shall be cleaned thoroughly, including removal of slag on welds, before the paste is applied. Surfaces to be coated with paste shall be heated with a torch so that all metallics in the paste will be melted when applied to the heated surfaces. Extreme care shall be taken to see that adjacent zinc-coated surfaces are not damaged by torch. Molten metal shall spread uniformly over all surfaces to be coated and the excess metal wiped off.

3.05 FIELD PAINTING

- A. Specified as scheduled under Section 09 91 00 - Painting.

3.06 DISSIMILAR MATERIAL

- A. Where aluminum comes in contact with metals other than stainless steel, zinc, white bronze or other metals compatible with aluminum, then those surfaces shall be kept from direct contact by

painting the dissimilar metal with a coating of heavy-bodied bituminous paint, a good quality caulking placed between the metals, non-absorptive tape or gasket.

END OF SECTION

SECTION 06 20 10

CARPENTRY AND MILLWORK

PART 1 - GENERAL

1.01 SUMMARY

- A. Related Documents:
The Drawings and general provisions of the Contract, including General and Supplementary General Conditions, and Division 1 Requirements, apply to the work in this Section.

1.02 SECTION INCLUDES

- A. All labor and materials, equipment and installation of all work required to complete the construction and installation of all work required to this trade as indicated on the drawings and as herein specified.

1.03 RELATED SECTIONS

- A. Section 09 91 00 – Painting
- B. Section 12 32 16 – Plastic Laminate Casework

1.04 REFERENCES

- A. American Plywood Association
- B. American Woodwork Institute

1.05 SUBMITTALS

- A. Submit shop drawings, product data and samples under provisions of Section 01 33 00.
- B. For all wood products designated in this specification as “FSC certified,” provide evidence of compliance with Forest Stewardship Council (FSC) standards by submitting certificates with company Chain-of-Custody (COC) number and also identifies each FSC certified product on a line-item basis.

1.06 QUALITY ASSURANCE

- A. Work shall comply with all local and state building and fire codes.
- B. Material and workmanship of all woodwork shall conform to the Premium grade requirements of the AWI Quality Standards.

1.07 REGULATORY REQUIREMENTS

- A. All materials are to conform to the minimum requirements of the State Building Code or as indicated in this specification, whichever is stronger or stricter.

1.08 DELIVERY, STORAGE AND HANDLING

- A. Deliver, store, protect and handle products to site under provisions of Section 01 60 00.
- B. Protect all materials from weather. Do not store in damp or wet areas. Stack lumber and plywood, and provide air circulation within stacks.

1.09 FIELD MEASUREMENTS

- A. Verify all field dimensions at the site prior to fabrication.

1.10 COORDINATION

- A. Coordinate work with other trades and under provisions of Section 01 31 00.

1.11 SUSTAINABLE BUILDING MATERIAL REQUIREMENTS

- A. All wood products used on this project are to be designated as "FSC-Certified" according to the rules of the Forest Stewardship Council (FSC) (www.fscus.org).

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Framing Lumber
 - 1. Moisture content when delivered to the project shall not exceed 19 percent.
 - 2. Wood studs, blocking, bridging, nailing pieces, shall be Douglas Fir, Coast Region construction grade "J" and "P" or Southern Pine No. 1. All structural load bearing lumber shall be of quality to provide 1200 psi units fiber stress.
 - 3. Mark of treating company certifying type of treatment applied on fire retardant treated and pressure preservative treated lumber.
- B. Plywood shall be of the types and grades listed below:
 - 1. Exposed exterior plywood to be exterior paint-grade, knot-free in thickness as noted on the drawings. Where thickness is not indicated, plywood shall be 3/4" thick. Exposed face is to be sanded smooth and painted with a primer and two coats of finish paint.
 - 2. Each panel of plywood shall be identified with a stamp as to type, grade and species by the grade trademark of the American Plywood Association.
Mark of treating company certifying type of treatment applied on fire retardant treated and pressure preservative treated plywood.

- C. Interior and Exterior Woodwork for Paint Finish
 - 1. Quality: Wood shall be free from knots, pitch or sap streaks, molded and executed as detailed and noted on the drawings.
 - 2. Species: Wood shall be clear, kiln-dried close-grained hardwood unless otherwise indicated.

- D. Plastic Laminate
 - 1. Manufacturers
 - a. Subject to compliance with requirements of this Specification Section, provide products listed herein from one of the following:
 - 1. Wilsonart Corporation
 - 2. Formica
 - 3. Arborite
 - b. Substitutions: Under provisions of Section 01 60 00.
 - 2. Counter tops and backsplashes:
 - a. Standard High Pressure Decorative Laminate - General Purpose Type: Wilsonart Type 107, having the following physical characteristics:
 - 1. Sheet thickness: 0.048 inch nominal.
 - 2. Exceeding performance requirements of NEMA LD 3 current revision Grade HGS.
 - 3. Surface burning characteristics in accordance with ASTM E 84; unbonded.

- E. Counter Brackets – Surface Mounted
 - 1. Manufacturer: Rangine Corporation
 - 2. Surface mounted Rakks models as follows:
 - 3. Provide the following models and sizes as required unless otherwise noted on drawings:
 - EH-1209: 12" x 9" (12" vertical) on counters between 11" and 13" deep
 - EH-1212: 12" x 12" on counters between 13 1/2" and 18" deep
 - EH-1818: 18" x 18" on counters between 18 1/2" and 25" deep
 - EH-1824: 18" x 24" (18" vertical) on counters between 25 1/2" to 30" deep
 - 4. Finish to be selected by Architect from manufacturer's standard colors.
 - 5. Fasteners in wall are to match color of bracket.
 - 6. Provide wood blocking in stud walls as required.
 - 7. Max distance between brackets to be 32 inches.
Also provide a bracket at the end of countertops that are not attached to a side wall.
 - 8. Size bracket as required to coordinate with shelf depth as noted on the drawings.
 - 9. Provide 5/8" dia. rubber grommet option in all vertical legs of each bracket.

PART 3 - EXECUTION

3.01 CONSTRUCTION

- A. Rough Carpentry
 - 1. General: Carefully lay out, cut, fit and rout all framing, blocking and other items of carpentry in such a manner as to minimize shrinkage and insure stability. Perform all carpentry work required for building in work of other trades and work to the details indicated and as required by field conditions.
 - 2. Provide fire retardant treated wood products as shown and as follows:

At exposed or semi-exposed wood in fire rated assemblies and in spaces having limited flame spreads for exposed combustibles. Where blocking is concealed in fire rated assemblies and all areas as required by code.

3. Includes: Rough carpentry shall consist of the installation of sleepers, blocking, nailers, curb nailers, furring, joists, studding, rafters, stringers, centers, rough flooring, grounds, screeds, and such other items of rough carpentry as may be required for proper construction and to complete the work. Absence of illustration, detail or specification will not relieve the Contractor from responsibility or carrying out the work.
4. Mechanical equipment clearances: Members shall be framed to allow for passage of pipes or ducts as required to avoid cutting of structural members. No members shall be cut, notched or bored for the passage of such pipes without permission of the Architect, and all members damaged by cutting shall be reinforced as directed by the Architect.
5. Pressure preservative treated lumber: All wood in direct contact with concrete, masonry, soil or gravel shall be pressure preservative treated wood, 0.40 lbs./cu.ft., ground contact grade with a 40 year warranty. Wood shall be free from large or loose knots, shakes, checks and warpage. Apply two coats of same preservative used in original treatment to all sawed or cut surfaces of treated lumber, in accordance with AWP A M4.
6. Furring and Grounds: Shall be minimum 1" x 3" strips, as shown on drawings or as required to match the condition, spaced maximum 16" on center and continuous at all vertical edges of framed openings. Furring shall be secured to concrete, brick or masonry units by power driven fasteners. Face of furring and grounds shall form a true, even plane for installation of materials thereon. Species shall be Fir or Southern Pine, at Contractor's option.
7. Trim
 - a. Trim shall be mitered and jointing shall be tight and formed to conceal shrinkage. All mortise, tongue-and-groove and shiplap joints shall be set in neutral white caulking compound. Interior woodwork shall be back primed and painted before installation.
 - b. Interior trim shall be milled, fabricated and erected as shown on the drawings. All finishes shall be machine-sanded at the mill and sand-papered and primed at the job.

Wood used for trim is to be any close-grained hardwood.

All interior trim including base, chair rails, ceiling mouldings, casings, window stools and aprons shall be of stock designs. All joints shall be made in an approved manner to conceal shrinkage and shall be tight, straight, plumb and level, in perfect alignment and closely fitted. Joints shall be secured with finish nails set for putty stopping. Window and door trim shall be in single lengths. Base shall be in long lengths. Mouldings shall be mitered at corners and coped at angles. These joints shall be made at the mill.
8. Plastic Laminate Countertops and Backsplash
 - a. Countertop in wet areas shall consist of a layer of plastic laminate adhered to 3/4" "Medex" or equal, water resistant medium density fiberboard (MDF) with backer sheet.
 - b. Backsplash shall be installed as indicated on drawings.
 - c. Plastic laminate adhesive shall be selected in accordance with manufacturer's recommendations for specific substrate used.
 - d. Front edge and exposed side edges of countertop and all edges of backsplashes are to be 3 mm thick PVC unless noted otherwise on drawings. Solid, high-impact, purified, color-thru, acid resistant, machine-applied with hot melt adhesives,

- trimmed, inside/outside length-radiused for uniform appearance, buffed and corner-radiused for consistent design. Submit sample to be approved by Architect.
9. Temporary Enclosures and Protection: Temporary enclosures of doors, windows and other exterior openings shall be provided when necessary to meet conditions specified. Maintain in good repair and remove when no longer required. Door and window frames shall be protected from traffic and from mortar drippings.

B. Blocking

1. Blocking layout and size: Continuous and solid, fire retardant 3/4 inch plywood or fire retardant 2x4 or larger where additional support is required.
2. Provide blocking in addition to any indications on the drawings in locations as follows:
 - a. Millwork attached to walls or ceilings.
 - b. All standing and running trim
 - c. Equipment attached to walls or ceilings.
 - d. At grab bars.
 - e. Toilet Room accessories.
 - f. Wall hung lavatories.
 - g. At cabinets and casework.
 - h. At shelving and counter brackets.
 - i. At all door wall stops.
 - j. As required to support light fixtures.
3. Attach blocking as follows:
 - a. In metal stud partitions: Screw attach through stud flanges.
 - b. At masonry: With oval head toggle bolts and washers or with epoxy tube and sleeve systems.
 - c. At concrete: With expansion shield bolts.
 - d. At steel: With flat head bolts/nuts or approved power actuated fasteners.

C. Construction Hardware

1. Furnish and install all bolts, nuts, expansion shields, lag screws, toggle bolts, wood screws, nails, flat cap metal nailing discs, staples, power driven anchors and other rough hardware as required.
2. Rough hardware items shall be of appropriate type and proper capacity and size as required for each specific application.
3. All fasteners used on exterior work shall be hot dip galvanized or stainless steel.
4. Concrete and masonry anchors: Where anchors are not included in concrete or masonry construction sections, anchors shall be galvanized machine screws or bolts with standard expansion-shield type concrete anchors, Phillips "Red Head" Masonry Anchors or approved equal, of sizes and types as required.
5. Fasteners used at treated wood: Fasteners meeting manufacturers approval and requirements if not listed use stainless steel.

3.02 CLEANING

- A. Clean work under provisions of 01 70 00.

3.03 PROTECTION OF FINISHED WORK

- A. Protect finished work under provisions of Section 01 70 00.

END OF SECTION

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SECTION 07 11 13

BITUMINOUS DAMPPROOFING

PART 1 - GENERAL

1.01 WORK INCLUDED

- A. Clean, patch and prepare surfaces to receive dampproofing specified herein.
- B. Provide dampproofing at interior wythe of concrete masonry units at cavity walls and at concrete back-up to masonry veneer.

1.02 SUBMITTALS

- A. Submit product data and samples in accordance with Section 01 33 00.
- B. Submit manufacturer's surface preparation and installation instructions.

1.03 ENVIRONMENTAL REQUIREMENTS

- A. Do not apply dampproofing on damp or frozen surfaces.
- B. Ensure temperatures are maintained at a minimum of 40 degrees F for 24 hours before application and continuously until dampproofing has cured.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Dampproofing: BASF Corporation– Masterseal 614
- B. Other acceptable manufacturers offering equivalent products.
 - 1. Karnak 920AF Fibered Emulsion Mastic
- C. Substitutions: Under provisions of Section 01 60 00.

2.02 MATERIALS

- A. Dampproofing System: Heavy Bodied, non-sag coating reinforced with long fibers; trowel application, waterborne solvent.

PART 3 - EXECUTION

3.01 SURFACE PREPARATION FOR DAMPPROOFING

- A. Clean and prepare surface to receive dampproofing in accordance with manufacturer's recommendations.
- B. Ensure surfaces are firm and free from frost, loose particles, cracks, pits, rough projections, grease, oil and other foreign matter detrimental to adhesion and monolithic application.

3.02 APPLICATION OF DAMPPROOFING

- A. Apply with brush or trowel in one coat, over dry, cured surface, to a dry film thickness of 1/16 inch.
- B. Protect adjacent surfaces from staining or migrating of mastic.
- C. Cover all applied dampproofing with a protection board a minimum of 1/8 inch thick. Board material is to be compatible with the dampproofing.
- D. Carefully backfill against board to prevent penetration of the board and dampproofing.

END OF SECTION

SECTION 07 21 13

BOARD INSULATION

PART 1 - GENERAL

1.01 WORK INCLUDED

- A. Board insulation at cavity wall construction.

1.02 RELATED WORK

- A. Section 04 26 13 – Veneer Masonry: Cavity wall construction.

1.03 REFERENCES

- A. ASTM C578 - Physical properties of Polystyrene.

1.04 SYSTEM DESCRIPTION

- A. Materials of this Section shall provide a continuous thermal barrier at building enclosure elements.

1.05 SUBMITTALS

- A. Submit manufacturer's installation instructions under provisions of Section 01 33 00.
- B. Sustainable Building Material Submittal:
 - 1. For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content.
 - a. Include statement indicating costs for each product having recycled content.
 - 2. Identify each regional material along with the location of its harvest, extraction, or manufacture.

PART 2 - PRODUCTS

2.01 ACCEPTABLE INSULATION MANUFACTURERS

- A. Styrofoam Brand by Dow Chemical Co.
- B. Other acceptable manufacturers offering equivalent products:
 - 1. Owens Corning
- C. Substitutions: Under provisions of Section 01 60 00.

2.02 INSULATION MATERIALS

- A. Insulation for masonry veneer/masonry backup cavity wall shall be Styrofoam Cavitymate Ultra: rigid closed cell extruded polystyrene. Thickness to be 2" with a thermal resistance R-Value of 10. (Unless noted otherwise on the drawings.)
Comply with ASTM C 578, Type IV, density 1.6 lb/cu. Ft. min., minimum compressive strength of 25 psi per ASTM D 1621.
Water absorption: Max. 0.1% by volume (ASTM C 272)
Surface burning characteristics: Flame spread=5, Smoke developed=165

2.03 ADHESIVE MATERIALS

- A. Adhesive: Type as recommended by insulation manufacturer.
1. Acceptable manufacturer's products:
 - a. ChemRex, Inc. "Contech Brands PL300 Foam Board Adhesive".
 - b. ChemRex, Inc. "Contech Brands Premium Foam Board Adhesive".
 - c. Dacar Products, Inc. "Foamgrab PS".

- 2.04 **SPRAY FOAM INSULATION:** Dow Great Stuff Pro Gaps & Cracks Insulating Foam Sealant which is a minimal-expanding, single component polyurethane foam sealant approved to be compatible with the board insulation by the manufacturer.

PART 3 - EXECUTION

3.01 PREPARATION

- A. Verify substrate and adjacent materials and insulation boards are dry and ready to receive insulation and adhesive.
- B. Verify substrate surface is flat, free of fins, irregularities and materials that will impede adhesive bond.
- C. Verify insulation boards are unbroken, free of damage.

3.02 INSTALLATION - CAVITY WALLS

- A. Apply adhesive in 2" diameter spot applications 12" o.c. both ways in accordance with manufacturer's recommendations.
- B. Install boards horizontally between wall reinforcement.
- C. Place boards in a method to maximize contact bedding. Stagger end joints, except at line of control joints. Butt edges and ends tight to adjacent board and to protrusions.
- D. Butt boards tight against each other to provide a monolithic plane of insulation with minimal gaps or openings.
- E. Fill all cracks and open gaps in and around board insulation with Dow Great Stuff Pro Gaps & Cracks Insulating Foam Sealant (or equal).

F. Do not span control joints.

3.03 CLEANING

A. Clean work under provisions of Section 01 70 00.

END OF SECTION

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SECTION 07 26 16

UNDER-SLAB VAPOR BARRIER

PART 1 – GENERAL

1.01 SUMMARY

- A. Products Supplied Under This Section
 - 1. Vapor Barrier, seam tape, pipe boots, detail strip for installation under concrete slabs.

1.02 RELATED SECTIONS

- A. Division 3 - Concrete Construction

1.03 REFERENCES

- A. American Society for Testing and Materials (ASTM)
 - 1. ASTM E 1745 Standard Specification for Plastic Water Vapor Retarders Used in Contact with Soil or Granular Fill Under Concrete Slabs
 - 2. ASTM E 154 Standard Test Methods for Water Vapor Retarders Used in Contact with Earth Under Concrete Slabs
 - 3. ASTM E 1643 Standard Practice for Installation of Water Vapor Retarders Used in Contact with Earth or Granular Fill Under Concrete Slabs
- B. American Concrete Institute (ACI)
 - 1. ACI 302.1R Vapor Barrier Component (plastic membrane).

1.04 SUBMITTALS

- A. Submit under provisions of Section 01 33 00.
- B. Quality Control / Assurance
 - 1. Independent laboratory test results showing compliance with ASTM & ACI Standards.
 - 2. Manufacturer's samples, literature
 - 3. Manufacturer's installation instructions for placement, seaming and pipe boot installation

PART 2 – PRODUCTS

2.01 MATERIALS

- A. 15 mil Vapor Barrier:
Extremely low permeance vapor barrier for critically sensitive, low permeance floor coverings.
 - 1. Vapor Barrier must have the following qualities
 - a. Thickness of Barrier (plastic) ACI 302.1R Not less than 15 mils
 - b. Water Vapor Barrier ASTM E-1745 Meets or exceeds Class A
 - c. Water Vapor Permeance ASTM F 1249 0.0086 Perms
 - d. Water Vapor Transmission Rate ASTM F 1249 0.0036
 - e. Puncture Resistance ASTM D 1709 2266 grams
 - f. Tensile Strength ASTM D 882 70.6 lbf/in

1. Acceptable 15 mil Vapor Barriers
 - a. Stego Wrap (15 mil) Vapor Barrier by Stego Industries LLC
 - b. Griffolyn 15-mil Green by Reef Industries, Inc.
 - c. Perminator 15-mil by W.R. Meadows

2.02 ACCESSORIES

- A. Seam Tape: High Density Polyethylene Tape with pressure sensitive adhesive. Minimum width 4 inches.
- B. Pipe Boots: Construct pipe boots from vapor barrier material and pressure sensitive tape per manufacturer's instructions around all penetrations through the vapor barrier.
- C. Perimeter / edge seal: Provide double sided tack tape to seal the vapor barrier around the entire perimeter wall or footing/grade beam. Ensure the concrete is clean and dry prior to adhering tape.

PART 3 – EXECUTION

3.01 PREPARATION

- A. Ensure that subsoil is approved by architect
 1. Level and tamp or roll aggregate, sand or tamped earth base.
- B. Contractor shall use a screeding system that does not puncture the vapor barrier.

3.02 INSTALLATION

- A. Install Vapor Barrier:
 1. Installation shall be in accordance with manufacturer's instructions and ASTM E 1643–98.
 - a. Install a vapor barrier as specified herein under all concrete slabs-on-grade and other locations as noted in the Construction Documents.
 - b. Unroll Vapor Barrier with the longest dimension parallel with the direction of the pour.
 - c. Lap Vapor Barrier over footings and seal to foundation walls using tack tape.
 - d. Overlap joints 6 inches and seal with manufacturer's seal tape.
 - e. Seal all penetrations (including pipes) with manufacturer's pipe boot.
 - f. No penetration of the vapor barrier is allowed except for reinforcing steel and permanent utilities.
 - g. Repair damaged areas by cutting patches of vapor barrier, overlapping damaged area 6 inches and taping all four sides with tape.

3.03 CLEANING

- A. Clean under provisions of Section 01 70 00.

END OF SECTION

SECTION 07 31 13

FIBERGLASS ARCHITECTURAL ROOF SHINGLES

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Granular surfaced shingle roofing.
- B. Moisture shedding underlayment, eave, valley and ridge.
- C. Associated metal flashings.

1.02 RELATED SECTIONS

- A. Section 02 41 19 - Selective Demolition

1.03 REFERENCES

- A. ANSI/ASTM B209 - Aluminum Alloy Sheet and Plate.
- B. ANSI/ASTM D226 - Roofing and waterproofing
- C. ANSI/ASTM E108 - Standard Test Method for Fire Resistance.
- D. ANSI/ASTM D1922 - Propagation tear resistance of plastic film and thin sheeting by pendulum method.
- E. ANSI/ASTM D3018 - Standard Specification for class A Asphalt Shingles.
- F. ANSI/ASTM D3161 - Standard Test Method for Wind Resistance of Asphalt Shingles (Organic or Fiberglass)
- G. ANSI/ASTM D3462 - Standard Specification for Asphalt Shingles. (Fiberglass)
- H. ANSI/ASTM D2822 - Asphalt Roof Cement.
- I. SMACNA MANUAL - Architectural Sheet Metal Manual.

1.04 SUBMITTALS

- A. Submit under provisions of Section 01 33 00.
- B. Shop Drawings: Indicate metal flashings, jointing methods and locations, fastening methods and locations, and installation details.
- C. Product Data: Provide data indicating material characteristics, performance criteria and limitations.
- D. Manufacturer's Certificate: Certify that roof shingles meet or exceed:

1. ASTM E108 Class A Fire Resistance
2. ASTM D3161 Wind Resistance
3. ASTM D1922 Tear Strength
4. ASTM D3018 Type 1
5. ASTM D3462 Standard for Asphalt Shingles. (Must have Independent certification)

E. Manufacturer's Installation Instructions

F. Samples: Submit samples indicating the full color range from the manufacturer's standard colors.

1.05 QUALITY ASSURANCE

A. Perform this work in accordance with the Asphalt Roofing Manufacturers Association Residential Asphalt Roofing Manual. Copies may be obtained at the:
Asphalt Roofing Manufacturers Assoc.

B. Maintain one copy on site at all times.

C. Manufacturer: Company specializing in manufacturing the products specified in this section with a minimum of five years of documented experience.

D. Installer: Company specializing in performing the work of this section with a minimum of five years of verifiable documented experience. Contractor must be certified by the shingle manufacturer.

E. Use only trained workmen skilled in the installation of this type of work. The foreman shall have a minimum of five years of verifiable documented experience.

F. Upon request furnish the name, location and contact person of previous roofing installations to the owner and the Architect.

1.06 REGULATORY REQUIREMENTS

A. Conform to Code for ASTM D3018 Class A, UL 790 Fire resistance and UL 58 Wind Uplift for shingle types specified.

B. Conform to Code for ASTM D3462 Tear resistance.

C. Conform to insurance requirements identified by owner or its representative.

D. Provide certificate of compliance from ASTM and UL indicating approval of specified products.

E. Submit evidence of applicable insurance requirements.

F. Conform to all applicable Federal, State and local codes and laws.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, protect, and handle products under the manufacturer's recommendation and under provisions of Section 01 60 00.
- B. Deliver materials in their original, unopened containers, dry, undamaged, sealed and labels intact.
- C. Stand roll materials on end.
- D. Store other materials flat, elevated from ground or roof deck, protected with waterproof covers as necessary to keep the materials dry.
- E. Protect materials from damage. Do not use materials damaged in handling or storage. Replace damaged materials at no additional cost to the Owner.
- F. When storing materials on the roof, and during application, the roofing contractor shall ensure that overloading of the deck and structure does not occur.

1.08 ENVIRONMENTAL REQUIREMENTS

- A. Do not install roofing materials during inclement weather.
- B. Do not install ice and water protection and shingles when ambient temperature is below 50 degrees Fahrenheit.
- C. Do not install roofing materials to damp or frozen deck.
- D. Do not expose materials vulnerable to water or sun damage in quantities greater than can be weatherproofed during the same day.
- E. Any damaged or deteriorated deck or flashing substrate which is discovered shall be promptly reported to the owner or their designated representative.

1.09 WARRANTY

- A. Upon completion of the roof system and after passing a final inspection performed by the roofing manufacturer and the owners representative. The manufacturer's Warranty will be furnished for the work of this section as follows:
 - 1. ROOF SHINGLE: 50 Year warranty
- B. Warranty Extension: Manufacturer of shingle will provide a Surestart-Plus warranty with 5-Star 10 Protection to cover labor, materials, tear-off, disposal and workmanship in the event of a materials defect during the first thirty (30) years after completion of application of shingles.
- C. Provide fifteen (15) year, 110 mph wind-resistance warranty
- D. Provide 15-year StreakFighter™ warranty.
- E. Provide 15 year Algae Resistant warranty.

1.10 EXTRA MATERIALS

- A. Furnish under provisions of Section 01 78 00.
- B. Provide two bundles of shingles packaged as required for long term storage.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Basis of Design: Shingles
CertainTeed Corporation
Style: Landmark Pro AR
Color: As selected by Architect from manufacturer's standard colors.
- B. Substitutions: Under provisions of Section 01 60 00.

2.02 MATERIALS

- A. ROOF SHINGLES
 - 1. Roof shingle shall conform to ASTM D 3018 Type I – Self-Sealing; UL Certification of ASTM D 3462, ASTM D 3161/UL997 80 mph Wind Resistance and UL Class A Fire Resistance; glass fiber mat base; ceramically coated, colored algae resistant granules across entire face of the shingle; two-piece laminated shingle.
Minimum weight of 250 lb. per square.
Provide associated Starter Shingles.
 - 2. Color selected by Architect from manufacturer's standard colors.
- B. DRIP EDGE:
 - 1. Aluminum, ASTM B209, pre-formed, 1/2 inch extension for drip break back for 1 inch vertical fascia, minimum 3 inch railing on roof surface.
 - 2. Color selected by Architect from manufacturer's standard colors.
- C. GABLE EDGE:
 - 1. Aluminum, ASTM B209, pre-formed, 1 inch vertical fascia, minimum 3 inch railing on roof surface.
 - 2. Color selected by Architect from manufacturer's standard colors.
- D. SHEET MATERIALS
 - 1. Underlayment: DiamondDeck by CertainTeed, or equal, is a synthetic polymer-based scrim-reinforced underlayment. Low-slope application minimum 2" per foot. Between slopes of 2" per foot up to 4" per foot apply two layers of DiamondDeck in "shingle-fashion" as described in the installation instructions.
 - 2. Eave and valley protection (Ice and Water Shield): WinterGuard by CertainTeed or equal: A sheet barrier of self adhering, rubberized asphalt membrane shingle underlayment having a high traction surface and internal reinforcement. The material must have a warranty equal or greater in duration to that of the shingles being applied.

2.03 ACCESSORIES

- A. Nails: Standard round wire type, (hot dipped zinc coated steel) with a minimum 7/16 head diameter and 0.104 inch shank diameter, (minimum 7/8 inch long) or of sufficient length to penetrate through roof sheathing and into the substrate. (a minimum of 1/2 inch).
- B. Plastic Cement: ASTM D2822 asphalt type with mineral fiber components, free of toxic solvents and asbestos, capable of setting within 24 hours at temperature of 75 degrees F and 50% RH. #19 cold cement manufactured by Karnak.
- C. Lap Cement: Fiberated cutback asphalt type, recommended for use in application underlayment, free of toxic solvents and asbestos: #16 double coverage cement manufactured by Karnak.

2.04 FLASHING MATERIALS

- A. Sheet flashings: Lead coated copper
- B. Bituminous Paint: Acid and alkali resistant type (color black).
- C. Nails: Standard round wire type, (hot dipped zinc coated steel) with a minimum 7/16 head diameter and 0.104 inch shank diameter, (minimum 7/8 inch long) or of sufficient length to penetrate through roof sheathing and into the substrate. (a minimum of 1/2 inch).

2.05 FLASHING FABRICATION

- A. Form flashings to protect roofing materials from physical damage and to shed water
- B. Form sections square and accurate to profile, in maximum possible lengths, free from distortion or defects detrimental to appearance or performance.
- C. Hem exposed edges of flashings minimum 1/4 inch on underside.
- D. Apply bituminous paint on concealed surfaces of flashings.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. **A survey of existing interior building conditions shall be made by both the contractor and the owner's representative prior to the start of construction operations. All defects shall be noted, and the contractor shall prepare a list of the same in writing. Said list shall be given to the owner for their review and approval. If the contractor does not submit a list to the owner it will be assumed that there are no defects in the building and that the contractor takes full responsibility for the interior of the building during the project.**
- B. Any damages caused by the contractor's operations shall be repaired to the satisfaction of the owner at the contractor's expense.

- C. The roofing contractor shall carefully examine the roof area in regards to dimensions and type of substrate and conditions that may affect proper execution of the work. Any variations shall be reported to the owner's representative and the Architect prior to the bid. No claims for extra costs shall be allowed because of lack of full knowledge of existing conditions.
- D. Verify existing site conditions.
- E. Verify that roof openings, curbs, pipes, sleeves, ducts and vents through roof are solidly set, and wood cant strips, wood nailing strips, and reglets are properly set and in place.
- F. Beginning of roof project means installer accepts existing conditions.

3.02 PROTECTION

- A. Schedule and execute all work without exposing the building interior to the effects of inclement weather. Protect the existing building, contents, and its inhabitants against all risks associated with this work.
- B. Provide suitable barricades to protect the general public.

3.03 PREPARATION

- A. Remove Existing roofing system completely down to existing roof deck.
- B. Verify deck is clean and smooth, free of depressions, waves, or projections.
- C. Fill Knot holes and surface cracks with a latex filler at areas of bonded eave protection.
- D. Broom clean deck surfaces under eave protection and underlayment.

3.04 INSTALLATION - PROTECTIVE UNDERLAYMENT

- A. Place underlayment over entire roof surface and install in accordance with manufacturer's instructions. Nail in place. No staples allowed.
- B. Install protective underlayment perpendicular to slope of roof.
- C. Weather lap and seal watertight with plastic cement, items projecting through mounted on roof.

3.05 INSTALLATION - EAVE ICE DAM PROTECTION

- A. Place eave edge and gable edge metal flashings tight with fascia boards. Weather lap joints 2 inches and seal with plastic cement. Secure flange with nails spaced 2 on center.
- B. Apply the self adhering, rubberized asphalt membrane eave ice dam protection under No.15 roofing felt at all eaves in accordance with manufacturer's instructions.
- C. Extend eave ice dam protection membrane from the eave's edge up the slope a minimum of 3 feet inside the exterior wall line of the building unless noted otherwise as a greater dimension on the drawings.

3.06 INSTALLATION - VALLEY PROTECTION

- A. Place one layer of self adhering, rubberized asphalt membrane, centered over valleys extending 18 inches both sides of valley. Lap joints minimum of 6 inches. Valley protection shall be applied in accordance with manufacturer's instructions.
- B. In valleys, the roof shingles are to be installed using the closed-cut method. Cut edge must be sealed with roof cement.

3.07 INSTALLATION - METAL FLASHINGS

- A. Weather lap joints a minimum of 2 inches and seal weather tight with plastic cement.
- B. Secure in place with nails at 2 inches on center. Conceal fastenings.
- C. Flash and seal work projecting through or mounted on roofing with plastic cement to make weather tight.
- D. Flashing metal shall be corrosion resistant.

3.08 INSTALLATION - ROOF SHINGLES

- A. Install shingles in accordance with manufacturer's instructions.
- B. Place shingles in straight coursing pattern with weather exposure as recommended by the manufacturer to produce double thickness over entire roof area and as required to meet the warranty. Provide double course of shingles at eaves and gables.
- C. Project first course of shingles 3/4 inch beyond fascia boards.
- D. Extend shingles 1/2 inch beyond face of gable edge fascia boards.
- E. Cap Hips and ridges with individual shingles, maintaining 5 inch weather exposure. Place to avoid exposed nails.
- F. Install shingles using "Hurricane Nailing" of six nails per shingle.

3.09 FIELD QUALITY CONTROL

- A. Field inspection by manufacturer's representative will be performed under provisions of Section 01 43 00.
- B. Field inspections of the work will also be performed by the Owners designated representative and or the Architect.
- C. Repair or replace defaced or disfigured finishes caused by work of this section.

3.10 PROTECTION OF FINISHED WORK

- A. Protect finished work under provisions of Section 01 70 00.
- B. Do not permit traffic over finished roof surface.

END OF SECTION

SECTION 07 50 01

REPAIRS TO EXISTING ROOF

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Repairs to existing roof where modified for installation of new construction elements.

1.02 SUBMITTALS

- A. Submit under provisions of Section 01 33 00.
- B. Product Data: Include manufacturer's specifications of materials and installation instructions.
- C. Samples: Submit if requested by the Architect.

1.03 QUALIFICATIONS

- A. Installer: Company specializing in installing the roofing system products required in this section with minimum of three years documented experience and approved by the existing roofing system manufacturer.

1.04 REGULATORY REQUIREMENTS

- A. Conform to all applicable Federal, State and local codes and laws.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, protect and handle products to site under provisions of Section 01 60 00.

1.06 FIELD MEASUREMENTS

- A. Verify actual dimensions with field measurements before fabrication.

1.07 EXISTING WARRANTY

- A. Existing roofing system is under a 20 year warranty.

Existing roofing system manufacturer is Carlisle EPDM – 60 mil.
The existing EPDM roof installation was completed in August 2020.

- B. Contractor is to notify manufacturer of the existing roofing system of intent to modify and repair and obtain instructions concerning materials and methods required to maintain integrity of the warranty. Furnish certificate from agency indicating acceptance and incorporation of repairs in the existing warranty.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Furnish materials compatible with existing roofing materials. Match or exceed quality, weights, type and finishes of existing materials. Provide, as applicable, but not limited to:
 - 1 Vapor retarders.
 - 2 Adhesives.
 - 3 Insulation materials & recovery board.
 - 4 Membranes.
 - 5 Surface coatings.
 - 6 Base flashings.
 - 7 Metal flashings.
 - 8 Expansion joint materials.
 - 9 Crickets and Cant strips.
 - 10 Pipe seals.

PART 3 EXECUTION

3.01 INSTALLATION

- A. All modifications to the existing warranted roofing system are to be made in accordance with the manufacturer's instructions and as required to maintain the existing warranty.
- B. Protect existing elements surrounding the work of this section from damage or disfigurement.
- C. Repair damages, if occurring, caused by foot traffic and movement of tools, equipment, and products across existing roof surface.
- D. Where new roof top equipment, pipe vents, and similar roof penetrations occur, install new roofing materials, in strict accordance with original roofing system manufacturer.
- E. Finished work shall be thorough, uniform, neat in appearance and watertight.

3.02 CLEANING

- A. Clean under provisions of Section 01 70 00.

END OF SECTION

SECTION 07 72 00

ROOF ACCESSORIES

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Furnish and install roof accessories and all associated components as outlined in this specification section.

1.02 RELATED SECTIONS

- A. Work specified elsewhere including, but not limited to, the furnishing and installing of the roofing system, wood nailers, flashings, and vapor barrier as occurring.

1.03 SUBMITTALS

- A. Submit under provisions of Section 01 33 00.
- B. Product Data: Provide data on product materials, characteristics, performance criteria, limitations and durability.
- C. Samples: Provide as requested by Architect.
- D. Manufacturer's installation instructions submitted indicating preparation required and installation techniques.
- E. Submit Material Safety Data Sheets for all liquid, paste or gaseous components.
- F. Submit shop drawings including standard detail drawings of product and recommended layout drawings.

1.04 QUALITY ASSURANCE

- A. Regulatory requirements: Conform to all applicable Local and State Codes.

1.05 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing the products specified in this section must have a minimum of five years documented experience.
- B. Installer: Company specializing in performing the work of this section must have a minimum of five years documented experience.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, and handle products under provisions of Section 01 60 00.

1.07 PROJECT/SITE CONDITIONS

- A. Roof surface shall be free of ponded water, snow or ice.

1.08 FIELD MEASUREMENTS

- A. Verify that field measurements are as indicated on drawings.

1.09 COORDINATION

- A. Coordinate and schedule installation of accessories with related work of other sections such as flashing, wood nailers, roofing system and vapor barrier as occurring.

1.10 WARRANTY

- A. Provide warranty under provisions of Section 01 78 00.

PART 2 - PRODUCTS

2.01 PRODUCTS

- A. Walkway Pads
 - 1. Walkway pads are to be Carlisle Sure-Seal EPDM pressure-sensitive molded walkway pads or equal. See drawings for quantities and locations.
 - 2. Provide and install Walkway Pads according to manufacturer's instructions. Membrane surface must be clean and primer applied as part of the installation of the pad.
 - 3. Provide a 1 inch wide gap between each walkway pad.
- B. Substitutions: Under provisions of Section 01 60 00.

PART 3 - EXECUTION

3.01 INSPECTION AND ACCEPTANCE

- A. Inspect all surfaces to receive work of this section. Correct any defects affecting installation.

3.02 INSTALLATION

- A. Install all products in accordance with manufacturer's instructions and requirements.

3.03 CLEANING

- A. Clean work under provisions of Section 01 70 00.
- B. Remove all debris from roof upon completion of installation and dispose in accordance with all applicable codes and laws.

END OF SECTION

SECTION 07 84 13

FIRESTOPPING

PART 1 – GENERAL

1.01 SUMMARY

- A. Related Documents:
The Drawings and general provisions of the Contract, including General and Supplementary General Conditions, and Division 1 Requirements, apply to the work in this Section.

1.02 RELATED SECTIONS

- A. Division 22 - Plumbing
- B. Division 23 – Mechanical
- C. Division 26 – Electrical

1.03 DESCRIPTION OF WORK

- A. The work of this Section consists of the provision of all plant, materials, labor and equipment and the like necessary or required for the complete execution of all firestopping and smoke seal work for this project as required by the schedules, keynotes and drawings, including, but not limited to the following:

NOTE – Firestopping is defined as a material, or combination of materials, to restore the integrity of fire rated walls and floors by maintaining an effective barrier against the spread of flame, smoke and toxic gases.

1. Provide firestopping and smoke seals as indicated on the drawings and as required to maintain full and continuous smoke and fire barrier between zones.

Seal all penetrations between floor/ceiling plane with expanding foam. No fiber insulation packing is permitted.

Cope and seal around all structural elements to insure smoke and fire barriers.
2. Provide firestopping of all openings in floors and walls both empty and those accommodating penetrating items such as cables and wires, cable trays, conduits, pipes, ducts, etc.; coordinate with Divisions 21, 22, 23 and 26.
3. Provide firestopping at joints between curtain walls and floor or roof openings and balance of openings between exterior walls and connecting floor assemblies at each floor.
4. Pack expansion joints in fire rated walls and floors;
5. Provide firestopping of openings at each floor level in shafts or stairwells.

1.04 REFERENCE STANDARDS

- A. American Society for Testing and Materials (ASTM)
 - 1. E 814 – Standard Method of Fire Tests of Through Penetration Fire Stops.
 - 2. E 119 – Methods of Fire Tests of Building construction and Materials.
 - 3. E 84 – Standard Test Method for Surface Burning Characteristics of Building Materials.
- B. Underwriters Laboratories, Inc. (UL)
 - 1. UL 1479 – Fire Tests of Through Penetration Fire Stops.
 - 2. UL 263 – Fire Tests of Building Construction and Materials.
 - 3. UL 723 – Surface Burning Characteristics of Building Materials.
 - 4. UL “Fire Resistance Directory” current year.
- C. Factory Mutual (FM) Approval Guide, current year.
- D. Building code of the jurisdiction of the work.
- E. National Fire Protection Association
 - 1. NFPA 101 – Life Safety Code.
 - 2. NFPA 70 – National Electrical Code.

1.05 QUALITY ASSURANCE

- A. Firestopping materials shall conform to both Flame (F) and Temperature (T) ratings as tested by nationally accepted test agencies per ASTM E 814 or UL 1479 fire tests.

The F rating and T rating must be a minimum of 1 hour but not less than the fire resistance rating of the assembly being penetrated.

The fire test shall be conducted with a minimum positive pressure differential of 0.03 inches of water column.
- B. Firestopping shall be performed by a Specialty Contractor trained or approved, in writing, by firestop material manufacturer.
Said specialist shall be as defined in the conditions.

Equipment used shall be in accordance with firestop material manufacturer's written installation instructions.
- C. Materials shall conform to all applicable governing codes.
- D. All materials used in the work shall be certified “asbestos free” and shall be free from any and all solvents or components that require hazardous waste disposal or, that after curing, dissolve in water.
- E. All materials shall comply with the interior finish flame spread and smoke developed requirements for the area in which they are installed. Coordinate with governing codes.

1.06 SUBMITTALS

- A. Submit under provisions of Section 01 33 00.
- B. Certification of specification compliance of all materials.
- C. Manufacturer's printed product data and drawings indicating product characteristics, performance, detail applications and limiting criteria.

Submittal shall include applicable UL and/or FM assembly numbers for each material and proposed installation.
- D. Manufacturer's installation instructions for each type of firestop required by the project.
- E. Manufacturer's approval of nominated installer of firestopping and smoke seal products.
- F. Mockups:
 - 1. Prepare job mockup of the material proposed for use in the project as directed by Architect.
Approved markups shall be left in place as part of the finished project and will constitute and standard for remaining work, including aesthetics.
- G. Manufacturers Material Safety Data Sheet (MSDS) must be submitted for each manufactured product.

1.07 PRODUCT DELIVERY STORAGE AND HANDLING

- A. Deliver, store, protect and handle products to site under provisions of Section 01 60 00.
- B. Deliver all materials to be used in the work of this section to the project site in original sealed containers with manufacturer's brand and name, lot numbers, UL labeling, mixing and installation instructions clearly identified thereon.
- C. Store all materials in accordance with manufacturer's directions.

All materials shall be dated with shelf life and shall be removed from the project site at the contractor's expense if date is expired.

1.08 PROJECT CONDITIONS

- A. Conform to manufacturer's printed instructions for installation and when applicable, curing in accordance with temperature and humidity. Conform to ventilation and safety requirements.
- B. Coordinate work required with work of other trades; firestopping shall, where practical, precede gypsum board or other applied sheet finishing operations.
- C. Where firestopping is installed at locations which will remain exposed in the finished work, provide protection as necessary to prevent damage to adjacent surfaces and finishes, and protect as required against damage from other construction operations.

- D. Adhesive and sealants use in the building interior [i.e., inside the exterior moisture barrier] shall not exceed VOC content limits of:
 - 1. Provisions of 01 81 10 Environmental Impact of Materials.
 - 2. Aerosol Adhesives: Green Seal Standard GC-36.

1.09 PREINSTALLATION CONFERENCE

- A. A preinstallation conference shall be scheduled in accordance with Section 01 31 00 by the contractor with this specialty contractor and all other specialty contractors, subcontractor and the like to establish procedures to maintain optimum working conditions and to coordinate the work of this section with related and adjacent work.

1.10 COORDINATION

- A. Coordinate construction of openings and penetrating items to ensure that through-penetration firestop systems are installed according to specified requirements, and comply with the following:
 - 1. Coordinate work of this section with similar work being performed by certain trades for their own work.
 - 2. All firestop work not performed by trades shall be performed under this section.
 - 3. Coordinate sizing of sleeves, openings, core-drilled holes, or cut openings to accommodate through-penetration firestop systems.
 - 4. Notify the Architect at least seven days in advance of through-penetration firestop system installations; confirm dates and times on days preceding each series of installations.
 - 5. Do not cover up through-penetration firestop system installations that will become concealed behind other construction until the Architect and building inspector, if required by authorities having jurisdiction, have examined each installation.

PART 2 – PRODUCTS

2.01 SPECIFICATION STANDARD: For purposes of establishing standards of quality and levels of performance and not for the purposes of limiting competition, the basis of this specification is upon units as manufactured by one of the following and their respective model suitable for the intended application.

- A. Bio Fireshield, Inc.; Damonmill Square, Concord, MA 01742.
 - 1. Novasit K-10 Firestop Mortar
 - 2. K-2 Firestop Mortar
 - 3. Biotherm Firestop Sealants and Caulk
 - 4. Firestop Sleeve
 - 5. Firestop Pillows
 - 6. Biostop 500 Intumescent Caulk
- B. IPC Corp.
 - 1. KBS Mortar Seal
 - 2. Flamesafe Sealants and Caulk
 - 3. FPS 1000 Putty and 1077 Putty Pads
 - 4. Firestop Kits – FSK200
 - 5. KBS Seal Bags
 - 6. Quelpyre Tapes and Blankets

- C. Dow Corning
 - 1. Firestop Sealant #2000
 - 2. Firestop Foam #2001
- D. 3M Corporation
 - 1. Fire Barrier Caulk, CP-25WB
 - 2. Fire Barrier MPS-2 Putty and 4S Putty Pads
 - 3. Fire Barrier Intumescent Wrap Strip #FS-195
- E. Nelson Firestop Products
 - 1. FSP Firestop Putty
 - 2. CMP Firestop Compound
 - 3. CLK Firestop Sealant
 - 4. PLW intumescent Pillow
 - 5. PCS Preformed Collar for Plastic Pipe Penetrations
 - 6. MPS Multi-Plug
 - 7. MCT Multi-Cable Transit
 - 8. EMCT Multi-Cable Transit and Plug
 - 9. CTG Firestop Coating
 - 10. CPS Composite Sheet
- F. Tremco, Inc.
 - 1. Fyre-Sil and Fyre-Sil SL
 - 2. Fyre-Shield
 - 3. THC-900/901
 - 4. Dymeric, Dymonic Sealant Systems
 - 5. Compatible forming systems.
- G. General Electric
 - 1. Pensil 100 Sealant
 - 2. Pensil 200 Foam
 - 3. Pensil 300 Joint Sealant
 - 4. Pensil 500 Putty
 - 5. Compatible forming systems.
- H. U.S. Gypsum Company
 - 1. U.S.G. "Thermafiber" unfaced safin insulation with third party wrap, 3.5 pcf density, UL R-10905 label.
 - 2. U.S.G. "Firecode" compound.
- I. Hilti Corporation
 - 1. Hilti CP 645 insulated firestop sleeve to replace existing pipe insulation

2.02 ACCESSORY ELEMENTS

- A. Forming, damming materials shall be mineral fiber board or other suitable material recommended by nominated system manufacturer.

- B. Primers, sealant and solvent cleaners shall be as recommended by the nominated system manufacturer.
- C. Metal Systems – 20 gauge phosphatized, electrogalvanized steel plate or galvanized steel clips.

PART 3 – EXECUTION

3.01 INSPECTION AND ACCEPTANCE

- A. Examine all surfaces and contiguous elements to receive work of this section and correct, as part of the work of this contract, any defects affecting installation.
- B. Commencement of work will be construed as complete acceptability of surfaces and contiguous elements.

3.02 PREPARATION

- A. The surface shall be dry, clean, and free of all foreign matter.
- B. Do not apply firestopping to surfaces previously painted or treated with a sealer, curing compound, water repellant or other coatings unless tests have been performed to ensure compatibility of materials.
- C. Provide primers as required which conform to manufacturer's recommendations for various substrates and conditions.
- D. Mask where necessary to protect adjoining surfaces.
- E. Remove excess material and stains on surfaces as required.

3.03 INSTALLATION – GENERAL SYSTEMS

- A. Install in strict accordance with manufacturer's printed instructions.
- B. Ensure that anchoring devices, backup materials, clips, sleeves, supports and other materials used in the actual fire test are installed.
- C. Install firestopping with sufficient pressure to properly fill and seal openings to ensure an effective smoke seal.
- D. Tool or trowel exposed surfaces. Remove excess firestop material promptly as work progresses and upon completion.
- E. Install dams when required to properly contain firestopping materials within openings and as required to achieve required fire resistance ratings. Combustible damming materials must be removed after appropriate curing. Incombustible damming materials may be left as a permanent component of the firestopping systems.

3.04 FIRESTOPPING CONSTRUCTION AT BUILDING EXTERIOR PERIMETERS, INTERIOR WALLS, SHAFTS, ETC.

- A. Install material of proper size on continuous plates or clips as required for proper support in order to safe-off area between exterior walls, interior walls and shafts and floor slabs, said walls and roof areas leaving NO VOIDS.
- B. Firestopping is required at all juncture conditions whether or not clips, angles or other structural elements exist either intermittently or continuously.
- C. Attach plates and clips to floor levels and other breaks and extend through framing to sheathing or other solid strata.
- D. Where metal decking flutes, either parallel or perpendicular to walls, occur and are open, same shall be fully packed and sealed with proper firestopping system.
- E. Where firestopping is accomplished after installation of drywall or other applied sheet finish, all spaces between penetrations and finish shall be filled to the thickness of said sheet finish with intumescent caulk.
- F. At all linear openings, fill voids with a minimum of 6 inches of minimum 3.5 lb./cu. ft. density safing insulation as specified in Part 2 herein and cover entire surface with UL listed firestop sealant of one of nominated manufacturers identified in Part 2 herein.

3.05 PENETRATION SEALS

- A. Penetrations are defined as conduits, cables, wires, piping, ducts or other elements passing through one through one or both outer surfaces of fire rated walls, floors or partitions and shall be firestopped on both sides of penetration in accordance with requirements set forth in Paragraph 1.04 of this Section.
- B. Where sleeves are used, same shall be as specified in Part 2 herein; in event that sleeves are not used, core openings and caulk penetrating items with intumescent system the full length of penetration and seal on both sides with intumescent caulk.
- C. Residual openings within square or rectangular holes shall be filled with compounds applicable for substrate encountered and all penetrations sealed on both sides with caulk.
- D. Where existing pipes penetrate new partition, replace existing pipe insulation with new insulated firestop sleeve and seal perimeter of remaining opening on both sides with caulk.

3.06 FIELD QUALITY CONTROL

- A. Contractor shall immediately notify the Architect if the firestopping systems herein specified cannot meet the requirements of the specification.
- B. Contractor shall examine firestops to ensure proper installation and full compliance with this specification.
- C. All areas of work must be accessible until inspection by the applicable code authorities.

- D. Correct unacceptable firestops and provide additional inspection to verify compliance with this specification at no additional cost.

3.07 CLEANING

- A. When finished work will be visible, clean adjacent surfaces in accordance with manufacturer's printed instructions.
- B. If visible in the finished work, remove temporary dams after initial cure of firestops.
- C. Correct staining and discoloring on adjacent surfaces.
- D. Remove all debris and excess materials entirely from site and leave work in a neat and clean condition.

END OF SECTION

SECTION 07 92 13

JOINT SEALANTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:

- 1. Silicone joint sealants.
- 2. Urethane joint sealants.
- 3. Acoustical joint sealants.

- B. Related Sections:

- 1. Division 09 Section "Gypsum Board" for sealing perimeter joints.
- 2. Division 09 Section "Tiling" for sealing tile joints.

1.3 PRECONSTRUCTION TESTING

- A. Preconstruction Compatibility and Adhesion Testing: Submit to joint-sealant manufacturers, for testing indicated below, samples of materials that will contact or affect joint sealants.

- 1. Use ASTM C 1087 to determine whether priming and other specific joint preparation techniques are required to obtain rapid, optimum adhesion of joint sealants to joint substrates.
- 2. Testing will not be required if joint-sealant manufacturers submit joint preparation data that are based on previous testing, not older than 24 months, of sealant products for adhesion to, and compatibility with, joint substrates and other materials matching those submitted.

1.4 SUBMITTALS

- A. Submit under provisions of Section 01 33 00.

- B. Product Data: For each joint-sealant product indicated.

- C. Sustainable Building Material Submittal:

- 1. Product Data for sealants and sealant primers used inside the weatherproofing system, including printed statement of VOC content.

- D. Samples for Initial Selection: Manufacturer's color charts consisting of strips of cured sealants showing the full range of colors available for each product exposed to view.

- E. Joint-Sealant Schedule: Include the following information:
 - 1. Joint-sealant application, joint location, and designation.
 - 2. Joint-sealant manufacturer and product name.
 - 3. Joint-sealant formulation.
 - 4. Joint-sealant color.
- F. Product Certificates: For each kind of joint sealant and accessory, from manufacturer.
- G. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, indicating that sealants comply with requirements.
- H. Preconstruction Compatibility and Adhesion Test Reports: From sealant manufacturer, indicating the following:
 - 1. Materials forming joint substrates and joint-sealant backings have been tested for compatibility and adhesion with joint sealants.
 - 2. Interpretation of test results and written recommendations for primers and substrate preparation needed for adhesion.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.
- B. Mockups: Install sealant in mockups of assemblies specified in other Sections that are indicated to receive joint sealants specified in this Section. Use materials and installation methods specified in this Section.
- C. Deliver, store, protect and handle products to site under provisions of Section 01 60 00.

1.6 PROJECT CONDITIONS

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

1.7 WARRANTY

- A. Warranty Period: Two years from date of Substantial Completion. Provide under the provisions of Section 01 78 00.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers as listed below

- B. Substitutions: Under provisions of Section 01 60 00.

2.2 MATERIALS, GENERAL

- A. Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by joint-sealant manufacturer, based on testing and field experience.
- B. VOC Content of Interior Sealants: Provide sealants and sealant primers for use inside the weatherproofing system that comply with the following limits for VOC content when calculated according to 40 CFR 59, Part 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.
- C. Colors of Exposed Joint Sealants: As selected by Architect from manufacturer's full standard range.

2.3 SILICONE JOINT SEALANTS

- A. Mildew-Resistant, Single-Component, Acid-Curing Silicone Joint Sealant: ASTM C 920, Type S, Grade NS, Class 25, for Use NT.
1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Dow Corning Corporation; 786 Mildew Resistant.
 - b. GE Advanced Materials - Silicones; Sanitary SCS1700.
 - c. Tremco Incorporated; Tremsil200 Sanitary.

2.4 URETHANE JOINT SEALANTS

- A. Single-Component, Nonsag, Urethane Joint Sealant: ASTM C 920, Type S, Grade NS, Class 25, for Use NT.
- Products: Subject to compliance with requirements, provide one of the following:
- a. Pecora Corporation; Dynatroll-XL.
 - b. Sika Corporation, Construction Products Division; Sikaflex - 1a.
 - c. Tremco Incorporated; Dymonic 100

2.5 JOINT SEALANT BACKING

- A. General: Provide sealant backings of material that are nonstaining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.
- B. Cylindrical Sealant Backings Rods: ASTM C 1330, Type C, Closed Cell, provide backing rods of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance.
- C. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint. Provide self-adhesive tape where applicable.

2.6 MISCELLANEOUS MATERIALS

- A. Primer: Material recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.
- B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces in any way, and formulated to promote optimum adhesion of sealants to joint substrates.
- C. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting joint-sealant performance.

3.2 PREPARATION

- A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions and the following requirements:
 - 1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, paints (except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer), old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.
 - 2. Clean porous joint substrate surfaces by brushing, grinding, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining after cleaning operations above by vacuuming or blowing out joints with oil-free compressed air.
 - 3. Remove laitance and form-release agents from concrete.
 - 4. Clean nonporous joint substrate surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants.
- B. Joint Priming: Prime joint substrates where recommended by joint-sealant manufacturer. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.
- C. Masking Tape: Use masking tape where required to prevent contact of sealant or primer with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

3.3 INSTALLATION OF 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 C1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.
- C. Install sealant backings of kind indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.
 - 1. Do not leave gaps between ends of sealant backings.
 - 2. Do not stretch, twist, puncture, or tear sealant backings.
 - 3. Remove absorbent sealant backings that have become wet before sealant application and replace them with dry materials.
- D. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.
- E. Install sealants using proven techniques that comply with the following and at the same time backings are installed:
 - 1. Place sealants so they directly contact and fully wet joint substrates.
 - 2. Completely fill recesses in each joint configuration.
 - 3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.
- F. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified in subparagraphs below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.
 - 1. Remove excess sealant from surfaces adjacent to joints.
 - 2. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.
 - 3. Provide concave joint profile per Figure 8A in ASTM C 1193, unless otherwise indicated.
 - a. Use masking tape to protect surfaces adjacent to recessed tooled joints.

3.4 CLEANING

- A. Clean off excess sealant or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur.
- B. Clean under provisions of Section 01 70 00.

3.5 PROTECTION

- A. Protect joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage

or deterioration occurs, cut out and remove damaged or deteriorated joint sealants immediately so installations with repaired areas are indistinguishable from original work.

3.6 JOINT-SEALANT SCHEDULE

- A. Joint-Sealant Application: Interior joints in vertical surfaces and horizontal nontraffic surfaces.
 - 1. Joint Locations:
 - a. Control and expansion joints on exposed interior surfaces of exterior walls.
 - b. Perimeter joints of exterior openings where indicated.
 - c. Tile control and expansion joints.
 - d. Vertical joints on exposed surfaces of interior unit masonry, concrete walls and partitions.
 - e. Perimeter joints between interior wall surfaces and frames of interior doors and windows.
 - f. Openings around all penetrations through partitions and perimeter of partitions designated as smoke partitions.
 - g. Other joints as indicated.
 - 2. Urethane Joint Sealant: Single component, nonsag, Class 35
 - 3. Joint-Sealant Color: As selected by Architect from manufacturer's full standard range.
- B. Joint-Sealant Application: Mildew-resistant interior joints in vertical surfaces and horizontal nontraffic surfaces.
 - 1. Joint Sealant Location:
 - a. Joints between plumbing fixtures and adjoining walls, floors, and counters.
 - b. Tile control and expansion joints where indicated.
 - c. Other joints as indicated.
 - 2. Joint Sealant: Mildew resistant, single component, nonsag, mildew resistant, acid curing.
 - 3. Joint-Sealant Color: As selected by Architect from manufacturer's full standard range.
- C. Joint-Sealant Application: Exterior joints in vertical surfaces and horizontal nontraffic surfaces.
 - 1. Joint Locations:
 - a. Control and expansion joints in unit masonry.
 - b. Joints between different materials listed above.
 - c. Perimeter joints between materials listed above and frames of doors, windows and louvers.
 - d. Control and expansion joints.
 - e. Other joints as indicated.
 - 2. Silicone Joint Sealant: Single component, Type S, Grade NS, Class 50.
 - 3. Joint-Sealant Color: As selected by Architect from manufacturer's full standard range.

END OF SECTION

SECTION 08 88 60

INSULATED METAL GLAZING PANELS

PART 1 – GENERAL

1.01 SUMMARY

A. Section Includes:

1. Aluminum-faced glazing panels for building storefront doors, sidelights & window systems.

1.02 REFERENCES

A. American Architectural Manufacturers Association (AAMA):

1. AAMA 609 & 610 Cleaning and Maintenance Guide for Architecturally Finished Aluminum
2. AAMA 2605 Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels

B. American Society of Civil Engineers (ASCE):

1. ASCE/SEI 7 Minimum Design Loads for Buildings and Other Structures

C. ASTM International:

1. ASTM B209 Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate
2. ASTM C920 Standard Specification for Elastomeric Joint Sealants
3. ASTM D2244 Standard Practice for Calculation of Color Tolerances and Color Differences from Instrumentally Measured Color Coordinates
4. ASTM D4214 Standard Test Methods for Evaluating the Degree of Chalking of Exterior Paint Films
5. ASTM E84 Standard Test Method for Surface Burning Characteristics of Building Materials
6. ASTM E330-84: Structural Performance of Exterior Windows, Curtain Walls and Doors under the influence of wind loads.
7. ASTM D1781-76: Climbing Drum Peel Test for Adhesives.
8. ASTM D3363-74: Method for Film Hardness by Pencil Test.
9. ASTM D2794-90: Resistance of Organic Coatings to the Effects of Rapid Deformation (Impact)
10. ASTM D3359-90: Method for Measuring Adhesion by the tape test.

1.03 SUBMITTALS

A. Submit under provisions of Section 01 33 00.

B. Product Data: Submit material descriptions, dimensions of individual components and profiles, and finishes for glazing panels.

C. Product Design: Submit design data including, but not limited to, material properties, section properties, and capacities for glazing panels.

D. Selected Samples: Submit Manufacturer's color charts or chips illustrating full range of colors and finishes available for glazing panels with factory-applied finishes.

1. Verification Samples:

- a. Submit one sample in thickness specified that measures approximately 3 inches x 5 inches, minimum.

- b. Submit two samples of each color or finish selected that measure approximately 3 inches x 4 inches, minimum.

E. Quality Assurance Submittals:

- 1. Glazing Panel Material Certification: Submit an official written statement from the Manufacturer documenting that product raw materials meet specified standards. Certification shall be backed by test reports and/or material certificates.
- 2. Glazing Panel Product Certification: Submit an official written statement from the Manufacturer documenting that product complies with specified tested standards indicated in this specification. Certification shall be backed by test reports.

F. Closeout Submittals:

- 1. Warranty: Submit Manufacturer and Installer warranty documents as specified within the Warranty section of this specification.
- 2. Maintenance: Submit Manufacturer's recommendations document for Cleaning and Maintenance of the glazing panels.

1.04 QUALITY ASSURANCE

A. Qualifications:

- 1. Manufacturer Qualifications: Company with a minimum of 10 years of continuous experience manufacturing glazing panels of the type specified:
 - a. Able to provide specified warranty on finish.
- 2. Installer Qualifications:
 - a. The Installer shall have:
 - i. Been in business of a similar trade and under the present company name for at least five (5) years prior to the start of this project, and
 - ii. Experience with similar sized glazing panel projects, and
 - b. The Installer must be capable of providing field service representation during installation.

- B. Conform to all applicable Federal, State and local codes and laws.

1.05 DELIVERY AND STORAGE

- A. Deliver, store, protect and handle products to site under provisions of Section 01 60 00.

- B. Upon receipt, perform visual inspection of glazing panels and inventory to identify any damages that may have occurred during shipping or any missing panels.

C. Storage:

- 1. Store glazing panels horizontally on pallets in a dry, well-ventilated environment under the protection of a temporary or permanent structure. If required to be stored in an exterior area, glazing panels must be placed under a well-ventilated, waterproof covering.
- 2. Store glazing panels a minimum of 4" above ground level to avoid contact with standing moisture (e.g. water, snow, etc.).
- 3. Store glazing panels in an area protected from other construction activities and associated debris.
- 4. Storage temperatures are not to exceed 120°F. Protect glazing panels from moisture and direct sunlight while on the job-site.

5. Do not stack more than 1000 pounds glazing panels on one pallet. Other materials shall not be stacked on, or placed in contact with, glazing panels to prevent staining, denting, or other damages.

1.06 PROJECT CONDITIONS

- A. Field/Shop Measurements: Verify locations of framing members and glazing dimensions by field/shop measurements prior to the preparation of the glazing panels.

1.07 WARRANTY

- A. Provide warranties for the specified product under the provisions of Section 01 78 00.
- B. Panel Manufacturer's Material Warranty: Submit, to the Owner, the Manufacturer's standard warranty.
 1. Warranty Period:
 - a. Material and Product Integrity: Five (5) years against delamination at any manufactured bond line
 - b. Coil-Coated PVDF/Kynar 500 Painted Finish: Minimum twenty (20) years against:
 - i. Chalking in excess of a numerical rating of eight (8) when measured in accordance with ASTM D4214, Method A
 - ii. Fading or change color in excess of five (5) E units (NBS) when calculated in accordance with ASTM D2244, paragraph 6.3
 - iii. Cracking, chipping, splitting, blistering, peeling, or loss of adhesion. Minute fracturing (i.e. crazing or cracking) as a result of routing and bending of the panels shall be excluded.
- C. Installation Warranty: Installer shall submit to the Owner a standard warranty document executed by an authorized company official. The warranty shall be in addition to, and not a limitation of, other rights Owner may have under the Contract Documents.
 1. Warranty Period:
 - a. Workmanship: One (1) year warranty period commencing on Date of Substantial Completion.

PART 2 – PRODUCTS

2.01 MANUFACTURERS

- A. Glazing Panel Manufacturers:
 1. Insulated glazing panels manufactured by Mapes Architectural Panels – www.mapes.com (Listed on drawings as "FEOP" and "OP".)
 2. Substitutions: Under provisions of Section 01 60 00.

2.02 GLAZING PANELS

A. Panel Description (Mapes-R)

1. Construction:
 - a. Panel Thickness – 1”
 - b. Exterior Substrate: Tempered Hardboard: 1/8”
 - c. Core: Isocyanurate: 5/8”
 - d. Interior Substrate: Tempered Hardboard: 1/8”
 - e. Aluminum Sheets (finish material skin on both sides) (in accordance with ASTM B209): Thickness: 0.032 inch
 - f. Fire Performance (tested in accordance with ASTM E84): Class A Material
 1. Flame Spread Index (FSI) shall not be more than 25
 2. Smoke Developed Index (SDI) shall not be more than 450
 - g. Tolerances - .8% of panels dimension length and width - (+/-) 1/16" thickness

B. See drawings for location of each type of panel.

2.03 FINISH

A. Aluminum Finish: Finish shall meet the performance criteria of AAMA 2605.

1. Standard and Standard Metallic Finishes:
 - a. Selected by Architect from Manufacturer’s standard color chart
 - b. Color may be a different color on the exterior than the interior.

2.04 RELATED MATERIALS

A. General: Refer to Related Sections specified herein for other materials, including joint sealants.

PART 3 – EXECUTION

3.01 PREPARATION

- A. Site Verification of Conditions: Verify that conditions of door, door frame, window, and glazing systems are acceptable for the glazing panels installation.
- B. Panel surfaces shall be free from defects prior to installation.
- C. If the panels need to have a cut-out in them, the cut-out is to be performed by the manufacturer to the size and in the location required. Verify exact cut-out information with Architect and Owner. Cut-outs are to be 3 inches or more away from the edges of the panel.

3.02 INSTALLATION

- A. Fabricate glazing panels with sharply cut edges and no displacement of face sheets or protrusion of core. When applicable, form glazing panel panned edges to be sharp, true, and free of buckle and/or warp.
- B. Fabrication Tolerances:
 1. Width: +/- 1/16 inch

2. Length: +/- 1/16 inch
3. Squareness: +/- 1/16 inch

C. Glazing Panel Installation:

1. Handling:
 - a. Protective masking should be left on the field of each glazing panel during installation to minimize potential damages from construction activities.
 - b. Handle glazing panels with clean work gloves to avoid hand injury from any sharp edges and to prevent staining of surfaces with contaminants.
 - c. When removing individual glazing panels from stacks, always lift one panel completely off the next to prevent surface scratches from construction debris. Do not slide one glazing panel across another. Glazing suction cups are recommended to handle glazing panels whenever possible.
2. Install the glazing panels plumb, level, and true in accordance with the glazing systems requirements. Install panels such that all edges are fully encapsulated and restrained from movement forward, backward, and side-to-side while allowing for thermal expansion.
3. Comply with Manufacturer's instructions for installation of joint sealants.
4. Separate contact of dissimilar metals with approved methods as defined by the Manufacturer in order to eliminate the possibility of corrosive or electrolytic action between metals.
5. Glaze panels securely and in accordance with approved shop drawings and manufacturer's instructions to allow for necessary thermal movement and structural support.
6. Do not install panels that are observed to be defective including warped, bowed, dented, scratched and delaminating components.
7. Weatherseal all joints as required using methods and materials as previously specified.

3.03 FIELD QUALITY CONTROL

- A. Manufacturer's Field Services: Upon Architect's request, provide manufacturer's field service consisting of product use recommendations and periodic site visit for inspection of product installation in accordance with manufacturer's instructions.

3.04 REMEDIATION AND CLEANING

- A. Remediation:
 1. Remove and replace glazing panels damaged as a direct result of activities in the Glazing Panel Installation section.
 2. Remove protective masking immediately after installation of glazing panels. Masking intentionally left in place after Glazing Panel Installation on an elevation at the direction of the General Contractor shall become the responsibility of the General Contractor.
 3. Glazing Panel Installation completion shall be agreed-upon between the Installer and the General Contractor.
 4. Following Glazing Panel Installation completion, any determination of repair or replacement of the glazing panels is at the discretion of the Architect. Such repair or replacement shall become the responsibility of the General Contractor.
 - a. At the discretion of the Architect, repair damaged glazing panels such that repairs are not discernible at a distance of 10 feet from the surface at a 90° angle per AAMA 2605.

5. Removal and replacement of glazing panels damaged by other trades shall be the responsibility of the General Contractor.
6. If required after Glazing Panel Installation, any additional protection of the glazing panels shall be the responsibility of the General Contractor.
7. Remove from project site damaged glazing panels, protective masking, and other debris attributable to work of this section.

B. Cleaning:

1. Cleaning and Maintenance of the glazing panels shall be performed at least once a year in accordance with AAMA 609 & 610.
2. Weep holes and drainage channels must be unobstructed and free from dirt and sealant.

END OF SECTION

SECTION 09 21 16

STEEL FRAMED DRYWALL SYSTEMS

PART 1 - GENERAL

- 1.01 SCOPE: Provide all necessary materials for construction of drywall systems.
- 1.02 RELATED SECTIONS:
- A. Division 06 Carpentry Section for wood framing, blocking and furring.
 - B. Division 09 Painting Section for paint applied to gypsum board surfaces.
- 1.03 DELIVERY AND STORAGE OF MATERIALS:
- A. Deliver, store, and handle under provision of Section 01 60 00.
 - B. All materials shall be delivered in their original unopened packages and stored in an enclosed shelter providing protection from damage and exposure to the elements. Damaged or deteriorated materials shall be removed from the premises. Stack gypsum panels flat to prevent sagging.
- 1.04 ENVIRONMENTAL CONDITIONS:
- A. In cold weather and during gypsum panel joint finishing, temperatures within the building shall be maintained within the range of 55 degrees to 70 degrees F. Adequate ventilation shall be provided to carry off excess moisture.
 - B. Do not install panels that are wet, those that are moisture damaged, and those that are mold damaged.
- 1.05 SUBMITTALS
- A. Submit under provisions of Section 01 33 00.
 - B. Product Data: Submit product data on all materials and accessories.

PART 2 - PRODUCTS

- 2.01 MANUFACTURERS
- A. Provide manufacturer and product specified under the Materials paragraph below.
 - B. Substitutions: Under provisions of Section 01 60 00.

2.02 MATERIALS: See drawings for size and location of materials.

- A. Non-Structural Studs: Cold-formed galvanized steel C-studs as per ASTM C 645, ProSTUD products manufactured by ClarkDietrich Building Systems.
 - 1. See drawings for gage, minimum 25 gage for interior non-load bearing, maximum 10'-0" high and 20 gage for above 10'. Provide 20 gage for jamb and lintel components.
 - 2. Flange Size: 1 1/4 inch.
 - 3. Web Depth: As specified on Drawings.
- B. Non-Structural Track: Cold-formed galvanized steel runner tracks, drywall track, in conformance with ASTM C 645, ProTRAK as manufactured by ClarkDietrich Building Systems.
 - 1. Flange Size: 1-1/4 inch
 - 2. Web Depth: Track web to match and coordinate with stud web size.
- C. Metal Furring (Hat) Channel manufactured by ClarkDietrich Building Systems: 7/8" depth by 10' or 12' length, (20 gauge at ceilings) (25 gauge at walls), meet or exceed ASTM C645.
- D. Z Furring Channel manufactured by ClarkDietrich Building Systems available in 1", 1-1/2", 2", 2 1/2" depths by 10' length with 1 1/4" wide flange, meet or exceed ASTM C645.
See drawings for size and gage.
- E. Provide 1-1/2" Cold-Rolled Channels.
- F. Galvanized Hanger Wire (12-ga)
- G. 18-ga. Galvanized Tie Wire.
- H. Faceboards - 48" wide USG Sheetrock Brand
Firecode Type X gypsum board
Provide lengths as required.
Thickness to be as indicated on drawings. If not indicated on drawings, board to be 5/8" thick.
- I. Fasteners - USG Screws: 3/8" Type S, pan head; 3/8", 1/2" Type S-12, pan head; 5/8" Type S-12 low-profile head; 1", 1-1/4", 1-5/8", 1-7/8", 2-1/4" Type S, bugle head; 1", 1-5/8", 2-1/4" Type S or S-12, trim head; 1-1/2" Type G, bugle head; 1-1/4" Type W, bugle head; 1'-1/4" annular ring drywall nail.
- J. USG Trim No. (200-A)(401)(402)(P-1)(801-A)(801-B).
- K. USG Corner Bead - (No. 103 DUR-A-BEAD) (No. 104 DUR-A-BEAD)(No.800) Metal Corner Reinforcement.
- L. USG Control Joint No. 093
- M. Joint Treatment (select a United States Gypsum Company Joint System)

Standard Gypsum Finish = Joint Treatment: Sheetrock Brand All Purpose Joint Compound.
Provide a Level 4 gypsum board finish. (Coat gypsum only at joints and fasteners)
This finish is to be used typically everywhere except where otherwise noted on the drawings.

- N. USG Acoustical Sealant

PART 3 - EXECUTION

3.01 PARTITION INSTALLATION

- A. **STUD SYSTEM ERECTION:** Attach steel runners at floor and ceiling to structural elements with suitable fasteners located 2" from each end and spaced 24" o.c.
To suspended ceilings, use toggle bolts or hollow wall anchors spaced 16" o.c.

Position studs vertically, with open side facing in same direction, engaging floor and ceiling runners, and spaced 16" o.c. When necessary, splice studs with 8" nested lap and two positive attachments per stud flange. Place studs in direct contact with all door frame jambs, abutting partitions, partition corners and existing construction elements. Where studs are installed directly against exterior walls and a possibility of water penetration through walls exists, install asphalt felt strips between studs and wall surfaces.

Anchor all studs for shelf-walls and those adjacent to door and window frames, partition intersections, corners and freestanding furring to ceiling and floor runner flanges with USG Metal Lock Fastener tool or screws. Securely anchor studs to jamb and head anchors of door or borrowed light frames by bolt or screw attachment. Over metal door and borrowed light frames, place horizontally a cut to length section of runner, with a web flange bend at each end, and secure to strut-studs with two screws in each bent web. Position a cut-to-length stud (extending to ceiling runner) at vertical panel joints over door frame header. When attaching studs to steel grid system, structural adequacy of grid to support end reaction of wall must be determined.

- C. As occurring:
Install Sound Attenuation Insulation after gypsum panels are applied to the resilient channel (if occurring) and before panels are applied to other side of studs. Insert the sound insulation in the stud cavity, by bowing the blanket slightly. After inserting, make a vertical cut between the studs. Slit the blanket with a sharp utility or hook-bill knife to ease the pressure of the blanket against the gypsum panels when they are installed. Butt ends of blankets closely together and fill all voids. Seal perimeter of gypboard and all penetrations with acoustical sealant to complete the requirements for a sound retardant partition.

3.02 APPLYING INTERIOR GYPSUM BOARD

A. Single-Layer Application:

1. On ceilings, apply gypsum panels before wall/partition board application to greatest extent possible and at right angles to framing, unless otherwise indicated.
2. On partitions/walls, apply gypsum panels 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 panels.
 - b. At stairwells and other high walls, install panels horizontally, unless otherwise indicated or required by fire-resistance-rated assembly.
3. On Z-furring members, apply gypsum panels vertically (parallel to framing) with no end joints. Locate edge joints over furring members.
4. Fastening Methods: Apply gypsum panels to supports with steel drill screws.

B. Gypsum Panel Attachment

Screw spacing that follows is for non-rated construction. For fire-rated construction, obtain screw spacing from manufacturer's fire test report.

For single-layer panel application, space screws 16" o.c. in field and along abutting end joints.

3.03 DRYWALL SOFFIT ERECTION:

Attach steel runners 24" o.c. to concrete slabs and concrete stub nails or power-driven anchors, to suspended ceilings with toggle bolts or to wood framing with suitable fasteners. On stud walls, space fasteners to engage each stud. On ceilings, place fastener close to outside face runner.

Fasten vertical face panel to web of face corner runner and flange of ceiling runner with 1" Type S Screws spaced 12" o.c. For braced furring, insert steel studs between face corner runners, sidewall and ceiling runners and attach studs to runners with Metal Lock Fastener tool or 3/8" pan head screws. Attach face panels to steel studs and runners with 1" Type S Screws spaced 12" o.c. Space screws in corner runner at least 1" from gypsum panel edge.

3.05 WALL FURRING INSTALLATION

- #### A. METAL FURRING (HAT) CHANNEL INSTALLATION:
- Attach metal furring channels horizontally, spaced 24" o.c. to interior of masonry or concrete surface with hammer set or power driven fasteners or concrete stub nails staggered 24" o.c. on opposite flanges. Where furring channel is installed directly to exterior wall and a possibility of water penetration through walls exists, install asphalt felt protection strip between furring channel and wall.

Apply gypsum panels parallel to channel. Position all edges over furring channels in parallel application; all ends over framing in perpendicular application with joints staggered in successive courses. Use maximum practical lengths to minimize end joints. Fit ends and edges closely, but not forced together. Fasten panels to channels with 1" Type S Screws spaced 16" o.c.

- #### B. Z FURRING CHANNEL INSTALLATION:
- Erect insulation vertically and hold in place with Z-furring channels spaced 24" o.c. Except at exterior corners, attach narrow flanges of furring channels to wall with concrete stub nails or power driven fasteners spaced 24" o.c. At exterior

corners, attach wide flange of furring channel to wall with short flange extending beyond corner. On adjacent wall surface, screw attach short flange of furring channel to web of attached channel. Start from this furring channel with a standard width insulation panel and continue to regular manner. At interior corners, space second channel no more than 12" from corner and cut insulation to fit. Hold mineral fiber insulation in place until gypsum panels are installed with 10" long staple field fabricated from 18 ga. tie wire and inserted through slot in channel. Apply wood blocking around window and door opening and as required for attachment of fixtures and furnishings.

Apply gypsum panels parallel to channels with vertical joints occurring over channels. Use no end joints in single-layer application. Attach gypsum panels with 1" Type S Screws spaced 16" oc. in field of panels and at edges, and with 1-1/4" Type S Screws spaced 12" o.c. at exterior corners. For double-layer application, apply base layer parallel to channels, face layer either perpendicular or parallel to channels with vertical joints offset at least one channel. Attach base layer with screws 24" o.c. and face layer with 1-5/8" screws 16" o.c.

3.09 ACCESSORY APPLICATION

- A. JOINT SYSTEM: Finish all face panel joints and internal angles with a United States Gypsum Company Joint System installed according to manufacturer's directions. Spot exposed fastened on face layers and finish corner bead, control joints and trim as required, with at least three coats of joint compound, feathered out onto panel faces and sanded smooth.
- B. CORNER BEAD: Reinforce all vertical and horizontal exterior corners with corner bead fastened with 9/16" galvanized staples 9" o.c. on both flanges along entire length of bead.
- C. METAL TRIM: Where assembly terminates against masonry or other dissimilar material, apply metal trim over panel edge and fasten with 9/16" galvanized staples 9" o.c.
- D. SCREWS: Power drive at least 3/8" from edges or ends of panel to provide uniform dimple 1/32" deep.
- E. CONTROL JOINTS: Break panel behind joint and back by double framing members (and 2" wide gypsum panel strip). Apply acoustical sealant to fill gap and attach control joint to face layer with 9/16" galvanized staples spaced 6" o.c. on both flanges along entire length of joint. Provide a full height control joint where a wall or partition extends in a continuous straight plane for more than 30 linear feet or where indicated on the drawings.

3.10 CLEANING

- A. Clean project under provisions of Section 01 70 00.

END OF SECTION

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SECTION 09 51 23

ACOUSTICAL CEILING SYSTEMS

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. The furnishing and installation of acoustical and suspension ceiling systems.

1.02 RELATED SECTIONS

- A. Division 26 - Electrical

1.03 REFERENCES

- A. Federal Specification SS-S-118B acoustical tile and panel properties.
- B. AMA 1-11 - Sound transmission
- C. ASTM C423 - Sound absorption
- D. UL - Underwriters Laboratories, Inc.
- E. ASTM C635 - Metal suspension system properties
- F. ASTM C636 - Acoustical ceiling system installation procedures

1.04 DESCRIPTION

- A. Acoustical ceiling panels.

1.05 SUBMITTALS

- A. Submit under provisions of Section 01 33 00.
- B. Product Data: Include manufacturer's specifications of materials and installation instructions.
- C. Samples: Submit two 6" x 12" samples of panels.
- D. Test reports: Submit data indicating the following ratings:
 - NRC (Noise reduction coefficient)
 - CAC (Ceiling Attenuation Class)
 - Light reflectance.
 - Flame spread
 - Smoke developed

1.06 MAINTENANCE DATA

- A. Submit under provisions of Section 01 78 00.
- B. Submit cleaning and maintenance data including procedures for stain removal and cleaning.

1.07 QUALITY CONTROL

- A. Work shall be performed in accordance with Section 01 45 00.

1.08 REGULATORY REQUIREMENTS

- A. Conform to the manufacturer's recommendations to achieve the fire resistive ratings as listed by Underwriters Laboratories, Inc. (Class A)

1.09 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, protect and handle products to site under provisions of Section 01 60 00.
- B. Storage shall be in building, closed to the weather with temperatures ranging from 60°F to 85°F at not more than 70% relative humidity.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Acoustical panels
 - 1. Armstrong
 - 2. Other acceptable manufacturers offering equivalent products.
 - a. USG
- B. Suspension System
 - 1. Armstrong
 - 2. Other acceptable manufacturers offering equivalent products.
 - a. Chicago Metallic Corp.
 - b. USG
- C. Substitutions: Under provisions of Section 01 60 00.

2.02 MATERIALS

- A. Acoustical Panels
 - 1. High-NRC (Noise Reduction Coefficient) Acoustical ceiling tile
 - a. Fine Fissured High-NRC Square Lay-in
(ACT as noted on the drawings)
(Model No. 1754: 24"x24") (Model No. 1755: 24"x48")
 - 1. Water felted mineral fiber panel with white latex paint finish.
 - 2. Square Lay-in, 7/8" thick
 - 3. Light reflectance = 0.86
 - 4. Flame spread = 25 or less

5. Smoke developed = 50 or less
6. Class A fire rating per ASTM E1264
7. NRC = 0.75
8. CAC = 35
9. Total recycled content: minimum 65%

B. Suspension Systems

1. Standard Exposed Grid

a. Prelude XL

1. Hot dipped galvanized steel with white baked polyester paint finish.
2. Intermediate duty main runners and cross tees with 15/16" flange face.
3. Wall angles shall be straight edge and corner caps shall be of same materials and finish.
4. Suspend with galvanized steel wire.
5. Total recycled content: minimum 25%

2.03 COLORS

- A. White

2.03 SIZE

- A. All ceiling panels shall be 2'x2' or 2'x4'.
See drawings for locations of different sizes.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Verify that all components in the ceiling plenum are installed. The building shall be in proper condition to receive the acoustical materials before any of the material shall be installed. The acoustical material shall be installed under conditions of normal occupancy. All wet work shall be completed, dry, and the building fully enclosed.

3.02 PROTECTION

- A. Protect existing elements surrounding the work of this section from damage or disfigurement.

3.03 INSTALLATION

- A. Install all acoustical panels in strict accordance with the manufacturer's instructions into the existing metal acoustical ceiling grid.
- B. Main runners shall be installed on 24 inch centers and suspended by hanger wire spaced not more than 48 inches on center along the main runners.
- C. Cross tees shall be 24 inches in length and shall be spaced 24 or 48 inches on center along the main runner to form 2'x2' or 2'x4' modules as scheduled on the drawings.
- D. Install wall moldings at intersection of suspended ceiling and all vertical surfaces.

E. Miter corners where wall moldings intersect or install corner caps.

F. The acoustical panels shall not be used to support any other materials.

3.04 CLEANING

A. Clean under provisions of Section 01 70 00.

END OF SECTION

SECTION 09 91 00

PAINTING

PART 1 - GENERAL

1.01 SUMMARY

- A. Related Documents:
The Drawings and general provisions of the Contract, including General and Supplementary General Conditions, and Division 1 Requirements, apply to the work in this Section.

1.01 SECTION INCLUDES

- A. Finish painting and priming of all items exposed and identified to receive a finish.

1.02 RELATED SECTIONS

- A. Surfaces scheduled or indicated to be painted.
- B. Touch up of shop coats provided under other sections unless specifically included in that section.
- C. Exposed structural steel.
- D. Finish painting of exposed piping, conduit, exposed raceways, metal hardware, exposed equipment including rooftop equipment supplied under mechanical and electrical trades, when such items have not been factory pre-painted.
- E. Examine the specifications for the various other trades and become thoroughly familiar with all their provisions regarding what they are painting. All exposed-to-view surfaces that are left unfinished by the requirements of other specifications shall be painted or finished as a part of this work.

1.03 REFERENCES

- A. ANSI/ASTM D16 - Definitions of Terms Relating to Paint, Varnish, Lacquer, and Related Products.
- B. ASTM D2016 - Test Method for Moisture Content of Wood.
- C. Federal Specifications

1.04 DEFINITIONS

- A. Conform to ANSI/ASTM D16 for interpretation of terms used in this Section.
- B. The term "paint" as used herein includes enamels, paint, emulsions, varnishes, stains, sealers and other coatings whether used as prime, intermediate or finish coats.

1.05 SUBMITTALS

- A. Submit under provisions of Section 01 33 00.

- B. Submit manufacturer's technical data sheet and Material Safety Data Sheets (MSDS) for each scheduled coating, giving the descriptive data, curing time, mixing, thinning and application instructions. Provide certification that paint was formulated within lead or mercury.
- C. Submit manufacturer's fan deck of color chips for selection of colors by the Architect.
- D. Samples
 - 1. At the request of the Architect, prepare and submit paint samples on the materials he requires for approval.
 - 2. Prepare and submit stained wood samples on the type and quality of wood specified for use on the project as requested by the Architect.
- E. Submit a list of all interior paints and coatings used in the project that are addressed by the Green Seal Standard GS-11 and state the Volatile Organic Compounds (VOC) content for each product.

1.06 QUALIFICATIONS

- A. Product Manufacturer: Company specializing in manufacturing quality paint and finish products with five years experience.
- B. Applicator: Company specializing in commercial painting and finishing with 3 years documented experience.

1.07 REGULATORY REQUIREMENTS

- A. Conform to applicable code for flame/fuel/smoke rating requirements for finishes.

1.08 FIELD SAMPLES

- A. At the request of the Architect, provide field sample panel, one complete surface of each color scheme illustrating special coating, color, texture, finish and workmanship.
- B. Locate where directed by the Architect.
- C. If approved, sample area will serve as a minimum standard for Work throughout the building. Accepted sample may remain as part of the Work.

1.09 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, and protect products under provisions of Section 01 60 00.
- B. Deliver all paint materials to the job site ready mixed and in their original containers with all labels intact and legible at time of use.
- C. Store only the approved materials at the job site, and store only in a suitable and designated area restricted to the storage of paint materials and related equipment.
- D. Use all means necessary to insure the safe storage and use of paint materials.

- E. All soiled or used rags, waste and trash must be disposed off site every night and every precaution taken to avoid the danger of fire.
- F. All materials must be stored at above freezing temperature.

1.10 ENVIRONMENTAL REQUIREMENTS

- A. Provide continuous ventilation and heating facilities to maintain surface and ambient temperatures above 45 degrees F for 24 hours before, during, and 48 hours after application of finishes.
- B. Do not apply exterior coatings during rain or snow, or when relative humidity is above 50 percent.
- C. Application Temperature for Paints: 50 degrees F minimum, and 95 degrees F maximum.
- D. Application Temperature for Varnish and Other Natural Finishes: 65 degrees F minimum and 90 degrees F maximum.
- E. Provide lighting level of 80 ft. candles measured mid-height at substrate surface.
- F. Do not apply paint to areas where dust is being generated.

1.11 COORDINATION

- A. Coordinate work under provisions of Section 01 31 00.

1.12 EXTRA MATERIALS

- A. Furnish under provisions of Section 01 78 00 extra paint equaling approximately 10% of each color and gloss used in each coating material used, tightly sealed in clearly labeled containers.
- B. The additional material shall be properly packaged for long term storage and delivered to the Owner.

PART 2 - PRODUCTS

2.01 MANUFACTURER:

- A. Subject to compliance with requirements of this Specification Section, provide products listed herein from one of the following:
 - 1. Paint:
 - a. Sherwin Williams
 - b. Pittsburgh Paint (PPG Industries, Inc)
 - c. Benjamin Moore Paint
- B. Substitutions: Under provisions of Section 01 60 00.

2.02 COMPATIBILITY:

- A. All paint materials and equipment shall be compatible in use; finish coats shall be compatible with prime coats; prime coats shall be compatible with the surface to be coated; all tools and equipment shall be compatible with the coating to be applied.
- B. Thinners, when used, shall be only those thinners recommended for that purpose by the manufacturer of the material to be thinned.

2.03 MIXING AND TINTING:

- A. Accomplish job mixing and tinting only when acceptable to the Architect. Mix only in mixing pails placed in suitable sized non-ferrous or oxide resistant metal pans.
- B. Tints and all other additives or thinners shall be used only as recommended by the manufacturer of the paint and as approved by the Architect.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Prior to all work of this Section, carefully inspect the installed work of all other trades and verify that all such work is complete to the point where this installation may properly commence.
- B. In the event of discrepancy, immediately notify the Architect.
- C. Do not proceed with installation in areas of discrepancy until all such discrepancies have been fully resolved.

3.02 PREPARATION:

- A. General
 - 1. Prior to all surface preparation and painting operations, completely mask, remove or otherwise adequately protect all hardware, accessories, machined surfaces, plates, lighting fixtures, and similar items in contact with painted surfaces but not schedule to receive paint.
 - 2. Remove all existing loose, flaking and poor condition paint by scraping and then sanding surface. Sand as required to feather edges of remaining paint.
 - 3. Spot prime all exposed nails and other metals that are to be painted with emulsion paints, using a primer recommended by the manufacturer of the coating system.
 - 4. Surface to be painted shall be thoroughly clean and dry. All concrete and masonry work shall be completely cured.
 - 5. All items concealing surfaces to be painted that are readily detachable shall be removed for the painting of said surface. Reinstall upon completion of space.
 - 6. Surfaces in spaces above suspended ceilings and chases are not required to be painted unless otherwise indicated.
 - 7. Doors shall be removed to paint the bottom edges.
 - 8. Provide minimum of one coat of primer and minimum of two coats of finish paint. The shop priming coat, as occurring, shall substitute for the field applied primer coat.

9. Complete coverage is required. Provide additional coats to areas that do not show complete coverage.
- B. Preparation of wood surfaces:
1. Clean all wood surfaces until they are free from dirt, oil, and all other foreign substance.
 2. Smooth all finished wood surfaces exposed to view, using the proper sandpaper.
 3. Where so required, use varying degrees of coarseness in sandpaper to produce uniformly textured and unmarred wood surfaces.
 4. On small, dry, seasoned knots, thoroughly scrape and clean the surface and apply one coat of good quality knot-sealer before application of the priming coat.
 5. On large, open, unseasoned knots, scrape off all pitch and thoroughly clean the area, followed by an application of one coat of good quality knot-sealer.
 6. Back prime all wood mouldings and trim.
 7. Fill nail holes, cracks, open joints and other defects with oil based putty after priming coat has dried. Color to match finish color.
- C. Preparation of metal surfaces:
1. Metals
 - a. Thoroughly clean all surfaces until they are completely free from dust, dirt, oil, loose rust and grease.
 - b. All shop-primed surfaces that have been marred or abraded shall be wire-brushed and touched up with the same material as the shop coat prior to painting of surfaces.
- D. Preparation of Concrete and Masonry
1. Concrete and masonry shall be repaired before painting.
 2. Dirt, fungus, grease and oil shall be removed prior to application of paint by washing with a solution composed of from 2 to 8 ounces of tri-sodium phosphate per gallon of hot water and then rinsing thoroughly with fresh water.
 3. Efflorescence shall be removed from concrete and masonry surfaces by scraping, wire brushing and washing with 5 to 10 percent solution of muriatic acid and then washing thoroughly with fresh water.
 4. Unless otherwise recommended by the manufacturer of the paint materials as approved, all concrete and masonry surfaces to be painted shall be given a neutralizing treatment consisting of 2 pounds of zinc-sulfate in one gallon of warm water. The neutralizer shall be applied liberally and allowed to dry, following which the surfaces shall be rinsed thoroughly with clean water and allowed to dry for not less than 48 hours before paint is applied.
- E. Preparation of Gypsum Wallboard
1. All surfaces must be thoroughly clean and joint treatment dry.
 2. Steel corner beads shall be spot primed before water based paint is applied.
 3. Do not apply solvent based coatings directly over unpainted wallboard.

F. Preparation of Plaster Surfaces

1. All holes and cracks in plaster surfaces shall be filled with patching plaster before painting.
2. Before painting plaster, the surfaces shall be tested with a moisture-testing device. Paint or sealer shall not be applied on plaster when the moisture content exceeds 5.5 percent. Test sufficient areas in each space as often as necessary to determine the proper moisture content for painting.

3.03 APPLICATION

A. General

1. Apply all paint in accordance with manufacturer's instructions.
2. Do not apply the initial coating until moisture-meter reading of the surface is within limits recommended by the paint materials manufacturer.
3. Allow sufficient drying time between coats in accordance with manufacturer's recommendations.
4. Oil base and Oleo resinous solvent type paints shall be considered dry for recoating when the paint feels firm, does not deform or feel sticky under moderate pressure of the thumb, and the application of another coat of paint does not cause lifting or loss of adhesion of the undercoat.
5. Schedule all cleaning and painting so that dust and other contaminants from the cleaning process will not fall on wet, newly painted surfaces.
6. Sand, dust, and clean between coats to remove all defects visible to the unaided eye from a distance of five feet.
7. Finished surfaces shall be free from runs, drops, ridges, waves, laps, sags and unnecessary brush marks.
8. Slightly vary the color of succeeding coats.
9. Primer and intermediate coats shall be tinted to approximately the tint of finish coats.
10. Damaged painting shall be retouched before applying the succeeding coat.
11. Do not apply additional coats until completed coat has been inspected and approved by the Architect.
12. Only inspected and approved coats of paint will be considered in determining the number of coats applied.
13. Edges of paint abutting other materials or colors shall be clean and sharp with no overlapping.
14. Refinish entire wall where portion of finish has been damaged or is not acceptable.
15. Refinish all woodwork that has been removed and reset.
16. Paint all exposed, plastic drain pipes, electrical conduits, uninsulated metal piping, ceiling & wall access panels, sprinkler piping and ductwork, unless otherwise noted. Verify with Architect prior to painting these items.
17. Colors will be selected by Architect from manufacturer's full color palette.
18. Unlimited number of different colors allowed per project. Multiple colors are allowed per room. Opposite sides of door frames, window frames and doors may be painted different colors at Architect's discretion. Number of colors is to be determined by Architect and included in a color schedule that will be assembled after submittal of color sample fanex by the General Contractor prior to commencement of work.
19. All steel door frames are to be painted using a brush or roller and back-brushed.

20. Spray painting is not allowed unless all sprayed surfaces are back-brushed using brushes or rollers.

3.04 STAIN & VARNISH PREPARATION AND APPLICATION

- A. Prepare and apply stain and varnish in accordance with manufacturer's instructions.
- B. Do not apply at temperatures lower than 50°F or under high humidity conditions. Surface must be dry, clean and free from grease.
- C. New woodwork: Apply stain and then three coats of varnish. Allow at least a four hour interval for drying between coats. Sand lightly between coats with 220 grit paper or finer and tack dust free. Follow manufacturer's instructions if thinning is required.
- D. Old intact (sound) clear varnish work: Old coats of varnish must be sanded thoroughly. Clean the surface and sand well with 220 grit paper. Remove sanding dust, wash thoroughly with TSP solution, rinse thoroughly and allow to dry. From this point, following instructions above for new floors and woodwork.
- E. Apply varnish with a first quality synthetic brush or lamb's wool applicator
- F. Clean-Up is accomplished using warm water and detergent immediately after use
- G. Drying: Dust free in 45 minutes; recoatable in 4 hours

3.04 CLEANING

- A. Prevent accidental spilling of paint materials and, in event of such spill, immediately remove all spilled material, the waste of equipment used to clean up the spill, and wash the surfaces to their original undamaged condition.
- B. After completion of the painting work, all glass shall be cleaned on both sides by professional window cleaners. The use of acid solution or water containing caustic soaps will not be permitted. The edge of compound shall not be disturbed by scrapers. Upon completion of contract, the glass shall be left whole, free of any defacements or rattle and shall be clean on both sides.
- C. Prior to final inspection visually inspect all surfaces and remove all paint and traces of paint from surfaces not scheduled to be painted.
- D. Paint storage space shall be thoroughly cleaned following the completion of all work.
- E. All waste materials shall be disposed of properly and in accordance with all Federal, State, and Local regulations. Do not dispose of waste materials in the building sanitary waste system.

3.05 WASTE MANAGEMENT

- A. Set aside extra paint for future color matches. All paint unused by the Contractor is to be delivered to the Owner in sealed containers.

- B. Close and tightly seal all partly used paint and finish containers and store in a well-ventilated, safe area at moderate temperature.
- C. Do not dispose of paints or solvents by pouring on ground. Place in designated containers for proper disposal.

3.06 PAINTING SCHEDULE

- A. Interior: Based on Sherwin Williams Paints unless noted otherwise.
 - 1. METAL - (Doors & frames, Ferrous Metal, steel pipe railings) (exposed, uninsulated metal piping and ductwork)
Semi-gloss Finish
1st Coat: S-W ProCryl Universal Primer, B66-310 Series (110 g/L)
(2-4 mils dry)
2nd & 3rd Coats: S-W Pro Industrial DTM Acrylic Semi-gloss B66-1150 Series
(6.0 mils wet, 2.5mils dry)
 - 2. METAL - (Open to structure ceilings)
Dryfall Waterborne Topcoats
Eg-Shell Finish
1st Coat: S-W ProCryl Universal Primer, B66-310 Series (110 g/L)
(2-4 mils dry)
2nd & 3rd Coats: S-W Waterborne Acrylic Dry Fall, B42W2 (58 g/L)
 - 3. WOOD - (Walls)
Eg-Shell / Satin Finish
1st Coat: S-W Premium Wall & Wood Primer B28 Series
(4 mils wet, 1.3 mils dry per coat)
2nd & 3rd Coats: S-W ProMar 200 Zero VOC Latex Eg-Shel B20-2600 Series
(4 mils wet, 1.7 mils dry per coat)
 - 4. WOOD - (Trim,)
Semi-gloss
1st Coat: S-W Premium Wall & Wood Primer B28 Series
(4 mils wet, 1.5 mils dry per coat)
2nd & 3rd Coats: S-W ProMar 200 Zero VOC Latex Semi-gloss B31-2600 Series
(4 mils wet, 1.7 mils dry per coat)
 - 5. DRYWALL - (Walls, Gypsum Board, etc.)
Eg-Shell / Satin Finish
1st Coat: S-W ProMar 200 Zero VOC Interior Latex Primer, B28W2600
(4 mils wet, 1.5 mils dry).
2nd & 3rd Coats: S-W ProMar 200 Zero VOC Latex Eg-Shel B20-2600 Series
(4 mils wet, 1.7 mils dry per coat)

6. CEILINGS – (Gypsum Board or Plaster)
Flat Finish
1st Coat: S-W ProMar 200 Zero VOC Interior Latex Primer, B28W2600
(4 mils wet, 1.5 mils dry).
2nd & 3rd Coats: S-W ProMar Ceiling Paint Latex Flat, A27W05050 Series
(4 mils wet, 1.2 mils dry per coat).
7. PVC, Plastic
Eg-Shel / Satin Finish
1st Coat: S-W All Surface Enamel Latex Primer, A41W210
(4 mils wet, 1.6 mils dry)
2nd & 3rd Coats: S-W ProMar 200 Zero VOC Latex Eg-Shel B20-2600 Series
(4 mils wet, 1.7 mils dry per coat)
8. CONCRETE BLOCK
Semi-gloss Finish
1st Coat: S-W Loxon Block Surfacer
(16 mils wet, 8 mils dry)
2nd & 3rd Coats: S-W ProMar 200 Zero VOC Latex Semi-gloss B31-2600 Series
(4 mils wet, 1.7 mils dry per coat)
9. STAINED WOOD

3 Coats of satin varnish, lightly sanded between coats.
a. Stain coat: 1 coat Stain
b. Seal coat: 1 coat Clear Satin Finish
c. First coat: 1 coat Sanding Sealer
d. Finish coat: 1 coat Clear Satin Finish
(Apply in accordance with manufacturer's instructions)

END OF SECTION

SECTION 22 00 00
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SECTION 22 00 00

PLUMBING

PART 1 – GENERAL

1.1 GENERAL REQUIREMENTS AND REFERENCES

- A. Include “General Requirements” and applicable parts of Division 1 as part of this section.
- B. Examine all other sections of the Specifications for requirements which affect work under this Section whether or not such work is specifically mentioned in this section. Where paragraphs of this section conflict with similar paragraphs of Division 1, requirements of this section shall prevail.
- C. Coordinate work with that of all other trades affecting, or affected by work of this section. Cooperate with such trades to assure the steady progress of all work under the Contract.
- D. The Plumbing Subcontractor shall be responsible for filing all documents, payment of all fees, and securing of all inspections and approvals necessary for the work of this section.
- E. The Plumbing Subcontractor shall carry in the Bid Price all Utility Company and Municipal back charges for all materials furnished and work performed by them in conjunction with this Contract and pay same to the respective agency upon demand. The Plumbing Subcontractor shall not be entitled to additional compensation after the submittal of his bid price should he fail, for any reason, to obtain the total back charge costs to be incurred by the local utility companies or municipal agencies.

1.2 DEFINITIONS

- A. As used in this section, “provide” means “furnish and install”, and “POS” means “Provided Under Other Sections”.
- B. As used in the Contract Drawings and Specifications for Plumbing work, certain non-technical words shall be understood to have specific meanings as follows, regardless of indications to the contrary in the General Conditions of other documents governing the Plumbing work.
 - 1. “Furnish” means: Purchase and deliver to the project site complete with every necessary appurtenance and support, all as part of the Plumbing work. Purchasing shall include payment of all sales taxes and other surcharges as may be required to assure that purchased item(s) are free of all liens, claims, or encumbrances.
 - 2. “Install” means: 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, all as part of the Plumbing work.
 - 3. “Provide” means: “Furnish” and “Install”.
 - 4. “New” means: Manufactured within the past two (2) years and never before used.
- C. Except where modified by a specific notation to the contrary, it shall be understood that the indication and/or description of any plumbing item in the Contract Drawings or Specifications for Plumbing work carries with it the instruction to furnish, install and connect the item as part of the Plumbing work, regardless of whether or not this instruction is explicitly stated.
- D. It shall be understood that the Specifications and Drawings for Plumbing work are complimentary and are to be taken together for a complete interpretation of the Plumbing work except that indications on the Contract Drawings, which refer to an individual element of work, take precedence over the Specifications

where they conflict.

1.3 SCOPE

- A. Perform work and provide material and equipment as shown on Contract Drawings and as specified or indicated in this Section of the Specifications. Completely coordinate work of this Section with work of other trades and provide a complete and fully functional installation.
 - 1. Domestic water piping system.
 - 2. Interior vent piping system.
 - 3. Natural gas system.
 - 4. Extend all gas train vents to atmosphere.
 - 5. Final connection to all gas fired equipment including valves, regulators, drip and dirt pockets, unions and necessary appurtenances.
 - 6. Insulation.
 - 7. Valves.
 - 8. Fittings unions, flanges and couplings.
 - 9. Hangers, plates and inserts.
 - 10. Cleaning, testing and disinfection of piping systems.
 - 11. All supplementary steel for piping and equipment support.
 - 12. Guarantees.
 - 13. Drilling for installation of inserts.
 - 14. Flexible connections.
 - 15. Core drilling.
 - 16. Fire seal off all penetrations in floors and walls to the rating of the barrier.
- B. Drawings and Specifications form complimentary requirements; provide work specified and not shown, and work shown and not specified as though explicitly required by both. Although work is not specifically shown or specified, provide supplementary or miscellaneous items, appurtenances, devices and materials obviously necessary for a sound, secure and complete installation.
- C. Give notices, file plans, obtain permits and licenses, pay fees and back charges, and obtain necessary approvals from Authorities Having Jurisdiction as required to perform work in accordance with all legal requirements and with Specifications, Drawings, Addenda and Change Orders, all of which are part of Contract Documents.
- D. Before submitting bid, visit and carefully examine site to identify existing conditions and difficulties that will affect work of this Section. No extra payment will be allowed for additional work caused by unfamiliarity with site conditions that are visible or readily construed by experienced observer. Site visit is particularly important because this is renovation work.
- E. Before starting work in a particular area of the project, visit site and examine conditions under which work must be performed including preparatory work done under other Sections or Contracts or by Owner. Report conditions that might affect work adversely in writing through Contractor to Architect. Do not proceed with work until defects have been corrected and conditions are satisfactory. Commencement of work shall be construed as complete acceptance of existing and preparatory work.

1.4 RELATED WORK UNDER OTHER SECTIONS

A. The following items are not included in this section and will be performed under other sections.

1. Temporary Facilities.
2. Earthwork: Excavation and backfill.
3. Concrete:
 - a. Housekeeping pads.
4. Masonry: All openings in masonry walls.
5. Waterproofing, Dampproofing and Caulking.
6. Roofing and Flashing.
7. Painting: All painting except as specified herein.
8. Finish Carpentry and Millwork.
9. Steel Doors and Frames.
10. Finish Hardware.
11. Fire Protection.
12. Electrical.
13. HVAC.
14. Furnishing of toilet accessories such as toilet paper holders, mirrors and soap dispensers.
15. Utility structures.

1.5 REGULATORY REQUIREMENTS

- A. Comply with all applicable Federal and State laws, and all Local Codes, By-laws and Ordinances.
- B. Where provisions of the Contract Documents conflict with any Codes, Rules or Regulations, the latter shall govern. Where the Contract requirements are in excess of applicable Codes, Rules or Regulations, the Contract provisions shall govern unless the Architect rules otherwise.
- C. Request inspections from Authorities Having Jurisdiction, obtain all permits and pay for all fees and inspection certificates as applicable and/or required. All permits and certificates shall be turned over to the Owner at the completion of the work. Copies of permits shall be given to the Resident Engineer prior to the start of work.
- D. Unless otherwise specified or indicated, materials and workmanship and equipment performance shall conform with the latest edition of the following standards, Codes, Specifications, Requirements and Regulations:
1. Local and State Building, Plumbing, Mechanical, Electrical, Fire and Health Department Codes.
 2. American Gas Association (AGA).
 3. National Fire Protection Association (NFPA).
 4. American Insurance Association (AIA), formerly National Board of Fire Underwriters.
 5. Occupational Safety and Health Act (OSHA).
 6. Factory Mutual Association (FM).

7. Underwriter's Laboratories (UL).

E. All Plumbing work shall meet or exceed any other State and Local Codes and/or Authorities Having Jurisdiction including all other standards indicated herein.

1.6 SUBMITTALS

A. This paragraph shall supplement Division 1.

B. Definitions:

1. Shop Drawings: Information prepared by the Contractor to illustrate portions of the work in more detail than shown in the Contract Documents.
2. Coordination Drawings: Detailed, large-scale layout Shop Drawings showing HVAC, Electrical, Plumbing and Fire Protection work superimposed to identify conflicts and ensure inter-coordination of Mechanical, Electrical, Architectural, Structural and other work.

C. Submittals Procedures and Format:

1. Review submittal packages for compliance with Contract Documents and then submit to Architect for review. Submit transparency and two (2) blue or black-line reproductions of each Shop Drawing larger than 8-1/2" x 11". Submit eight (8) sets of each smaller shop drawing. After review, transparency original of each large Shop Drawing and six (6) sets of each small shop drawing will be returned with reviewer's marks. Electronically submitted shop drawings are acceptable.
2. Each Shop Drawing shall indicate in title block, and each Product Data package shall indicate on cover sheet, the following information:
 - a. Title.
 - b. Name and location of project.
 - c. Names of Architect, Engineer, Contractor and Subcontractor(s).
 - d. Names of Manufacturer, Supplier, Vendor, etc.
 - e. Date of submittal.
 - f. Whether original submittal or resubmitted.
3. Shop Drawings showing Manufacturer's product data shall contain detailed dimensional Drawings, accurate and complete description of materials of construction, Manufacturer's published performance characteristics and capacity ratings (performance data alone is not acceptable), plumbing requirements and wiring diagrams. Drawings shall clearly indicate location (terminal block or wire number), voltage and function for all field terminations, and other information necessary to demonstrate compliance with all requirements of Contract Documents.

D. Acceptable Manufacturers:

1. The Architect's Plumbing design for each project is based on the single Manufacturer listed in the schedule or shown on the Contract Drawings. In Division 22 00 00 of these Specifications certain "Alternate Manufacturers" are listed as being acceptable. These are acceptable only if, as a minimum, they:
 - a. Accepted by Architect and Engineer.
 - b. Meet all performance criteria listed in the schedules and outlined in the Specifications.
 - c. Have equivalent operating characteristics to those called for in the Specifications.
 - d. Fit within the available space it was designed for, including space for maintenance and component

removal, with no modifications to either the space or the product. Clearances to walls, ceilings and other equipment will be at least equal to those shown on the Contract Documents. The fact that a Manufacturer's name appears as acceptable shall not be taken to mean the Architect has determined that the Manufacturer's products will fit within the available space. This determination is solely the responsibility of the Contractor.

- e. For equipment mounted in areas where structural matters are a consideration, the products must have a weight no greater than the product listed in the schedules or Specifications.
 - f. Products must adhere to all architectural considerations including, but not limited to, being the same size and of the same physical appearance as scheduled or specified products.
- E. Substitutions: Substitution of products by Manufacturers other than those listed shall only be done in accordance with subparagraph "F" "Substitutions and Deviations".
- F. Substitutions and Deviations:
- 1. Deviations from the Contract Documents and the substitution of materials or equipment relative to the "Acceptable Manufacturers" referred to above, shall be requested individually in writing whether deviations result from field conditions, standard shop practice, or other cause. Submit letter with transmittal of Shop Drawings which flags the substitution or deviation to the attention of the Architect. The letter shall describe changes in the system shown and physical characteristics (connections to adjacent materials, plumbing services, service access requirements, and other characteristics), and differences in operating characteristics or cycles.
 - 2. Without letters flagging the substitution or deviation to the Architect, it is possible that the Architect may not notice such substitution or deviation or may not realize its ramifications. Therefore, if such letters are not submitted to the Architect, the Contractor shall hold the Architect and his consultants harmless for any and all adverse consequences resulting from the deviations being implemented. Adverse consequences shall include, but not be limited to, excessive noise, excessive maintenance, shortened longevity, spatial coordination problems, and inadequate performance versus scheduled design. This shall apply regardless of whether the Architect has reviewed or approved Shop Drawings containing the deviation, and will be strictly enforced.
 - 3. Do not request substitute materials or equipment unless identical material or equipment has been operated successfully for at least three (3) consecutive years. Such materials and equipment shall be a regular cataloged item shown in the current catalog of the Manufacturer. When deviation or substitution is permitted, coordinate fully with related changes to Architectural, Structural, Plumbing, Fire Protection, Mechanical, and other work. Ensure that related changes necessary for coordination of substituted items are made within the Contract Price. Assume full responsibility for safety, operation and performance of the altered system.
 - 4. Substitutions of equipment, systems, etc. requiring approval of local Authorities must comply with such regulations and be filed by the Contractor (should filing be necessary).
 - 5. Consideration will not be given to claims that the substituted item meets the performance requirements with lesser construction. Performance, as delineated in schedules and in the Specifications, shall be interpreted as minimum performance.
 - 6. Approval of proposed deviations or substitutions, if any, will be made at discretion of Architect.
 - 7. If equipment is proposed for substitution that is not tested and rated according to industry-wide standards, the Architect shall have the right to have performance tests completed, at the Contractor's expense, to confirm the Manufacturer's performance claims.
- G. Submittal Notations: Submittals will be returned from the Architect marked as illustrated below:

☐ NO EXCEPTION TAKEN	☐ ACCEPTED AS NOTED
☐ NOT ACCEPTED	☐ REVISE AND RESUBMIT

1. Checking is only for general conformance with the design concept of the project and general compliance with the information given in the Contract Documents. Any action shown is subject to the requirements of the Contract Drawings and Specifications. Contractor is responsible for dimensions which shall be confirmed and correlated at the job site; fabrication process and techniques of construction; coordination of his work with that of all other trades; and the satisfactory performance of his work.
- H. Schedule: Incorporated the Shop Drawing review period into the construction schedule so that work is not delayed. Contractor shall assume full responsibility for delays caused by not incorporating the following Shop Drawing review time requirements into his project schedule. Allow at least ten (10) working days, exclusive of transmittal time, for review each time a Shop Drawing is submitted or resubmitted with the exception that fifteen (15) working days, exclusive of transmittal time, are required for the following:
- I. Schedule:
1. Certification of domestic water system disinfection.
 2. Coordination Drawings, if required by this Specification.
 3. Adjustment and balancing certification.
 4. If more than five (5) Shop Drawings of this trade are received in one (1) calendar week.
- J. List of Proposed Equipment and Materials: Within four (4) weeks after Award of Contract and before ordering materials or equipment, submit a complete list of proposed materials and equipment and indicate Manufacturer's names and addresses. No consideration will be given to partial lists submitted out of sequence.
- K. Responsibility:
1. The intent of submittal review is to check for capacity, rating, and certain construction features. Contractor shall ensure that work meets requirements of the Contract Documents regarding information that pertains to fabrication processes or means, methods, techniques, sequences and procedures of construction; and for coordination of work of this and other Sections. Work shall comply with submittals marked "REVIEWED" to extent that they agree with the Contract Documents. Submittal review shall not diminish responsibility under this Contract for dimensional coordination, quantities, installation, wiring, supports and access for service, nor the Shop Drawing errors or deviations from requirements of the Contract Documents. The Architect's noting of some errors while overlooking others will not excuse the Contractor for proceeding in error. Contract Documents requirements are not limited, waived, nor superseded in any way by review.
 2. Inform Subcontractors, Manufacturers, Suppliers, etc. of scope and limited nature of review process and enforce compliance with the Contract Documents.
- L. Material and equipment requiring Shop Drawing Submittals shall include but not be limited to:
1. Piping.
 2. Fittings, unions, flanges and couplings.
 3. Insulation.
 4. Sleeve packing.

5. Valves
6. Hangers, plates and inserts.
7. Flexible connections.
8. Fire-rated penetration assemblies (ASTM E814, UL 1479).
9. Access panels.
10. Shop Drawings shall be submitted as a single bound package, organized and titled.

1.7 SURVEYS AND MEASUREMENTS

- A. Base all required measurements, both horizontal and vertical, on reference points established by the General Contractor and be responsible for the correct laying out of the Plumbing work. In the event of a discrepancy between actual measurements and those indicated, notify the General Contractor in writing. Do not proceed with the work required until written instructions have been issued by the General Contractor.

1.8 COORDINATION

- A. HVAC, Plumbing, Fire Protection, and Electrical Drawings are diagrammatic. They indicate general arrangements of Mechanical and Electrical systems and other work. They do not show all offsets required for coordination nor do they show the exact routings and locations needed to coordinate with Structural and other trades and to meet Architectural requirements.
- B. Work shall be performed in cooperation with other trades on the project and so scheduled as to allow speedy and efficient completion of the work.
- C. Furnish to other trades advance information on locations and sizes of all frames, boxes, sleeves and openings needed for their work. Furnish information and Shop Drawings necessary to allow trades affected by the work to install their work properly and without delay.
- D. In all spaces, prior to installation of visible material and equipment, including access panels, review Architectural Drawings for exact locations and where not definitely indicated, request information from Architect. Where the Plumbing work shall interfere with the work of other trades, assist in coordinating the space conditions to make satisfactory adjustments before installation. Without extra cost to the Owner, make reasonable modifications to the work as required by normal Structural interferences. Pay the General Contractor for additional openings, or relocating and/or enlarging existing openings through concrete floors, walls, beams and roof required for any work which was not properly coordinated. Maintain maximum headroom at all locations. All piping, duct, conduit, and associated components to be as tight to underside of structure as possible.
- E. If any Plumbing work has been installed before coordination with other trades so as to cause interference with the work of such trades, all necessary adjustments and corrections shall be made by the plumbing trades involved without extra cost to the Owner.
- F. Where conflicts or potential conflicts exist and engineering guidance is desired, submit sketch of proposed resolution to Architect for review and approval.
- G. Protect all materials and work of other trades from damage which may be caused by the Plumbing work, and repair all damages without extra cost to the Owner.

1.9 MECHANICAL AND ELECTRICAL COORDINATION

- A. Plumbing Subcontractor shall furnish and install various electrical items relating to the plumbing

equipment and control apparatus. The Electrical Subcontractor shall be required to connect power wiring to this equipment unless noted otherwise.

- B. The Plumbing and Electrical Subcontractors shall coordinate their respective portions of the work, as well as the electrical characteristics of the plumbing equipment.
- C. All power wiring and local disconnect switches will be provided by the Electrical Subcontractor for the line voltage power. All control and interlocking wiring shall be the responsibility of the Plumbing Subcontractor.
- D. 120V and above power wiring sources extended and connected to heating and ventilating control panels, transformers and switches shall be the responsibility of the Electrical Subcontractor. All low voltage thermostats, zone valve and any switch wiring shall be the responsibility of the HVAC Subcontractor.
- E. Temperature control and equipment wiring shall be installed by the Plumbing Subcontractor.
- F. Pipe heat tracing shall be furnished and installed by the Plumbing Subcontractor. Power connections shall be by the Electrical Subcontractor.
- G. The Electrical Subcontractor will provide all magnetic starters except those furnished as an integral part of packaged equipment.

1.10 COORDINATION DRAWINGS

A. Coordination Drawings:

- 1. The Sheetmetal Subcontractor shall prepare a complete set of 3D model electronic Drawings at a scale not less than 3/8" equals 1'-0", showing structure and other information as needed for coordination. He shall show sheetmetal layout thereon. These will be the Coordination Drawings.
- 2. The main paths of egress and for equipment removal, from main Mechanical, Electrical, Plumbing and Fire Protection rooms must be clearly shown on the Coordination Drawings. All fire and smoke partitions must be highlighted on the Coordination Drawings for appropriate coordination.
- 3. Each of the below specialty trades shall add its work to these background Drawings with appropriate elevations and grid dimensions. Specialty trade information is required for fan rooms and mechanical rooms, horizontal exits from duct shafts, crossovers, and for spaces in and above ceilings where congestion of work may occur such as corridors, and even entire floors. Drawings shall indicate horizontal and vertical dimensions, to avoid interference with structural framing, ceilings, partitions, and other services.
 - a. Specialty Trades:
 - 1) Plumbing System.
 - 2) HVAC Piping and Associated Control System.
 - 3) Electrical.
 - 4) Sheet Metal Work.
- 4. Each specialty trade shall sign and date each electronic Coordination Drawing. Return Drawings to the Sheetmetal Subcontractor, who shall route them sequentially to all specialty trades.
- 5. Where conflicts occur with placement of materials of various trades, the Sheetmetal Subcontractor will be responsible to coordinate the available space to accommodate all trades. Any resulting adjustments shall be initialed and dated by the specialty trade. The Sheetmetal Subcontractor shall then final date and sign each Coordination Drawing. If he cannot resolve conflicts, the decision of the General Contractor shall be final, subject to the approval of the Architect.

6. A Subcontractor who fails to promptly review and incorporate his work on the Coordination Drawings shall assume full responsibility of any installation conflicts affecting his work and of any schedule ramifications.
7. The Sheetmetal Subcontractor shall make electronic copies of all Coordination Drawings. Fabrication shall not start until such electronic Drawings are received by the Architect/Engineer and have been reviewed.
8. Review of Coordination Drawings shall not diminish responsibility under this Contract for final coordination of installation and maintenance clearances of all systems and equipment with Architectural, Structural, Mechanical, Electrical, Plumbing and Fire Protection Contractors.

1.11 INSTALLATION REQUIREMENTS

- A. The arrangement of all Plumbing work shown on the Contract Drawings is diagrammatic only and indicates the minimum requirements of the work. Conditions at the building including actual measurements shall determine the details of the installation. All work shall be laid out and installed so as to require the least amount of cutting and patching.
- B. Review the Architectural Drawings and Specifications before ordering any material and equipment. Any discrepancies shall be brought to the attention of the Architect for his determination prior to proceeding with the work.

1.12 TYPICAL DETAILS

- A. Typical details where shown on the Contract Drawings shall apply to each and every item of the project where such items are applicable. They are not repeated in full on the Contract Drawings, which in many cases are diagrammatic only, but with the intention that such details shall be incorporated in full. Any alternate method proposed for use by the Contractor shall have the prior approval of the Architect.

1.13 SLEEVES, INSERTS

- A. Furnish and install all sleeves, inserts, anchor bolts and similar items to be set into masonry or concrete, as required for Plumbing work as indicated in Division 1. Internal diameter of sleeve ball shall be 1/2" larger than the outside diameter of the pipe or insulation covered line passing through it.

1.14 FIRESTOPPING, SMOKEPROOFING & WATERPROOFING

- A. All cutting, patching, firestopping and waterproofing shall be performed by the Fire Suppression Subcontractor. Refer to Sections 01 73 29 – CUTTING AND PATCHING, 07 00 01 – WATERPROOFING, DAMPPROOFING & CAULKING, and 07 84 13 PENETRATION FIRESTOPPING for project requirements.

1.15 CORING, DRILLING

- A. Core, cut and/or drill all holes in walls and floors required for the installation of sleeves and supports for the Plumbing work as indicated in Division 1.

1.16 ACCESSIBILITY

- A. Install all work such that parts requiring periodic inspection, operation, maintenance and repair are readily accessible.
- B. Furnish all access panels appropriate to particular conditions, to be installed by trades having responsibility for the construction of actual walls, floors or ceilings at required locations.

1.17 SUPPLEMENTARY SUPPORTING STEEL

- A. Provide all supplementary (non-structural) steelwork required for mounting or supporting equipment and materials.
- B. Steelwork shall be firmly connected to building construction as required. Locations and methods of attachment shall be approved by the Architect.
- C. Steelwork shall be of sufficient strength to allow only minimum deflection in conformity with Manufacturer's published requirements.
- D. All supplementary steelwork shall be installed in a neat and workmanlike manner parallel to floor, wall and ceiling construction: all turns shall be made at forty-five and ninety degrees, and/or as dictated by construction and installation conditions.
- E. All manufactured steel parts and fittings shall be galvanized.

1.18 TOOLS AND EQUIPMENT

- A. Provide all tools and equipment required for the fabrication and installation of the plumbing equipment at the site.

1.19 PORTABLE AND DETACHABLE PARTS

- A. Contractors shall retain in their possession all portable and/or detachable parts and portions of materials, devices, equipment, etc. necessary for the proper operation and maintenance of the Mechanical and Electrical systems until final completion of the work, at which time they shall be handed over to the Owner.

1.20 RECORD DRAWINGS, PROJECT CLOSEOUT

- A. As work progresses and for the duration of Contract, maintain a complete and separate set of prints of Contract Drawings at job site at all times. Record work completed and all changes from original Contract Drawings clearly and accurately including work installed as a modification or addition to the original design. Work shall be updated on a weekly basis and shall be made available for review by Architect. Failure to perform this work shall be reason for withholding requisition payments. In addition, take photographs of all concealed equipment in gypsum board ceilings, shafts, and other concealed, inaccessible work. At completion of work, make copies of photographs with written explanation on back. These shall become part of Record Documents.
- B. At the completion of work, prepare a complete set of electronic Record Drawings showing all systems as actually installed. The electronic copies will be made available for the Plumbing Contractor's copying, at his expense. The quantity of copies which are made available shall in no way be interpreted as setting a limit to the number of Drawings necessary to show the required information. The Plumbing Contractor's professional Draft Person shall transfer changes to electronic copies. Submit sets of prints to Architect for comments as indicated in Division 1 – 01 77 00 CONTRACT CLOSEOUT.
- C. The Architect will not certify the accuracy of the Record Drawings. This is the sole responsibility of the Plumbing Contractor.
- D. This trade shall submit the Record Drawings for approval by the Fire and Building Departments in a form acceptable to the departments, when required by the jurisdiction.
- E. Record Drawings shall show record condition of details, sections, riser diagrams, control changes and corrections to schedules. Schedules shall show actual Manufacturer, Make and Model numbers of final equipment installation.

1.21 GUARANTEE/WARRANTY

A. Guarantee and 24 Hour Service:

1. Guarantee Work of this Section in writing for not less than one (1) year following the date of acceptance by the Owner. If the equipment is used for temporary power etc, prior to acceptance by the Owner, the bid price shall include an extended period of warranty covering the one (1) year of occupancy, starting from the date of acceptance by the Owner. The guarantee shall repair or replace defective materials, equipment, workmanship and installation that develop within this period, promptly and to the Architect's satisfaction and correct damage caused in making necessary repairs and replacements under guarantee within Contract Price.
2. In addition to guarantee requirements of Division 1 and of Subparagraph A above, obtain written equipment and material warranties offered in Manufacturer's published data without exclusion or limitation, in Owner's name.
3. Upon receipt of notice from the Owner of failure of any part of the systems or equipment during the warranty period, the affected part or parts shall be replaced by this Contractor without any reimbursement.
4. Replace material and equipment that require excessive service during guarantee period as defined and as directed by Architect.
5. Provide 24 hour service beginning on the date the project is accepted by the Owner, whether or not fully occupied, and lasting until the termination of the guarantee period. Service shall be at no cost to the Owner. Service can be provided by this Contractor or a separate service organization. Choice of service organization shall be subject to Architect and Owner approval. Submit name and a phone number that will be answered on a 24 hour basis each day of the week, for the duration of the service.
6. Submit copies of equipment and material warranties to Architect before final payment.
7. At end of guarantee period, transfer Manufacturer's equipment and material warranties still in force to Owner.
8. This paragraph shall not be interpreted to limit Owner's rights under applicable Codes and Laws and under this Contract.
9. PART 2 paragraphs of this Specification may specify warranty requirements that exceed those of this paragraph. Those paragraphs shall govern.
10. Use of systems provided under this Section for temporary services and facilities shall not constitute Final Acceptance of Work by Owner, and shall not initiate the guarantee period.
11. Provide Manufacturer's Engineering and Technical Staff at site to analyze and rectify problems that develop during guarantee period immediately. If problems cannot be rectified immediately to Owner's satisfaction, advise the Architect in writing, describe efforts to rectify situation, and provide analysis of cause of problem. The Architect and/or Engineer will direct course of action.

1.22 OPERATING, INSTRUCTION AND MAINTENANCE MANUALS

- A. Refer to Section 01 77 00 – CONTRACT CLOSEOUT and 01 78 23 – OPERATION AND MAINTENANCE DATA for submittal procedures pertaining to operating and maintenance manuals.
- B. Each copy of the approved operating and maintenance manual shall contain copies of the approved Shop Drawings, equipment literature, cuts, bulletins, details, equipment and engineering data sheets and typewritten instructions relative to the care and maintenance for the operation of the equipment, all properly indexed. Each manual shall have the following minimum contents:

1. Table of Contents.
2. Introduction:
 - a. Explanation of manual and its purpose and use.
 - b. Description of the plumbing systems.
 - c. Safety precautions necessary for equipment.
 - d. Illustrations, schematics and diagrams.
 - e. Installation drawing.
3. Maintenance:
 - a. Maintenance and lubricating instructions.
 - b. Replacement charts.
 - c. Trouble-shooting charts for equipment components.
 - d. Testing instructions for each typical component.
 - e. Two (2) typed sets of instructions for ordering spare parts. Each set shall include name, price, telephone number and address of where they may be obtained.
4. Manufacturer's Literature:
 - a. The equipment for which Shop Drawings have been submitted and approved.

1.23 QUALITY ASSURANCE

- A. The requirements of the State Building Code and Local regulations establish the minimum acceptable quality of workmanship and materials, and all work shall conform thereto unless more stringent requirements are indicated or specified herein.
- B. All work shall comply with the latest editions of the Codes as referenced herein.
- C. Follow Manufacturer's directions for articles furnished, in addition to directions shown on the Contract Drawings or specified herein.
- D. Protect all work, materials, and equipment from damage during process of work. Replace all damaged or defective work, materials and equipment without additional cost to the Owner.
- E. All equipment and materials for permanent installation shall be the products of recognized Manufacturers and shall be new.
- F. Equipment and materials shall:
 1. Where normally subject to Underwriters Laboratory Inc. listing or labeling services, be so listed and labeled.
 2. Be without blemish or defect.
 3. Not be used for temporary purposes.
 4. Be in accordance with the latest applicable ASME standards.
- G. Products shall meet with the acceptance of all Authorities Having Jurisdiction over the work. Where such acceptance is contingent upon having the products examined, tested and certified by Underwriters or other recognized testing laboratory, the product shall be so examined, tested and certified.

- H. All items of equipment or material of one (1) generic type shall be the product of one (1) Manufacturer throughout.
- I. For items which are to be installed but not purchased as part of the Electrical work, the Electrical work shall include:
1. The coordination of their delivery.
 2. Their unloading from delivery trucks driven into any point on the property line at grade level.
 3. Their safe handling and field storage until the time of permanent placement in the project.
 4. The correction of any damage, defacement or corrosion to which they may have been subjected. Replacement, if necessary, shall be coordinated with the Contractor who originally purchased the item.
 5. Field erection and internal wiring as necessary for their proper operation.
 6. Mounting in place, including the purchase and installation of all dunnage, supporting members, and fastenings, necessary to adapt them to architectural and structural conditions.
 7. Their connection to building wiring including the purchase and installation of all termination junction boxes necessary to adapt and connect them to this wiring. Included also shall be the purchase and installation of any substitute lugs or other wiring terminations as may be necessary to adapt their terminals to the building wiring as called for and to the connection methods set forth in these Specifications.
- J. Items which are to be installed but not purchased as part of the Plumbing work shall be carefully examined upon delivery to the project. Claims that any of these items have been received in such condition that their installation will require procedures beyond the reasonable scope of the Plumbing work will be considered only if presented in writing within one (1) week of the date of delivery to the project of the items in question. The Plumbing work includes all procedures, regardless of how extensive, necessary to put into satisfactory operation, all items for which no claims have been submitted as outlined above.

1.24 DELIVERY, STORAGE AND HANDLING

- A. All materials for the work of this section shall be delivered, stored and handled so as to preclude damage of any nature. Manufactured materials shall be delivered and stored in their original containers, plainly marked with the products' and manufacturer's name. Materials in broken containers or in packages showing watermarks or other evidence of damage shall not be used and shall be removed from the site.

PART 2 – PRODUCTS

2.1 PIPE MATERIALS

- A. The table below indicates pipe class for each service. Refer to the following pages for expanded Specifications for the respective class.

PIPE MATERIALS SPEC INDEX

Service	Code	Maximum Operating (psig)	Service Limits (Temperature °F)	Pipe Material
Domestic Cold Water	CW	150 below grade	250	Copper
Domestic Hot Return	HWR	150 below grade	250	Copper
Domestic Hot Water	HW	150 below grade	250	Copper
Natural Gas	G	50	70	C. Steel
Vent	S	Gravity	120	Cast Iron

- B. Each valve type shall be the product of a single Manufacturer. Each system shall be provided with valves as required by Code and shown on the Contract Drawings and shall be installed to facilitate operation, replacement and repair.
- C. Provide access panels for concealed valves behind non-removable ceilings or walls.
- D. Provide shut-off valves on supply piping to individual pieces of equipment.
- E. Provide pipe dope, Teflon tape, wax rings, neoprene gaskets and other jointing compounds as required by best standard practice and only on service as recommended by Manufacturer.
- F. Apply putties and jointing compounds for plumbing fixtures and trim as recommended by Manufacturers.
- G. Valves on insulated piping system shall be equipped with extended handles to accommodate insulation thickness.

2.2 COPPER PIPE (FOR CW, HWR, HW, TW SYSTEMS)

	1/2" to 3"	4" and Larger
Pipe	Seamless copper water tube, drawn temper, Type L. ASTM B-88. See Note 1.	Seamless copper water tube, drawn temper, Type L. ASTM B-8. See Notes 2 & 5.
Fittings	Wrought copper, solder-joint. ASTM B-16.22.	Ductile iron coupling with copper alkyd enamel paint coating, ASTM A-536. Grade "E" EPDM elastomer gasket. ASTM D-2000. Equal to Victaulic Style 606 coupling. ASTM B-75 copper alloy fittings. ASTM B-584 grooved end cast bronze fittings for 6" pipe size.
Joints	ASTM B-32 solder filled material, Alloy Sb5 "95/5." ASTM B-813 liquid or paste flux. Soldering procedures shall comply with ASTM B-828.	Rolled groove prepared and assembled in accordance with Manufacturer's instructions.
Mechanical Joints	Cast copper alloy unions, hexagonal stock with ball-and-socket joint, solder joint ends. ASME B-6.18.	ANSI Class 150 flange adapter equal to Victaulic Style 641 for connections to flanged equipment. ANSI B-16.1 flange dimensions. Watts G-4000-FDA series.
Valves Gate	Use ball valve.	Use ball valve.
Ball	All bronze, 3 piece, full port, PTFE seats, solder end connections. 600 psig WOG. Apollo 82-200, Milwaukee BA-350, Watts B-6801.	Class 125, cast iron body, epoxy coated. Full port, flanged ends, stainless steel ball and stem. ANSI B16.1 flange dimensions. Watts G-4000 FDA series.

A. Notes:

1. Contact between dissimilar metals shall be made with dielectric couplings or dielectric flanges. Contact between ferrous and stud bolts and bronze flanges shall be electrically insulated with non-

metallic washers.

2. Provide mechanical joint connections to all equipment such as water heaters, pumps, compressors, etc.

2.3 STEEL PIPE (FOR NATURAL GAS SYSTEMS)

	2" and Smaller	2-1/2" and Larger
Pipe	Schedule 40 carbon steel ASTM A53 Grade B, A106 Grade A or A120.	Schedule 40 Carbon Steel ASTM A-53, Grade B, A106 Grade A or A120.
Fittings	Screwed malleable iron 125 psi.	Butt weld carbon steel Schedule 40, A234.
Unions	Screw 150X malleable iron A105 Grade II.	Use flange.
Flanges	150# raised face, screwed, A105.	150# raised face weld neck A105 ASTM A181. Grade I. 150# flat face for cast iron valve.
Valves, Plugs, Gas Cock	Use ball valve.	Iron body, greaseable and lubricated tapered plug, flanged end, 175 working pressure Nordstrom 143, Serck Audco LSW-133-GG, Walworth.
Solenoid	Honeywell Skinner Value U121XXXXX/423/XXXXX with coils, printed circuit and other parts for intrinsic safe Specifications completely encapsulated within the enclosure using epoxy material. Operated at 24 VDC with an intrinsic safety barrier.	
Ball (Gas)	Bottom loaded pressure stem. Valve rated at 600 psi WOG. Watts B-6000-UL-MASS or equal.	
Emergency Gas Shut-Off	Zurn Accudoor custom valve box with brushed stainless finish. Flush door, glass pane, labeled "Safety Gas Shut-off Valve", T-handle locks. Furnish and install approved ball valve as specified above.	
Check (Gas)	150# Class, bronze swing check valve, aluminum disc, screwed cap and threaded ends. Approved equal to Eclipse, Inc. series 1000.	
Gaskets	1/16" red rubber, wire inserted. 150# raised face and 125 flat-face gasket.	

A. Notes:

1. Provide two wrenches for each gas cock size.
2. The Contractor, at his option, may weld piping down to 1-1/4" if permitted by local Codes.
3. All welders for gas piping must be certified per the requirements of Section 23 00 00.
4. All exterior black steel gas piping shall be painted with two (2) coats of epoxy-based paint. (Coordinate paint color with Architect.)
5. When steel comes in contact with dissimilar material, provide dielectric couplings or dielectric flanges. Contact between ferrous stud bolts and bronze flanges shall be electrically insulated with non-metallic washers. Provide union connections to all pneumatically operated equipment.

2.4 VENT

	Above Grade	Below Grade
Piping	Schedule 40 solid core PVC DWV piping conforming to ASTM D2665 & NSF-14, with ends for solvent cemented joints.	Schedule 40 solid core PVC DWV piping conforming to ASTM D2321 & NSF-14, with ends for solvent cemented joints.
Fittings	PVC Socket Fittings: ASTM D 2665, made to ASTM D 3311, drain, waste, and vent patterns.	PVC Socket Fittings: ASTM D 2665, made to ASTM D 3311, drain, waste, and vent patterns.
Joints	Solvent Cement: ASTM D 2564, PVC solvent cement shall have a VOC content of 510 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24). Primer: ASTM F 656. Primer shall have a VOC content of 550 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).	Solvent Cement: ASTM D 2564, PVC solvent cement shall have a VOC content of 510 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24). Primer: ASTM F 656. Primer shall have a VOC content of 550 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

A. Notes:

1. Copper tube and fittings shall not be used on urinal wastes.
2. Cellular (foam) core PVC piping is not approved for installation and shall not be installed.

2.5 INSULATION

- A. Insulation shall be by Owens-Corning, Certain-Teed or Manville.
- B. Insulation shall be installed by insulation firm regularly specializing in this work and employing men particularly skilled therein. No covering applied by plumber's "helpers" will be acceptable.
- C. Insulation installation shall meet Manufacturer's recommendations. No insulation shall be applied until piping has passed tests as required by Authorities Having Jurisdiction.
- D. Insulation, jackets and adhesives shall be flame-retardant and shall have ASTM E-84 fire hazard ratings of

25 flame spread, 50 smoke developed and 50 fuel contributed.

1. Interior Applications – Jackets:

- a. Type a – Vapor Barrier Jackets: Kraft reinforced foil vapor barrier with self-sealing adhesive joints. Jacket shall be heavy duty fire retardant material with glass fiber reinforcing and self-sealing lap. Jacket will be factory applied to the insulation. Jacket shall have neat, white Kraft finish or white vinyl suitable for painting, with bead puncture resistance of 50 units minimum. Vapor barrier shall be .001” aluminum foil adhered to the inner surface of the jacket. Permeance shall not exceed 0.02 perms. Jacket shall be Owens-Corning Fiberglass “ASJ-SSL” or Manville FlameSafe “AP-T”.
- b. Type b – PVC Jackets: One piece, pre-molded type.

E. Insulation and jacketing shall be in accordance with following:

1. Type A: Glass fiber insulation; ANSI/ASTM C547; “k” value of 0.22 – 0.28 at 100° F non-combustible.
2. Type B: Molded, flexible closed cell vinyl, ASTM D635; “k” value of 1.17 bacterial resistant.

F. Schedule: The following piping systems require insulation:

Piping System	Type	Insulation Thickness Inch (mm)	Jacket Type
Domestic Hot Water Supply/Return Less Than 1-1/2”	A	1”	a, b
Domestic Hot Water Supply/Return 1-1/2” and Larger	A	1-1/2”	a, b
Domestic Cold Water	A	1”	a, b

1. Notes:

- a. Two (2) layers of 1” with staggered joints. Provide galvanized ½” steel bands, 12” on center, apply 1’ hexagonal mesh over insulation and ½” thick coat of insulating cement troweled smooth. Apply glass cloth jacket and size with one brush coat of lagging adhesive.
- b. Unless noted otherwise, Section “F” pertains to all piping specified system. This note pertains to all piping scheduled above.

G. Insulation of exterior piping and fittings shall be covered with 0.016” thick smooth aluminum jacket with longitudinal zee closures. Jacket shall be secured at both joints with 2” wide aluminum straps centered over butt joint of jacket. Provide ½” wide aluminum bands on 12” centers. Fitting covers shall be manufactured for purpose intended and shall be of same material.

H. Pipe hangers shall be outside insulation and shall incorporate 12”, 26 gauge protection shields. Insulation on piping that passes through walls or partitions shall pass continuously through sleeves, except at firewalls, smoke partitions and floor penetrations where space between sleeves and piping shall be fire stopped with approved packing.

2.6 PIPE SUPPORTS

- A. Provide adjustable clevis hangers for hanger sizes 4” and larger and cast brass split-ring hinged hangers or band type hangers for smaller. Support piping from building structure to maintain required grade and pitch of pipe lines, prevent vibration, secure piping in place and provide for expansion and contraction. Hangers on all insulated pipe shall be clevis type.
- B. Provide vertical brackets and guides for horizontal piping where it is racked along walls. Trapeze hangers

may be used where conditions permit. Provide all necessary pipe clips, anchors and sundries for proper alignment and support of piping. Hangers for copper piping shall be coated for dielectric isolation. Hangers for PVC, polypropylene and other plastic piping shall be extended V-shaped, with angle iron pipe supports as necessary.

- C. Hangers for gas piping shall be steel hangers with cast rollers or pipe and roller supports.
- D. Hanger rods shall have machine threads. Beam clamps, concrete inserts and expansion shields shall be provided as required. No ramset or shot shields will be allowed.
- E. Hanger spacing shall meet requirements of State and Local Plumbing Codes. In no case shall horizontal piping be supported at intervals greater than 10'-0".
- F. Piping below basement or lowest level slab (that is, buried piping), need not be supported from structure if slab is not designed as structural slab. The Plumbing Contractor shall support all piping under structural slabs on grade.
- G. Pipe supports shall not bear on sleeves.
- H. Friction clamps shall be installed at base of plumbing risers and at each floor. Friction clamps shall not be supported from or rest on sleeves.
- I. Horizontal piping shall be suspended from building structure by mild steel rod connecting pipe hanger to inserts, beam clamps, angle brackets and lag screws as required by Building Construction in accordance with the following:

Rod Size	Pipe Size
3/8"	1/2" to 2"
1/2"	2-1/2" to 4"
5/8"	5" to 12"
3/4"	15"

- J. Hangers on insulated lines shall be sized to fit the outside diameter of pipe insulation. Provide hangers for insulated piping with 12" long, 18 gauge galvanized insulation shields.
- K. Piping at equipment and control valves shall be supported to prevent strains or distortions in connected equipment and control valves. Piping at equipment shall be supported to allow for removal of equipment, valves and accessories with a minimum of dismantling and without requiring additional support after these items are removed.
- L. Piping installed under this Section shall be independently supported from building structure by means of beam attachments and not from piping, ductwork or conduit of other trades. Supplementary steel, including factory-fabricated channels, required to meet the requirements specified herein, shall be provided by the Plumbing Contractor.
- M. Maximum spacing of hangers on runs of steel, copper or brass pipe shall be as follows:

Schedule: Hanger Spacing in Feet/Pipe Material		
Pipe Size (Inches)	Steel (Feet)	Copper or Brass (Feet)
1/2 to 1	7	5
1 to 1 1/4	10	6
1 to 1 1/2	10	8
2 to 8	10	10

- N. Maximum spacing of hangers on soil pipe shall be 5' and hangers shall be provided at all changes in direction. Hanger rods to support piping from the structure or supplementary steel shall not exceed 4' in

total length. Where pipe support assemblies exceed 4' in total length, Plumbing Contractor shall provide factory-fabricated channels and associated accessories.

- O. All thermoplastic piping systems shall be hung in strict accordance with Manufacturer's recommendations.
- P. Hangers in areas exposed to weather or in unheated spaces shall be provided with a shop coat of rust inhibited paint. Hanger rods shall be hot dipped galvanized.
- Q. Hangers and rods for under slab piping shall be hot dipped galvanized.

2.7 SLEEVES, INSERTS, FIRE STOPPING AND ESCUTCHEONS

- A. All pipes passing through floors, walls or partitions shall be provided with sleeves having an internal diameter one inch larger than the outside diameter of pipe. Pipe Sleeve Materials:
 - 1. Sleeves through floors and through exterior, structural and fire-rated construction, shall be hot dipped galvanized Schedule 40 steel pipe. Sleeves shall extend 1" above finished floor.
 - 2. Sleeves through partitions and non-fire-rated construction shall be 26 gauge galvanized steel with lock longitudinal seams or approved plastic pipe.
 - 3. Provide waterproofing membrane locking devices at floors. Provide 150 lb. Slip-on welding flanges at exterior wall penetrations.
 - 4. Provide one-piece chrome plates escutcheons on all wall, floor and ceiling pipe penetrations in finished rooms and areas.
- B. Fire stop penetration seals in fire-rated construction shall be products of STI SpecSeal, 3M, Proset Systems Firefill or Dow and shall be installed in accordance with the latest requirements of ASTM E814 (UL 1479). Fire stop penetration sealants for non-metallic and insulated piping shall be intumescent (STI SpecSeal Series 100 Sealant or SpecSeal Collar or approved equal). Provide mineral fiberboard, matting or putty for damming and forming. Finish seals flush to wall surface and fill gaps with silicone adhesive sealant caulking (Dow 96-081 RTV or approved equal). Provide 1" thick ceramic fiberboard on both sides of penetrations in 2 and 3 hour rated walls and floors less than 8" thick.
- C. Packing for sleeves that do not require maintenance of fire rating shall be oakum, silicate foam, ceramic fiber or mineral fiber with approved sealant. Pack or foam to within one inch of both wall surfaces. Seal penetration packing with approved caulking and paintable waterproof mastic surface finish or silicone caulking.
- D. Waterproof Pipe Penetrations:
 - 1. Sleeves through outside walls shall be provided with pipe to wall penetration closures equal to Link-Seal Thunderline Corporation. Seals shall be mechanical type of interlocking rubber links shaped to fill space between pipe and sleeve. Links shall be assembled with bolts to form a belt around the pipe with pressure plate under each bolt head and nut. After seal assembly is positioned, tightening of bolts will provide watertight seal. This Contractor shall determine the required inside diameter of each individual sleeve before ordering, fabricating or installing. The inside diameter of each sleeve shall be sized as recommended by the Manufacturer to fit the pipe and Link-Seal to assure a watertight joint.
 - 2. Prefabricated modular sleeves shall be Mason Industries (SWS) or approved equal stiffened galvanized steel sleeves with preformed closed-cell elastomeric seal (non-fire rated) or preformed mineral fiber or silicone foam seal (fire rated).
 - 3. Provide waterproof 1" single ring set in silicone and bolted to floor or wall at chipped and drilled penetrations of existing slabs on grade and existing walls below grade.
- E. Inserts shall be individual or strip type or pressed steel construction with accommodation for removable

nuts and threaded rods up to 3/4" diameter, permitting lateral adjustment. Individual inserts shall have an opening at the top to allow reinforcing rods up to 1/2" diameter to be passed through the insert body. Strip inserts shall have attached rods with hooked ends to allow fastening to reinforcing rods.

- F. Unless otherwise specified herein, escutcheons shall be cast brass chrome plated type and provided with a set screw to properly hold escutcheon in place.

2.8 EQUIPMENT – GENERAL

- A. The following mechanical equipment is to be supplied by a single Manufacturer as part of this package unless otherwise noted.
- B. Equipment Tags:
1. All equipment shall be tagged using black phenol background with a 1/4" white engraved lettering tag affixed to the piece. Tag shall be minimum of 2" high and 4" long for large equipment and shall include the tag number and the piece.
 2. Equipment Tag Sequence (Example):
 - a. G-CMP – 1XXX where:
 - b. G – Indicates system (Natural Gas)
 - c. CMP – Indicates equipment (Booster Pump)
 - d. 1 – Indicates piece number (1, 2, 3...)
- C. All equipment furnished in the following pages shall be furnished with seismic anchoring points. Equipment supplied shall be constructed with a seismic rating.

PART 3 – EXECUTION

3.1 DEMOLITION

- A. Disconnect and dismantle existing plumbing systems and equipment to be demolished and leave debris and disconnected equipment on floor for removal under Section 20 70 00 – SELECTIVE DEMOLITION.
- B. Remove existing plumbing stacks, mains and branches when serving fixtures to be demolished. Remove piping back to active main and provide valve cap or plug to suit system. Obtain existing record Drawings from Owner. Maintain existing plumbing risers and stacks serving fixtures to remain.
- C. After walls and ceilings are removed and piping is exposed, verify piping serves only plumbing fixtures indicated for demolition before shut-down for disconnection. Identify existing piping which serves fixtures to remain. Promptly notify Architect of active piping to be maintained when located in partitions to be demolished.
- D. Remove existing stacks and risers located in existing partitions to be demolished and provide new off-set at ceiling and drop through floor and reconnect to existing services at the floor below.

3.2 COORDINATION

- A. Cooperate and coordinate with work of other Sections in executing work of this Section.

3.3 EXPANSION PROVISIONS

- A. Allow for expansion with offsets, loops, swing joints, expansion joints and other means, where necessary to protect piping systems as shown. Take-offs from mains to run outs shall not have less than a three (3) elbow swing.

- B. Anchor mains and risers with loops or offsets to structure to impart expansion toward loops and offsets. Anchors shall be forged wrought iron, secured to pipe and structure. Provide vibration isolation as required and as specified.
- C. Provide pipe alignment guides to guide expanding pipe to move freely from anchor points towards expansion joints, offsets and other expansion provisions.

3.4 PIPE IDENTIFICATION

- A. Provide color-coded pipe identification markers on piping installed under this section. Pipe markers shall be snap-on laminated plastic protected by clean acrylic coating. Pipe markers shall be applied after Architectural painting where such is required.
- B. Provide arrow marker with each pipe content marker to indicate direction of flow. If flow can be in either direction, use double-headed arrow marker.
- C. Main shall be labeled at points of entrance and exit from mechanical room, adjacent to each valve, on each riser, at each tee fitting, at points of entrance and exit from building, at least once in each room and at intervals no longer than 20'.
- D. In general, 2" high legend shall be used for pipe lines 4" in diameter and larger, and 3/4" high legend shall be used for pipe lines 3" in diameter and smaller.
- E. Markers shall be Seton, MIS or approved equivalent.
- F. Color banding shall meet ANSI latest and OSHA requirements.
- G. Markers shall have legends and color coding with black letters:

- 1. Markers are to be applied to all piping, regardless of under jacket colors per the following schedule:

Service	Legend	Background Color
Cold Water	Cold Water	Green
Hot Water	Domestic Hot Water	Yellow
Hot Water Return	Domestic Hot Water Return	Yellow
Vent	Vent	Yellow
Fuel Gas	Fuel Gas	Yellow

- H. In Penthouse, Plumbing Room, Shipping Dock, Janitor's Closets and other areas without hung ceilings, colored PVC jackets shall be used per the schedule.
 - 1. All insulated piping exposed in mechanical rooms shall be covered with a Ceel-Co plastic jacket. Color pattern and system identification legend shall be as in the schedule.
 - 2. This plastic jacket shall include fitting covers and piping covers.
 - 3. Piping to be covered with this plastic jacket shall be insulated and finished as herein specified and then the plastic jacket shall be applied.

3.5 TAGS, VALVES, EQUIPMENT AND INSTRUMENTS

- A. Upon completion of work, attach engraved laminated plastic tags to all valves and instrumentation. Equipment shall bear a stamped stainless tag. Tags shall have black characters on white face, consecutively numbered and prefixed with letter "P" for general valves. Tags shall bear the number used in the P&IDs for those items so marked.
- B. Embossed or engraved aluminum or brass tags may be substituted if desired. Tags shall be at least 1/8" thick.

- C. Tags shall be at least 1" diameter with numerals at least 3/8" high and attached by "S" hooks and chains.
- D. Nameplates, catalog numbers and rating identifications shall be securely attached to electrical and mechanical equipment with screws or rivets. Adhesives or cements will not be permitted.
- E. Non-potable water outlets shall be identified with permanently attached yellow color-code or 4" high triangle tag reading "Water Unsafe".
- F. Coordinate numbering system with existing piping tags as not to duplicate numbers.

3.6 FLASHING AND COUNTER FLASHING

- A. Floor drains shall be flashed watertight with 20 ounce sheet copper flashing which shall extend 8" beyond drain flashing flange.
- B. Provide counter flashing for roof penetrations required under this Section including vents and roof drains.
- C. Flashing of vents, roof drains and other penetrations of roof required under this Section shall be done under other Sections.

3.7 JOINTS AND CONNECTIONS

- A. Joints and connections shall be permanent and shall be gas and water-tight. Jointing shall be types specified for serviced indicated. Joints and connections shall meet requirements of Manufacturer's best recommended practice. All transitions between different piping materials shall be made using approved adapters. Adapters for transitions between two (2) types of piping materials shall be manufactured for purpose intended.

3.8 INTERIOR WATER SUPPLY SYSTEM

- A. Provide a complete, new (domestic and/or protected) hot and cold water piping system as indicated on Contract Drawings and as specified, including supplies to fixtures and indicated equipment. Piping shall be pitched at least 1" in 40 feet so that it can be drained completely at low points with drain valves. Piping shall be pitched up toward fixtures for proper air relief. Provide automatic air vents with outlet piped to floor and gate valve ahead of air vents, where offsets cannot be vented by means of fixture connections.
 - 1. Pipe used in piping assembly shall be clean and shall have ends square and reamed before putting into fittings.
 - 2. Cut tube to required length with hacksaw or tube cutter designed for copper work.
 - 3. Remove burrs from inside and outside of cut edge and clean end of tube with steel wool or sand cloth until discoloration is removed and metal is smooth and bright.
 - 4. Oxides shall be removed by sand cloth and brush.
 - 5. Removal of oxides or discoloration of pipe and fittings by acids or self-cleaning flux is forbidden.
 - 6. Apply a thin, uniform and complete coating of reliable brand of soldering flux (Nokorode or Crest) to cleaned surfaces of tube and fittings.
 - 7. When joints are soldered, remove excess solder with a cloth or brush leaving a fillet of solder in chamber at end of the fitting.
 - 8. Connections to tanks and equipment shall be made with unions.
 - 9. Water services supplying the building shall flow through in-line strainers and shall have containment backflow protection as indicated.

3.9 INTERIOR VENT PIPING

- A. Provide vent lines shown in building as shown on Contract Drawings. Vents shall extend through roof and shall increase to at least 4". Piping shall be assembled and installed without undue strains and stresses and provision shall be made for expansion, contraction and structural settlement.
- B. Vents from fixtures or line of fixtures, when connected to vent line serving other fixtures, shall be extended at least 6" above flood level rim of highest of fixtures to prevent use of vent line as waste. No vent terminal shall be directly beneath door, window or other ventilating opening of building, nor shall any vent be within 12 feet horizontally of such opening.
- C. Provide sleeves for pipe that pass through walls.
- D. Piping shall be run straight and plumb and offsets shall be made at an angle of not less than 45.
- E. Carefully lay out work in advance so pipes pass through openings and permit proper pitch to stacks. Due to extensive ventilation and lighting systems all trades shall coordinate work with work of other trades.
- F. Above ground PVC piping shall be installed according to ASTM D2665. Underground PVC piping shall be installed according to ASTM D2321.
- G. For PVC piping, solvent cement joints shall be used for joints. All surfaces shall be cleaned and dry prior to applying the primer and solvent cement. Installation practices shall comply with ASTM F402. The joint shall conform to ASTM D2885 and ASTM D2665 appendixes.

3.10 EQUIPMENT ROUGHINGS AND CONNECTIONS

- A. Provide roughing and final connections for gas systems including indirect wastes, traps, tailpieces, stops and supplies, valves and unions for all equipment and fixtures including those supplied under other sections.
- B. Provide complete plumbing roughings with capped and valved service with union of flange to suit Owner furnished equipment.
- C. Refer to Architectural floor plans and Equipment schedules for all equipment provided under other sections or by Owner. Roughing for all equipment including floor drain locations shall be based on approved Shop Drawings. Install indirect waste discharge to spill into floor drain funnel. Floor drain grate and sediment bucket shall be removable.

3.11 GAS SERVICE PIPING

- A. Piping shall be done by licensed gas fitter (as required by Code).
- B. Gas piping shall pitch to drain and shall have drip pockets at least 6" long with removable caps at low points. Branch connections shall be taken from top or side of horizontal running main. Provide gas cock or valve on connections to fixtures or equipment.
- C. Provide union connection between shut-off cock and equipment to permit disconnection of equipment.
- D. Provide pressure reducing valve between meter and building piping, as required by Gas Company, piped and vented to outside of building.
- E. Provide individual vents from regulators, pressure switches and reliefs on factory packaged equipment gas trains at all equipment located on this system. It is this Contractor's responsibility to extend all vents to atmosphere terminal at a safe location in conjunction with the Fuel Gas Code.
- F. Gas piping and safety devices shall meet requirements of NFPA No. 54 and shall be subject to inspection and approval of State Gas Regulatory Board.

1. Special Note: Provide aluminum check valves on all gas pipes that enter rooms where compressed air is installed or when both compressed air and gas piping connect to the same piece of equipment. This is required in all areas where gas and air are present.

- G. Provide a gas cock valve at each branch run out from main or riser serving gas outlets.
- H. Piping shall be securely fastened, separately hung, and shall not support any other weight or piping. Piping dropped in concrete block walls shall be factory wrapped for corrosion protection.
- I. Gas valves or cocks shall not be concealed and shall be readily accessible for inspection and repair.
- J. Welded piping shall conform to the latest requirements of the Rhode Island Gas Code.

3.12 CLEANING

- A. Clean systems thoroughly before testing. Fixtures, equipment, pipe, valves and fittings shall be free of grease, metal cuttings, dirt and other foreign material. Remove protective covers. Fixtures (including lavatories, water closets and urinals) shall be cleaned and ready for use.
- B. Repair stoppage, discoloration and damage to parts of building, finish and furnishings due to failure to properly clean piping system within Contract Price.
- C. After completion of project, clean the exterior surface of equipment included in this section, including concrete residue.
- D. After the completion of the work, all materials and equipment surfaces shall be thoroughly cleaned and polished in accordance with the finish of the material. All chromed surfaces shall be highly polished.
- E. Before the systems are tested and balanced, pipes and equipment shall be thoroughly cleaned so that no dirt, dust, or other foreign matter will be deposited in or carried through the systems.
- F. Water systems shall be thoroughly flushed and cleansed of any and all deleterious materials at least once before system is placed in operation. At this time, these systems will be carefully checked for leaking and defects as hereinafter specified. An approved cleansing agent will be used in flushing.
- G. At all times, keep the premises clear of undue accumulation of rubbish.
- H. On completion of the work, remove all rubbish and debris resulting from this Contract and dispose of same. At any time should the General Contractor be dissatisfied with the performance of clean-up responsibilities, he may elect, after proper notification, to undertake this operation and back charge this Subcontractor accordingly.
- I. All equipment shall be thoroughly cleaned and left in a satisfactory condition for proper operation at project completion.

3.13 DISINFECTION OF WATER SYSTEMS - INTERIOR AND EXTERIOR

- A. Water piping systems shall be thoroughly disinfected with a solution containing no less than 50 parts per million of available chlorine. Chlorinating materials shall be either liquid chlorine or sodium hypochlorite solution, and shall be introduced into the system and drawn to all points in the system. Disinfection solution shall be allowed to remain in system for 24 hours. During this time, valves and faucets shall be opened and closed several times. After disinfection, solution shall be flushed from the system with clear water until residual chlorine content is no greater than 0.2 parts per million.
 1. Notify all parties 48 hours prior to cleaning system.
 2. Bypass all building filters.
 3. Perform chlorination prior to heating the domestic hot water system. Run circulation pumps on the

domestic HW system.

4. Provide advance notice to all trades prior to procedure. Post warning signs throughout the job site.
 5. Collect samples randomly and at end user points.
- B. Work shall be supervised by Owner and performed by approved chemical testing laboratory and results sent to the Architect or Architect's Representative for verification.
- C. Testing laboratory shall submit a summary of test procedure for approval prior to any work performed. Subcontractor shall provide valves required to disinfect water supply system in part as required by phasing of construction and to provide isolating valves and draw-off valves for proper containment, phasing and flushing.

3.14 TESTING AND ADJUSTING – GENERAL

A. Scope:

1. Test and adjust plumbing systems as specified and as required by Code and Contract Documents.
2. Testing, balancing and adjusting shall in no way relieve guarantee requirements.
3. Provide services of qualified personnel, equipment and apparatus required to perform tests.
4. All systems shall be thoroughly adjusted for perfect intended operation. All mechanical equipment shall be adjusted for flow, temperature, etc. of fluid. The entire hot water circulation system shall be thoroughly balanced so hot water draw from fixtures shall be as quickly available as possible. Pumps, relief valves and pressure reducing valves shall be adjusted as required. Submit in writing to the Engineer upon completion of this work that it is complete and ready for use.

B. Before date of acceptance, furnish Architect with Certificates of Testing and Inspection indicating approval of Authorities Having Jurisdiction and conformance with requirements of Contract Documents.

C. General:

1. Submit proposed test procedures, recording forms and test equipment for review before testing.
2. Notify Architect and Authorities involved at least 48 hours before testing and inspection.
3. Do not paint, cover or conceal work before testing, inspecting and obtaining approval; this includes backfilling and application of insulation.
4. Costs of repairs and restoration of work of other trades and of existing building surfaces or material damaged during cleaning or testing shall be borne by trade performing cleaning or testing.

D. No tests shall be started until systems have been cleaned as described under "Cleaning" paragraph. Provide temporary piping and connections for testing, flushing or draining systems to be tested.

1. Repair or replace leaks, damage and defects that result from tests to like-new condition. Remove and replace defective materials with acceptable materials.
2. Piping and joints shall be made tight without caulking. Continue tests until systems operate without adjustments and repair to equipment or piping.
3. Provide testing instruments, force pumps, gauges, equipment and labor necessary to conduct tests. Instruments used for testing and balancing shall have been calibrated within six months before balancing. Instrument calibration shall be certified.'
4. Submit six (6) copies of complete testing and balancing report to Architect for review.

E. Final test shall be made after vertical and horizontal pipes and roughing-in have been run and before sewer

or fixture connection is made.

1. After soil, waste and storm lines, etc. have been installed outlets shall be temporarily plugged up.
2. Fill pipes with water to top of vertical lines and allow them to remain so filled for 24 hours.
3. Retesting after leaks are repaired shall be at no additional cost.

F. Pressurized Piping Systems:

1. Leak tests shall be conducted in accordance with ANSI applicable Codes and as specified herein.
2. Before piping of various systems has been covered or furred-in, piping systems shall be tested tight for 1 hour under hydrostatic pressure, 1-1/2 times systems working pressures, but not greater than test pressure of 150 psig.
3. Tests shall be witnessed by Architect and pronounced satisfactory before pressure is removed or any water drained off.
4. Equipment shall be valved off or removed during test if equipment pressure rating is less than test pressure.
5. Retest systems after leaks are repaired within Contract Price.

G. Gravity Systems: Test under water pressure at heads specified in Plumbing Codes. Fill pipe lines with water to top of 5 foot vertical section of pipe or to level of top of vent pipe; maintain head pressure for 30 minutes.

H. Potable Water System Test:

1. Certification of the potable water system integrity shall be required where separate systems of potable and non-potable water are provided to supply plumbing fixtures.
2. Fill potable water system to capacity with clean clear water. Introduce water at top of piping system (Hot and Cold). During filling, introduce green food coloring dye into piping system. A floor-by-floor survey shall be conducted. Operate each outlet (Hot and Cold) connected to potable water system until coloring has been observed. A method of maintaining the level of water and coloring shall be employed in order to make up the drawn off amounts. A survey sheet shall indicate each floor and the room number sequentially.
3. This survey is required to be performed after all pressure testing and flushing of the piping system, but before sterilization. Further, it is required that all fixtures connected to the potable water system be installed prior to the test.

I. Pumps shall be tested to check impeller trim and operating characteristics. Following data shall be recorded and submitted to Architect for review:

1. Flow at operating conditions where flow venturi or orifices are installed in system.
2. Shutoff pressure required to check impeller trim.
3. Discharge pressure at operating conditions.
4. Suction pressure at operating conditions.
5. Motor amperage on each phase at operating conditions.

J. Prove capacity and performance of each piece of equipment by field tests as specified herein various paragraphs. Equipment and instruments required for tests, as well as additional thermowells or gauge connections shall be installed at no additional cost to Owner.

1. Qualified Representative of Equipment Manufacturer shall be present. Architect may witness tests, if he so desires.
2. Test requirements shall include, but not be limited to, the following:
 - a. Domestic water pumps.

K. Examine PART 2 for supplemental testing requirements.

3.15 TESTING: PIPING SYSTEMS

A. General:

1. Piping systems shall be subjected to testing water or air as noted and shall hold tight at the pressure head stated for the time interval required without adding air or water. While any system is being tested, required head or pressure shall be maintained until joints are inspected.
2. Tests shall be witnessed by inspector having jurisdiction, and the Architect within 48 hour notice, given these Authorities.
3. Equipment, material, and labor required for testing of various systems, or part thereof, shall be provided by Plumbing Contractor.

B. Sanitary and Waste System:

1. Water test shall be applied to drainage system either in their entirety or in sections as required, after rough piping has been installed.
2. If applied to entire system, openings in piping system shall be tightly closed, except the highest opening and system filled with water to point of overflow.
3. If system is tested in sections, each opening shall be tightly closed except highest opening in the section under test and each section shall be filled with water but no section shall be tested with less than a 10' head of water.
4. In testing successive sections, at least upper 10' of next preceding section shall be tested so that no joint of piping in building, except the uppermost 10' of the system shall be submitted to a test of less than a 10' head of water.
5. Water shall be kept in system for at least 15 minutes before inspection starts; the system shall then be made tight at all points.

C. Points of drainage systems tested with air instead of water shall be tested by attaching an air compressor testing apparatus to suitable opening and, after closing all other inlets or outlets, forcing air into systems until a uniform gauge pressure of 5 psi or sufficient pressure to balance a column of mercury 10" high. Pressure shall be held without introduction of additional air for a period of at least 15 minutes.

D. All new and existing sanitary, waste and vent piping installed under the floor slab, in the area of work, shall be video camera scoped and recorded upon completion and prior to final acceptance. Any debris found in underground piping shall be flushed and removed as part of this Contract. All video recordings and results shall be submitted to the Owner as part of the closeout documents.

E. Interior Water Piping System: Upon completion of water supply systems or section thereof, as required, system shall be tested and proved tight under a water pressure of 150 psi. Gauge shall be located on lowest new floor and pressure shall hold for a period of one (1) hours without introducing additional water. Water used for testing shall be from a potable source of supply.

F. Natural Gas Piping Systems – Domestic Gas:

1. Upon completion of gas piping system or section thereof, as required, test by attaching an air compressor testing apparatus to any suitable opening, and after closing all other inlets and outlets, force air into the system until a uniform pressure of at least 6" mercury or 3 lb. gauge for a period of no less than 30 minutes for each 500 cubic feet of pipe volume without showing any drop in pressure. Pressure shall be measured with a mercury manometer, slope gauge, or an equivalent device calibrated to read in increments of no greater than 1/10 lbs.

G. Testing Summary:

1. W&V – with water to a 10 foot head for 30 minutes.
2. Water – with potable water to 150 psi for one hour.
3. Gas (Low Pressure) – with air to 6" mercury for ten minutes.

H. Defective Work: If inspection or tests show defects, such defective work or material shall be replaced and inspection and tests shall be repeated. Repairs to piping shall be made with new material. No caulking or screwed joints or holes shall be acceptable.

I. Additional Tests:

1. Provide additional tests such as smoke pressure tests as required by regulations or as directed by Authorities making the inspection.
2. Provide for any repeated test as directed by the Architect, to make all systems tight as required.
3. Visual inspections of joints and valves shall be made as directed by the Architect.

END OF SECTION

SECTION 23 00 00 (Alternate Design)

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SECTION 23 00 00 (Alternate Design)

HVAC

PART 1 – GENERAL

1.1 GENERAL REQUIREMENTS AND REFERENCES

- A. Include “General Requirements” and applicable parts of Division 1 as part of this Section.
- B. Examine all other sections of the Specifications for requirements which affect work under this Section whether or not such work is specifically mentioned in this Section. Where paragraphs of this Section conflict with similar paragraphs of Division 1, requirements of this Section shall prevail.
- C. Coordinate work with that of all other Trades affecting, or affected by work of this Section. Cooperate with such Trades to assure the steady progress of all work under the Contract.
- D. The Subcontractor shall be responsible for filing all documents, payment of all fees, and securing of all inspections and approvals necessary for the work of this Section.

1.2 RELATED DOCUMENTS

- A. The Contractor, Subcontractors, and/or suppliers providing goods and services referenced in or related to this Section shall also be bound by the Related Documents identified in Division 01 Section “Summary”.

1.3 DEFINITIONS

- A. As used in this section, “provide” means “furnish and install”, “POS” means “Provided Under Other Sections” and “HVAC” means “Heating, Ventilating and Air Conditioning”.
- B. As used in the Drawings and Specifications for Mechanical Work, certain non-technical words shall be understood to have specific meanings as follows, regardless of indications to the contrary in the General Conditions of other documents governing the HVAC work.
 - 1. “Furnish” means: Purchase and deliver to the project site complete with every necessary appurtenance and support, all as part of the HVAC work. Purchasing shall include payment of all sales taxes and other surcharges as may be required to assure that purchased item(s) are free of all liens, claims, or encumbrances.
 - 2. “Install” means: 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, all as part of the HVAC work.
 - 3. “Provide” means: “Furnish” and “Install”.
 - 4. “New” means: Manufactured within the past two (2) years and never before used.
- C. Except where modified by a specific notation to the contrary, it shall be understood that the indication and/or description of any HVAC item in the Drawings or Specifications for HVAC work carries with it the

instruction to furnish, install and connect the item as part of the HVAC work, regardless of whether or not this instruction is explicitly stated.

- D. It shall be understood that the Specifications and Drawings for HVAC work are complimentary and are to be taken together for a complete interpretation of the HVAC work except that indications on the Drawings, which refer to an individual element of work, take precedence over the Specifications where they conflict.

1.4 SCOPE

- A. Perform work and provide material and equipment as shown on Drawings and as specified or indicated in this Section of the Specifications. Completely coordinate work of this Section with work of other trades and provide a complete and fully functional installation.
- B. Drawings and Specifications form complimentary requirements; provide work specified and not shown, and work shown and not specified as though explicitly required by both. Although work is not specifically shown or specified, provide supplementary or miscellaneous items, appurtenances, devices and materials obviously necessary for a sound, secure and complete installation.

1.5 REGULATORY REQUIREMENTS

- A. Perform work strictly as required by rules, regulations, standards, codes, ordinances and laws of Local, State and Federal governments, and all other Authorities that have legal jurisdiction over the site. Materials and equipment shall be manufacturer installed and tested as specified in latest editions of applicable publications, standards, rulings and determinations of:
1. Local and State Building, Plumbing, Mechanical, Electrical, Fire and Health Department Codes.
 2. American Gas Association (AGA).
 3. National Fire Protection Association (NFPA).
 4. American Insurance Association (A.I.A.) (formerly National Board of Fire Underwriters).
 5. Occupational Safety and Health Act (OSHA).
 6. Underwriters' Laboratories (UL).
- B. Material and equipment shall be listed by Underwriters' Laboratories (UL), and approved by ASME and AGA for intended service.
- C. When requirements cited in this Specification conflict with each other or with Contract Documents the most stringent shall govern work. The Architect may relax this requirement when such relaxation does not violate the rulings of Authorities that have jurisdiction. Approval for such relaxation shall be obtained in writing.
- D. Most recent editions of applicable Specifications and publications of the following organizations shall form part of the Contract Documents.
1. American National Standards Institute (ANSI).

2. American Society of Mechanical Engineers (ASME).
3. National Electric Manufacturers Association (NEMA).
4. American Society for Testing and Materials (ASTM).
5. American Water Works Association (AWWA).
6. American Society for Heating, Refrigerating and Air Conditioning Engineers (ASHRAE).
7. Air Moving and Conditioning Association (AMCA).
8. Sheetmetal and Air Conditioning Contractors National Association (SMACNA).
9. Air Conditioning and Refrigeration Institute (ARI).
10. Thermal Insulation Manufacturers Association (TIMA).

1.6 SUBMITTALS

A. This section shall supplement Division 1.

B. Definitions:

1. Shop Drawings: Information prepared by the Contractor to illustrate portions of the work in more detail than shown in the Contract Documents.
2. Coordination Drawings: Detailed, large-scale layout Shop Drawings showing HVAC, Electrical, Plumbing and Fire Protection work superimposed to identify conflicts and ensure inter-coordination of Mechanical, Electrical, Architectural, Structural and other work.
3. Manufacturer's Product Data: Information prepared by the manufacturer which depicts standard equipment.

C. Submittals Procedures and Format:

1. Review submittal packages for compliance with Contract Documents and then submit to Architect for review. All shop drawings shall be submitted electronically (email or web-based construction management portal) in PDF format. After review, comments shall be returned through an online portal on company standard letterhead with formal review stamp and notes..
2. Each Shop Drawing shall indicate in title block, and each Product Data package shall indicate on cover sheet, the following information:
 - a. Title.
 - b. Name and location of project.
 - c. Names of Architect, Engineer, Contractor and Subcontractor(s).
 - d. Names of Manufacturer, Supplier, Vendor, etc.
 - e. Date of submittal.

- f. Whether original submittal or resubmitted.
- 3. Shop Drawings showing layouts of systems shall contain sufficient plans, elevations, sections, details and schematics to describe work clearly. They shall be $\frac{1}{4}" = 1'-0"$ and shall indicate work of other Sections where physical clearances are critical and where interferences are possible. Provide larger scale details as necessary. Sheetmetal Drawings shall show elements of Architect's reflected ceiling plan, exposed ductwork, walls, partitions, diffusers, registers, grilles, fire dampers, sleeves and other aspects of construction as necessary for coordination.

D. Acceptable Manufacturers:

- 1. The Architect's Mechanical/Electrical design for each project is based on the single manufacturer listed in the schedule or shown on the Drawings. In these Specifications certain "Alternate Manufacturers" are listed as being acceptable. These are acceptable only if, as a minimum, they:
 - a. Meet all performance criteria listed in the schedules and outlined in the Specifications.
 - b. Have identical operating characteristics to those called for in the Specifications.
 - c. Fit within the available space it was designed for, including space for maintenance and component removal, with no modifications to either the space or the product. Clearances to walls, ceilings and other equipment will be at least equal to those shown on the Contract Documents. The fact that a manufacturer's name appears as acceptable shall not be taken to mean the Architect has determined that the manufacturer's products will fit within the available space. This determination is solely the responsibility of the Contractor.
 - d. For equipment mounted in areas where structural matters are a consideration, the products must have a weight no greater than the product listed in the schedules or Specifications.
 - e. Products must adhere to all architectural considerations including, but not limited to, being the same size and of the same physical appearance as scheduled or specified products.

E. Substitutions and Deviations:

- 1. Deviations from the Contract Documents and the substitution of materials or equipment relative to the "Acceptable Manufacturers" referred to above, shall be requested individually in writing whether deviations result from field conditions, standard shop practice, or other cause. Submit letter with transmittal of Shop Drawings which flags the substitution or deviation to the attention of the Architect. The letter shall describe changes in the system shown and physical characteristics (connections to adjacent materials, electrical services, service access requirements, and other characteristics), and differences in operating characteristics or cycles.
- 2. Without letters flagging the substitution or deviation to the Architect, it is possible that the Architect may not notice such substitution or deviation or may not realize its ramifications. Therefore, if such letters are not submitted to the Architect, the Contractor shall hold the Architect and his consultants harmless for any and all adverse consequences resulting from the deviations being implemented. Adverse consequences shall include, but not be limited to, excessive noise, excessive maintenance, shortened longevity, spatial coordination problems, and inadequate performance versus scheduled design. This shall apply regardless of whether the Architect has reviewed or approved Shop Drawings containing the deviation, and will be strictly enforced.
- 3. Do not request substitute materials or equipment unless identical material or equipment has been operated successfully for at least three (3) consecutive years. Such materials and equipment shall be a

regular cataloged item shown in the current catalog of the manufacturer. When deviation or substitution is permitted, coordinate fully with related changes to Architectural, Structural, Plumbing, Fire Protection, Mechanical, and other work. Ensure that related changes necessary for coordination of substituted items are made within the Contract Price. Assume full responsibility for safety, operation and performance of the altered system.

4. Substitutions of equipment, systems, etc. requiring approval of local Authorities must comply with such regulations and be filed by the Contractor (should filing be necessary).
5. Consideration will not be given to claims that the substituted item meets the performance requirements with lesser construction. Performance, as delineated in schedules and in the Specifications, shall be interpreted as minimum performance.
6. Approval of proposed deviations or substitutions, if any, will be made at discretion of Architect.
7. If equipment is proposed for substitution that is not tested and rated according to industry-wide standards, the Architect shall have the right to have performance tests completed, at the Contractor's expense, to confirm the manufacturer's performance claims.

F. Submittal Notations: will be returned from the Architect marked as illustrated below:

☐ NO EXCEPTION TAKEN	☐ ACCEPTED AS NOTED
☐ NOT ACCEPTED	☐ REVISE AND RESUBMIT

1. Checking is only for general conformance with the design concept of the project and general compliance with the information given in the Contract Documents. Any action shown is subject to the requirements of the Drawings and Specifications. Contractor is responsible for dimensions which shall be confirmed and correlated at the job site; fabrication process and techniques of construction; coordination of his work with that of all other trades; and the satisfactory performance of his work.

G. Schedule: Incorporate the Shop Drawing review period into the construction schedule so that work is not delayed. Contractor shall assume full responsibility for delays caused by not incorporating the following Shop Drawing review time requirements into his project schedule. Allow at least ten (10) working days, exclusive of transmittal time, for review each time a Shop Drawing is submitted or resubmitted with the exception that fifteen (15) working days, exclusive of transmittal time, are required for the following:

1. Automatic temperature controls.
2. Coordination Drawings, if required by this Specification.
3. If more than five (5) Shop Drawings of this trade are received in one (1) calendar week.

H. List of Proposed Equipment and Materials: Within four (4) weeks after Award of Contract and before ordering materials or equipment, submit a complete list of proposed materials and equipment and indicate manufacturer's names and addresses. No consideration will be given to partial lists submitted out of sequence.

I. Responsibility:

1. The intent of submittal review is to check for capacity, rating, and certain construction features. Contractor shall ensure that work meets requirements of the Contract Documents regarding information that pertains to fabrication processes or means, methods, techniques, sequences and procedures of construction; and for coordination of work of this and other Sections. Work shall comply with submittals marked "REVIEWED" to extent that they agree with the Contract Documents. Submittal review shall not diminish responsibility under this Contract for dimensional coordination, quantities, installation, wiring, supports and access for service, nor the Shop Drawing errors or deviations from requirements of the Contract Documents. The Architect's noting of some errors while overlooking others will not excuse the Contractor for proceeding in error. Contract Document requirements are not limited, waived, nor superseded in any way by review.
 2. Inform Subcontractors, Manufacturers, Suppliers, etc. of scope and limited nature of review process and enforce compliance with the Contract Documents.
- J. Material and equipment requiring Shop Drawing and/or Manufacturer's Data Submittals shall include but not be limited to:
1. Diffusers, registers, grilles, splitters, dampers and accessories.
 2. Ventilating and exhaust fans.
 3. Filters.
 4. Automatic controls.
 5. Insulation and acoustical lining.
 6. Vibration isolation.
 7. Equipment bases and supports.
 8. Identification for pipe, duct, valves and equipment.
 9. Complete ductwork Shop Drawings, construction details and duct construction standards.
 10. Access panels.
 11. Color selection charts and samples for equipment and systems in finished areas.
 12. Variable refrigerant flow system.
 13. Electric heaters.
 14. Energy recovery unit.
 15. Ductless heat pump systems.
 16. Condensate pumps.
 17. Constant flow regulators.

18. Motorized dampers.

19. Raceways and boxes for controls wiring.

1.7 SURVEYS AND MEASUREMENTS

- A. Base all required measurements, both horizontal and vertical, on reference points established by the General Contractor and be responsible for the correct laying out of the Mechanical work. In the event of a discrepancy between actual measurements and those indicated, notify the General Contractor in writing. Do not proceed with the work required until written instructions have been issued by the General Contractor.

1.8 COORDINATION

- A. HVAC, Plumbing, Fire Protection, and Electrical Drawings are diagrammatic. They indicate general arrangements of Mechanical systems and other work. They do not show all offsets required for coordination nor do they show the exact routings and locations needed to coordinate with Structural and other trades and to meet Architectural requirements.
- B. Work shall be performed in cooperation with other trades on the project and so scheduled as to allow speedy and efficient completion of the work.
- C. Furnish to other trades advance information on locations and sizes of all frames, boxes, sleeves and openings needed for their work. Furnish information and Shop Drawings necessary to allow trades affected by the work to install their work properly and without delay.
- D. In all spaces, prior to installation of visible material and equipment, including access panels, review Architectural Drawings for exact locations and where not definitely indicated, request information from Architect. Where the HVAC work shall interfere with the work of other trades, assist in coordinating the space conditions to make satisfactory adjustments before installation. Without extra cost to the Owner, make reasonable modifications to the work as required by normal Structural interferences. The Mechanical Contractor shall be liable for any additional openings, or relocating and/or enlarging existing openings through concrete floors, walls, beams and roof required for any work which was not properly coordinated. Maintain maximum headroom at all locations. All piping, duct, conduit, and associated components to be as tight to underside of structure as possible.
- E. If any HVAC work has been installed before coordination with other trades so as to cause interference with the work of such trades, all necessary adjustments and corrections shall be made by the trades involved without extra cost to the Owner.
- F. Where conflicts or potential conflicts exist and engineering guidance is desired, submit sketch of proposed resolution to Architect for review and approval.
- G. Protect all materials and work of other trades from damage which may be caused by the Mechanical work, and repair all damages without extra cost to the Owners.

1.9 MECHANICAL AND ELECTRICAL COORDINATION

- A. The HVAC Subcontractor shall furnish and install various electrical items relating to the heating and

ventilating equipment and control apparatus. The Electrical Subcontractor shall be required to connect power wiring to this equipment unless noted otherwise.

- B. The HVAC and Electrical Subcontractors shall coordinate their respective portions of the work, as well as the electrical characteristics of the heating, ventilating and air conditioning equipment.
- C. All power wiring and local disconnect switches will be provided by the Electrical Subcontractor for the line voltage power. All control and interlocking wiring shall be the responsibility of the HVAC Subcontractor.
- D. 120V and above power wiring sources extended and connected to HVAC control panels, transformers and switches shall be the responsibility of the Electrical Subcontractor. All low voltage thermostats and any switch wiring shall be the responsibility of the HVAC Subcontractor.
- E. Temperature control and equipment wiring shall be installed by the HVAC Subcontractor.
- F. The Electrical Subcontractor will provide all magnetic starters except those furnished as an integral part of packaged equipment.

1.10 MECHANICAL AND ELECTRICAL COORDINATION DRAWINGS

A. Coordination Drawings:

- 1. The Sheetmetal Subcontractor shall prepare a complete set of electronic Drawings at a scale not less than 3/8" equals 1'-0", showing structure and other information as needed for coordination. He shall show sheetmetal layout thereon. These will be the Coordination Drawings.
- 2. The main paths of egress and for equipment removal, from main Mechanical and Electrical rooms must be clearly shown on the Coordination Drawings. All fire and smoke partitions must be highlighted on the Coordination Drawings for appropriate coordination.
- 3. Each of the below specialty trades shall add its work to these background Drawings with appropriate elevations and grid dimensions. Specialty trade information is required for fan rooms and mechanical rooms, horizontal exits from duct shafts, crossovers, and for spaces in and above ceilings where congestion of work may occur such as corridors, and even entire floors. Drawings shall indicate horizontal and vertical dimensions, to avoid interference with structural framing, ceilings, partitions, and other services.
 - a. Specialty Trades:
 - 1) Plumbing System.
 - 2) HVAC Piping and Associated Control System.
 - 3) Electrical.
 - 4) Sheet Metal Work.
- 4. Each specialty trade shall sign and date each electronic Coordination Drawing. Return Drawings to the Sheetmetal Subcontractor, who shall route them sequentially to all specialty trades.
- 5. Where conflicts occur with placement of materials of various trades, the Sheetmetal Subcontractor will be responsible to coordinate the available space to accommodate all trades. Any resulting adjustments

shall be initialed and dated by the specialty trade. The Sheetmetal Subcontractor shall then final date and sign each Coordination Drawing. If he cannot resolve conflicts, the decision of the General Contractor shall be final, subject to the approval of the Architect.

6. A Subcontractor who fails to promptly review and incorporate his work on the Coordination Drawings shall assume full responsibility of any installation conflicts affecting his work and of any schedule ramifications.
7. The Sheetmetal Subcontractor shall make electronic copies of all Coordination Drawings. Fabrication shall not start until such electronic Drawings are received by the Architect/Engineer and have been reviewed.
8. Review of Coordination Drawings shall not diminish responsibility under this Contract for final coordination of installation and maintenance clearances of all systems and equipment with Architectural, Structural, Mechanical, and Electrical Contractors.

1.11 INSTALLATION REQUIREMENTS

- A. The arrangement of all HVAC work shown on the Drawings is diagrammatic only and indicates the minimum requirements of the work. Conditions at the building including actual measurements shall determine the details of the installation. All work shall be laid out and installed so as to require the least amount of cutting and patching.
- B. Review the Architectural Drawings and Specifications before ordering any material and equipment. Any discrepancies shall be brought to the attention of the Architect for his determination prior to proceeding with the work.

1.12 TYPICAL DETAILS

- A. Typical details where shown on the Drawings shall apply to each and every item of the project where such items are applicable. They are not repeated in full on the Drawings, which in many cases are diagrammatic only, but with the intention that such details shall be incorporated in full. Any alternate method proposed for use by the Contractor shall have the prior approval of the Architect.

1.13 SLEEVES, INSERTS

- A. Furnish and install all sleeves, inserts, anchor bolts and similar items to be set into masonry or concrete, as required for HVAC work as indicated in Division 01.

1.14 CORING, DRILLING

- A. Furnish and install all sleeves, inserts, anchor bolts and similar items to be set into masonry or concrete, as required for HVAC work as indicated in Division 01.

1.15 ACCESSIBILITY

- A. Install all work such that parts requiring periodic inspection, operation, maintenance and repair are readily accessible.

- B. Furnish all access panels appropriate to particular conditions, to be installed by trades having responsibility for the construction of actual walls, floors or ceilings at required locations.

1.16 SUPPLEMENTARY SUPPORTING STEEL

- A. Provide all supplementary (non-structural) steelwork required for mounting or supporting equipment and materials.
- B. Steelwork shall be firmly connected to building construction as required. Locations and methods of attachment shall be approved by the Architect.
- C. Steelwork shall be of sufficient strength to allow only minimum deflection in conformity with manufacturer's published requirements.
- D. All supplementary steelwork shall be installed in a neat and workmanlike manner parallel to floor, wall and ceiling construction: all turns shall be made at forty-five and ninety degrees, and/or as dictated by construction and installation conditions.
- E. All manufactured steel parts and fittings shall be galvanized.

1.17 TOOLS AND EQUIPMENT

- A. Provide all tools and equipment required for the fabrication and installation of the mechanical equipment at the site.

1.18 PORTABLE AND DETACHABLE PARTS

- A. Contractors shall retain in their possession all portable and/or detachable parts and portions of materials, devices, equipment, etc. necessary for the proper operation and maintenance of the Mechanical and Electrical systems until final completion of the work, at which time they shall be handed over to the Owners.

1.19 RECORD DRAWINGS, PROJECT CLOSEOUT

- A. As work progresses and for the duration of Contract, maintain a complete and separate set of prints of Contract Drawings at job site at all times. Record work completed and all changes from original Contract Drawings clearly and accurately including work installed as a modification or addition to the original design. Work shall be updated on a weekly basis and shall be made available for review by Architect. Failure to perform this work shall be reason for withholding requisition payments. In addition, take photographs of all concealed equipment in gypsum board ceilings, shafts, and other concealed, inaccessible work. At completion of work, make copies of photographs with written explanation on back. These shall become part of Record Documents.
- B. At the completion of work, prepare a complete set of Record Drawings showing all systems as actually installed. The copies will be made available for the HVAC Contractor's copying, at his expense, to serve as backgrounds for the Record Drawings. The quantity of copies which are made available shall in no way be interpreted as setting a limit to the number of Drawings necessary to show the required information. The HVAC Contractor's professional Draft Person shall transfer changes to electronic CAD files. Submit

three (3) sets of electronic copies to Architect for comments as to compliance with this section.

- C. The Architect will not certify the accuracy of the Record Drawings. This is the sole responsibility of the Mechanical Contractor.
- D. This trade shall submit the Record Drawings for approval by the Fire and Building Departments in a form acceptable to the departments, when required by the jurisdiction.
- E. Record Drawings shall show record condition of details, sections, riser diagrams, control changes and corrections to schedules. Schedules shall show actual manufacturer, make and model numbers of final equipment installation.

1.20 GUARANTEE/WARRANTY

A. Guarantee and 24 hour service.

1. Guarantee Work of this Section in writing for not less than one (1) year following the date of acceptance by the Owner. If the equipment is used for temporary heat, cooling, etc, prior to acceptance by the Owner, the bid price shall include an extended period of warranty covering the one (1) year of occupancy, starting from the date of acceptance by the Owner. The
2. guarantee shall repair or replace defective materials, equipment, workmanship and installation that develop within this period, promptly and to the Architect's satisfaction and correct damage caused in making necessary repairs and replacements under guarantee within Contract Price.
3. In addition to guarantee requirements of Division 1 and of Subparagraph A above, obtain written equipment and material warranties offered in manufacturer's published data without exclusion or limitation, in Owner's name.
4. Upon receipt of notice from the Owner of failure of any part of the systems or equipment during the warranty period, the affected part or parts shall be replaced by this Contractor without any reimbursement.
5. Replace material and equipment that require excessive service during guarantee period as defined and as directed by Architect.
6. Provide 24 hour service beginning on the date the project is accepted by the Owner, whether or not fully occupied, and lasting until the termination of the guarantee period. Service shall be at no cost to the Owner. Service can be provided by this Contractor or a separate service organization. Choice of service organization shall be subject to Architect and Owner approval. Submit name and a phone number that will be answered on a 24 hour basis each day of the week, for the duration of the service.
7. Submit copies of equipment and material warranties to Architect before final payment.
8. At end of guarantee period, transfer manufacturer's equipment and material warranties still in force to Owner.
9. This paragraph shall not be interpreted to limit Owner's rights under applicable codes and laws and under this Contract.

10. PART 2 paragraphs of this Specification may specify warranty requirements that exceed those of this paragraph. Those paragraphs shall govern.
11. Use of systems provided under this Section for temporary services and facilities shall not constitute Final Acceptance of Work by Owner, and shall not initiate the guarantee period.
12. Provide manufacturer's engineering and technical staff at site to analyze and rectify problems that develop during guarantee period immediately. If problems cannot be rectified immediately to Owner's satisfaction, advise the Architect in writing, describe efforts to rectify situation, and provide analysis of cause of problem. The Architect and/or Engineer will direct course of action.

1.21 OPERATING, INSTRUCTION AND MAINTENANCE MANUALS

- A. Obtain at time of purchase of equipment, three copies of operation, lubrication and maintenance manuals for all items. Assemble literature in coordinated manuals with additional information describing combined operation of field-assembled units, including as-built wiring diagrams. The manual shall contain the names and addresses of manufacturers and local representatives who stock or furnish repair parts for items or equipment. Divide manuals into three sections or books as follows:
 1. Directions for and sequence of operation of each item of HVAC system, e.g. air handling units and boilers. Sequence shall list valves, switches and other devices used to start, stop and control system. Detail procedure to be followed in case of malfunctions. Include detailed approved flow diagrams of temperature control, heating, refrigerant diagram, etc. as appropriate for systems provided. Include approved valve directory showing each valve number, location of each valve and equipment or fixture controlled by valve.
 2. Detailed maintenance and troubleshooting manuals containing data furnished by manufacturer for complete maintenance. Include copy of balancing report.
 3. Lubrication instructions detailing type of lubricant, amount and intervals recommended by manufacturer for each item of equipment. Include additional instructions necessary for implementation of first class lubrication program. Include approved summary of lubrication instructions in chart form, where appropriate.
- B. Furnish three copies of manuals to the Architect for approval and distribution to the Owner. Deliver manuals no less than 30 days prior to acceptance of equipment to permit the Owner's personnel to become familiar with equipment and operation prior to acceptance.
- C. Provide framed and glazed charts as follows: mount as directed by the Architect.
 1. Flow diagrams from first part of manual as described above.
 2. Valve directory.
 3. Lubrication chart from third part of manual.
- D. Operating Instructions: Upon completion of installation or when the Owner accepts portions of building and equipment for operational use, instruct the Owner's operating personnel in any or all parts of the various systems. Instructions shall be performed by factory authorized personnel. The Owner shall determine which systems require additional instructions. The duration of instructions shall take equipment

through complete cycle of operation (at least five working days). Make adjustments under operating conditions.

- E. Each contractor shall be responsible for his work and equipment until finally inspected, tested and accepted. Carefully store materials and equipment which are not immediately installed after delivery to site. Close open ends of work with temporary covers or plug during construction to prevent entry of obstructing material.
- F. Each separate contractor shall protect the work and material of other trades that might be damaged by his work or workmen and make good all damage thus caused.

1.22 QUALITY ASSURANCE

- A. The requirements of the State Building Code and Local regulations establish the minimum acceptable quality of workmanship and materials, and all work shall conform thereto unless more stringent requirements are indicated or specified herein.
- B. All work shall comply with the latest editions of the codes as referenced herein.
- C. Follow manufacturer's directions for articles furnished, in addition to directions shown on Drawings or specified herein.
- D. Protect all work, materials, and equipment from damage during process of work. Replace all damaged or defective work, materials and equipment without additional cost to the Owner.
- E. All equipment and materials for permanent installation shall be the products of recognized manufacturers and shall be new.
- F. Equipment and materials shall:
 - 1. Where normally subject to Underwriters Laboratory Inc. listing or labeling services, be so listed and labeled.
 - 2. Be without blemish or defect.
 - 3. Not be used for temporary purposes.
 - 4. Be in accordance with the latest applicable ASHRAE standards.
- G. Purchase products which will meet with the acceptance of all Authorities Having Jurisdiction over the work. Where such acceptance is contingent upon having the products examined, tested and certified by Underwriters or other recognized testing laboratory, the product shall be so examined, tested and certified.
- H. Except for plans, all items of equipment or material of one generic type shall be the product of one manufacturer throughout.
- I. For items which are to be installed but not purchased as part of the HVAC work, the Mechanical Contractor work shall include:
 - 1. The coordination of their delivery.

2. Their unloading from delivery trucks driven into any point on the property line at grade level.
 3. Their safe handling and field storage until the time of permanent placement in the project.
 4. The correction of any damage, defacement or corrosion to which they may have been subjected. Replacement, if necessary, shall be coordinated with the Contractor who originally purchased the item.
 5. Field erection and internal wiring as necessary for their proper operation.
 6. Mounting in place, including the purchase and installation of all dunnage, supporting members, and fastenings, necessary to adapt them to architectural and structural conditions.
- J. Items which are to be installed, but not purchased as part of the HVAC work shall be carefully examined upon delivery to the project. Claims that any of these items have been received in such condition that their installation will require procedures beyond the reasonable scope of the HVAC work will be considered only if presented in writing within one (1) week of the date of delivery to the project of the items in question. The mechanical work includes all procedures, regardless of how extensive, necessary to put into satisfactory operation, all items for which no claims have been submitted as outlined above.

1.23 DELIVERY, STORAGE AND HANDLING

- A. All materials for the work of this section shall be delivered, stored and handled so as to preclude damage of any nature. Manufactured materials shall be delivered and stored in their original containers, plainly marked with the products' and manufacturer's name. Materials in broken containers or in packages showing watermarks or other evidence of damage shall not be used and shall be removed from the site.

1.24 FIRESTOPPING, SMOKEPROOFING & WATERPROOFING

- A. All cutting, patching, firestopping and waterproofing shall be performed by the HVAC Subcontractor. Refer to Section 01 00 00 – CONSOLIDATED GENERAL REQUIREMENTS, 07 00 01 – WATERPROOFING, DAMPPROOFING & CAULKING, AND 07 84 13 PENETRATION FIRESTOPPING for project requirements.

PART 2 – PRODUCTS

2.1 DUCTWORK AND AIR DISTRIBUTION EQUIPMENT

A. Reference Standards:

1. Material, construction and installation shall meet requirements of most recent editions of the following standards and references, except for more stringent requirements specified or shown on the Drawings:

Standard:	As Applicable To:
SMACNA HVAC Duct Construction Standards Metal and Flexible	Sheetmetal Ductwork; Duct Liners; Adhesives; Fasteners; Flexible Ductwork
SMACNA HVAC Air Duct Leakage Test Manual	Duct Leakage Testing
ADC and TIMA Flexible Duct Performance Standards	Flexible Ductwork
NFPA 90A	Fire Dampers; Fire Resistance Standards for Ducts and Liners

B. General:

1. Provide supporting and hanging devices necessary to install the entire HVAC system including ductwork and equipment, and to prevent vibration.
2. Provide vertical and horizontal supports as required by code to meet minimum applicable earthquake resistance standards.
3. Ductwork shall be free from vibration under all conditions of operation. Dimensions shown on the Drawings for lined ductwork are net inside dimensions. Increase ductwork dimensions to accommodate lining requirements.
4. Pipe or conduit crossing duct: No pipe, conduit, hanger, Architectural element nor structural member shall pass through ductwork.
5. When making offsets and transformations necessary to accommodate structural conditions, preserve full cross-sectional area of the ductwork as shown on the Drawings.

6. Ductwork shall have pressure-velocity classifications as follows:

Duct Construction Class	Static Pressure Rating	Pressure	SMACNA Seal Class	SMACNA Leakage Class	Velocity
2"	2"	Pos. or Neg.	B	12	2500 fpm or less
1"	1"	Pos. or Neg.	B	12	2500 fpm or less
1/2"	1/2"	Pos. or Neg.	B	12	2000 fpm or less

- a. For negative pressures over 3" w.g., refer to SMACNA Round and Rectangular Industrial Duct Construction Standards for joint and intermediate reinforcement requirements
 - b. Unless otherwise specified or shown on the Drawings, the following pressure classifications shall be used for the types of ductwork listed below:
 - 1) 2" Class: All ductwork.
7. Sealing requirements for Class B, Leakage Class 12, galvanized, non-welded, aluminum or non-welded stainless steel ductwork:
- a. Transverse Joints:
 - 1) During assembly seal all flanged transverse joints with sealing tape of quality equal to Hardcast Inc. Model 1902-FR. Corners shall be sealed as described by SMACNA and when applicable per manufacturer's published procedures.
 - 2) Seal all non-flanged transverse joints with Hardcast Inc. Versa Grip Model 102 or approved equal.
 - b. Longitudinal Seams: Seal all longitudinal seams during ductwork fabrication with Hardcast Inc. Cold Seal Model 1001 or approved equal.
8. Support:
- a. Space hangers as required by SMACNA (8 ft. max.) for horizontal duct on 8 ft. centers, unless concentrated loadings require closer spacing.
 - b. Support vertical duct on each floor or slab it penetrates.
 - c. Supports for ductwork and equipment shall be galvanized unless specified otherwise.
9. Connections:
- a. Connect inlets and outlets of air handling units and fans to ductwork with flexible connections unless fan has vibration isolator mounts inside unit with flexible connections and no external vibration isolators. Exception: Do not use flex on life safety smoke exhaust fans.
 - b. Indoors, flexible connections shall be neoprene-coated fibrous glass fire retardant fabric, by Ventifabrics, or Durodyne. Outdoors, flexible connections shall be DuPont hyplon-coated fibrous glass fire, weather and UV-resistant by Ventifabrics or Durodyne.
 - c. Secure flexible connections tightly to air handlers with metal bands. Bands shall be same material

as duct construction.

- d. Connections from trunk to branch duct shall be as detailed on Drawings.

10. Construction:

- a. No sharp metal edges shall extend into air streams.
- b. Install drive slips on air-leaving side of duct with sheetmetal screws on 6" centers.
- c. Spin in collars shall NOT be used for branch connections in 3" or higher pressure class ductwork.

11. Joints:

- a. Longitudinal lock seams shall be double-locked and flattened to make tight joints.
- b. Make transverse joints, field connections, collar attachments and flexible connections to ducts and equipment with sheetmetal screws or bolts and nuts. Do not use rivets or staples.

12. Prefabricated Transverse Duct Joints:

- a. Transverse joints in galvanized sheetmetal ductwork may be made with galvanized gasketed frame and angle duct systems by Ductmate, TDF, TDC, or approved equal.

Angles shall be at least 20 gauge. Prefabricated transverse duct joints shall not be used for duct 16 ga. and heavier, nor for duct 23 ga. and lighter.
- b. Secure angles to duct with screws (using clutched arbor) or spot-welds spaced as recommended by manufacturer for duct pressure class.

13. Elbows and Bends:

- a. Elbows and bends for rectangular ducts shall have centerline radius of 1-1/2 times duct width wherever possible. Elbows for grease exhaust and fume hood exhaust shall be full radius. Vanes or mitered duct are not allowed.
- b. Where centerline radius is less than 1-1/2 times duct width (on supply, return and exhaust ductwork), elbows shall be radius throat (square throat not allowed) with radius heel. For elbows whose width is greater than 48 inches and/or where shown on plans, provide splitter vanes. Install vanes in accordance with SMACNA. Where multiple elbows are separated by less than ten duct diameters use splitter (full length) vanes.
- c. For round ductwork provide stamped elbows, with centerline radii equal to 1-1/2 times duct diameter, or gored elbows as follows:

Elbow Angle	No. of Gores
0° - 36°	2
37° - 72°	3
73° - 90°	5

- d. Elbows for flat oval ducts shall have centerline radii equal to 1-1/2 times duct diameter in plane of bend, or gored elbows with gores as specified for round ducts.

14. Access Panels/Doors:

- a. Provide proper pressure and leakage rated, gasketed, duct mounted access panels/doors for the following items with minimum sizes, as indicated. Access doors shall be of double wall construction. Access doors in insulated ducts shall be insulated. Gauges of door materials, number of hinges, number and type of door locks shall be as required by the SMACNA Duct Construction Standards. Hinged doors are not acceptable, screwed or bolted access panels are not acceptable. Doors shall be chained to frame with a minimum length of 6" to prevent loss of door. For seal Class A, access doors shall be leakage rated, neoprene gasketed UL 94 HF1 listed, DUCTMATE "sandwich" or approved equal. Door metal shall be the same gauge as the attached duct material. For grease and high temperature ducts, door assembly shall be rated for 2300° F. The minimum sizes shall be:
 - 1) Fire dampers – 12" x 12", or larger.
 - 2) Combination Fire/Smoke dampers – 12" x 12", or larger.
 - 3) Smoke dampers – 6" x 6" minimum.
 - 4) Automatic control dampers – 6" x 6" minimum.
 - 5) Manual volume dampers 2 sq. ft. and larger – 6" x 6" minimum.
 - 6) Inlet side to all coils – 12" x 12", or larger.
 - 7) Suction and discharge sides of inline fans – 24" x 24" minimum
 - 8) At additional locations indicated on Drawings, or specified elsewhere – 12" x 12" minimum.
 - 9) Generally access doors are not shown on the Drawings, but shall be provided in accordance with the above.

15. Extractors shall have adjusting rod and locknut on outside of duct.

16. Connections to roof fans:

- a. Shall be at least 22 gauge galvanized steel soldered watertight.
- b. Solder side seams at least 12" up from bottom.
- c. Provide suitable dielectric gaskets to join dissimilar materials.

17. Plenums and Connections to Louvers:

- a. Shall be 18 ga. minimum cross-broken and properly reinforced with galvanized angle irons to SMACNA requirements.
- b. Shall have bottom and corner seams soldered watertight at least 12" up from bottom.
- c. Shall have neoprene gaskets or other non-corrodible material to make connections to louvers watertight.
- d. Shall pitch connection back towards the louver. Provide half-coupling drain connection at bottom of plenum unless noted otherwise. Pipe drain to nearest floor drain.
- e. Shall have unused portions of louvers blocked-off with sheetmetal; sealed air and watertight; insulated with 2" thick 6 lb. Density rigid or board insulation.

18. Duct Pressure Tests:

- a. Pressure test ducts after takeoffs and wall penetrations are in place and before applying exterior insulation. Correct any leaks.
- b. Pressure and leak test 20% of medium and low-pressure ductwork at 100% of operating system pressure. Duct shall be constructed so there is no joint or structural failure at the test pressure.

19. Materials:

- a. Sheetmetal ducts shall be constructed of hot-dipped galvanized sheetmetal with G90 Commercial coating according to ASTM 527 unless specified otherwise.
- b. Stainless steel (SS) ductwork shall be 18 gauge for gun cleaning hood and ductwork; and as required by SMACNA for other ducts. Materials shall be 316/No. 4 finish for exposed duct, 304/No. 1 finish for concealed ducts. Joints and seams shall be welded as required by SMACNA Guidelines for Welding Sheetmetal.
- c. Aluminum ductwork shall be Alclad 3003-1414 or alloy 552-H32, of thickness required by the SMACNA duct construction standards with Alloy 6061 bracing angles, and Pittsburgh lock longitudinal corner and double-side seaming.

C. 2" and Lower Pressure Class Ductwork – Rectangular:

1. Ducts wider than 19" with more than 10 square feet of unbraced panel shall be beaded or cross-broken.
2. Internal stiffening struts shall only be used upon prior written approval of the Architect.
3. Make changes in duct size with tapered connections as required by SMACNA. Changes shall NOT exceed 30° from line of airflow. Take-off to the diffusers shall be 45° leading edge type or bellmouth type.
4. Transverse joints shall be TDF/TDC or slip joints; use flat or standing seam according to SMACNA. Where the duct size requires a standing seam but space restrictions dictate flat seam, notify Architect prior to fabrication.

D. 2" and Lower Pressure Class Ductwork – Round:

1. Joints:
 - a. Longitudinal joints shall be spiral seam, butt welded, lap and seam welded, or ACME lock-grooved seam. Snap lock seams shall be used on 1/2" w.g. pressure class duct only.
 - b. Transverse joints shall be beaded sleeve joint or other approved joints listed in SMACNA. Use three (3) or more sheetmetal screws at 15" uniform intervals along circumference of joints.
2. Branch fittings shall be conical tee (Buckley or equal) or combination tee as shown in SMACNA.

E. Flexible Duct:

1. Flexible ductwork shall be Flexmaster Triple-Lock Buck Duct Flexible Air Duct (insulated or non-insulated) as manufactured by Buckley Associates, ATCO, or equal. Flexible duct, non-insulated, shall be Underwriters Laboratory Listed UL 181 Class 0 air duct and constructed in accordance with NFPA Standards 90A and 90B. It shall have a smoke/flame spread rating of 50/25.

2. The duct shall be made from a tape of dead soft aluminum sheet, spiral wound into a tube and spiral corrugated to provide strength and stability. The joint shall consist of a triple lock mechanically performed without the use of adhesives to make a durable airtight seam. A double lock is not acceptable.
3. Flexible duct connected to insulated or lined duct shall also be insulated. Flexmaster insulated flex shall have a gray Fire Retardant Polyethylene outer jacket with a 1/2 lb. density, 1-1/2" thick fiberglass insulation blanket, factory wrapped providing a thermal performance of R-8 overall. Flexible Duct, insulated, shall be Underwriters Laboratory
4. listed and constructed in accordance with NFPA Standards 90A and 90B. It shall have a smoke/flame spread rating of 50/25.
5. The flexible duct shall be supported as required.
6. Flexible ductwork shall be rated at 12" positive pressure. Flexible ductwork from 3" to 16" in diameter shall have a negative pressure rating of 12". Flexible ductwork 18" to 20" in diameter shall have a negative pressure rating of 8".
7. All flexible ductwork shall be individually boxed and labeled for delivery to the jobsite for maximum protection.
8. Submittals shall include data on minimum thickness of aluminum core, in addition to other data listed above required to ensure that submitted product meets the requirements of these Specifications.
9. Provide sealing compound for installation. See further paragraphs in this Specification and details for other installation requirements.
10. Flexible duct length shall not exceed 5'-0" in length.

F. Fire Dampers:

1. Provide fire dampers throughout the air distribution system(s) as required by applicable codes, standards and Authorities. Provide an access door for each fire damper of sufficient size to repair the internal fusible link (see access panel/door section). Fire dampers indicated on the Drawings may not fully represent the exact number required for this project. It is the Contractor's responsibility, at no additional cost to the Owner, to provide all required dampers.
2. Fire dampers shall be the fusible link spring loaded type. Where in ductwork served by fans which shut off during a fire alarm condition, dampers shall be the static type, similar to Greenheck Model FD series. Where in ductwork served by fans which do not shut off during a fire alarm condition, dampers shall be the dynamic type, similar to Greenheck Model DFD series.
3. Fire damper frames shall be fitted with angle iron stop and stainless steel spring latch, and shall be securely fastened to building construction.
4. Seal spaces between damper frames and walls and between damper frames and floor with approved fire-retardant material.
5. The use of fire dampers shall NOT reduce net free area of duct below that shown on Drawings. Fire

dampers shall be Type B with the blades of the fire dampers out of the air stream.

6. Samples of fire dampers shall be submitted to and approved by Local Authorities Having Jurisdiction.
 7. Dampers shall bear 1-1/2 hour UL-rating fire damper label and shall be constructed and installed as required by UL-555.
 8. Fire dampers shall be Buckley, Greenheck, Ruskin, Nailor Industries, Pottorff or Prefco for use in the proper duct pressure classification.
 9. Dampers shall be installed per SMACNA with breakaway connections and nose pieces on duct liner (see SMACNA HVAC Duct Construction Standards).
- G. Ceiling Radiation Dampers and Fire-Rated Blankets: For fire-rated ceiling assemblies, provide at all ceiling diffusers, registers and grilles: Radiation dampers (Nailor Industries Series 0700 or approved equal) and Fire Blanket (Nailor Industries 0725 or approved equal) or fire assembly: radiation damper and blanket already assembled Nailor or equal.
- H. Combination Fire/Smoke Dampers:
1. Provide and install combination fire and smoke dampers as required and as indicated on the drawings. As related work of this section, see also Electrical Specifications fire alarm system sequence of operations. Devices shall be FSD series as manufactured by Greenheck, Pottorff, or another approved equal.
 2. Dampers shall have a UL 555 fire resistance rating of 1-1/2 hours when intended installation is in less than 3-hour rated fire-resistant assemblies. Rating shall be 3 hours when intended installation is in 3-hour or greater rated fire-resistant assemblies.
 3. Fire closure temperature: Each combination fire smoke damper shall be equipped with a factory installed heat responsive device rated to close the damper when the temperature at the damper reaches 250°F.
 4. Dampers shall have a UL 555S approved elevated temperature rating of 250°F minimum.
 5. Dampers shall have a UL 555S Class II leakage class rating minimum and a differential pressure rating of 4 in. wg. Damper velocity rating shall be 2000 feet/min. minimum.
 6. Frame construction: shall be 16 gauge galvanized steel formed into a 5 in. by 1 in. structural hat channel. Frames shall be 4-piece construction with 1-1/2 in. minimum integral overlapping gusset reinforcements in each corner.
 7. Blade construction: shall be 16 gauge galvanized steel strengthened by three longitudinal 1 in. deep V-grooves running the entire length of each blade. Each blade shall be symmetrical relative to its axle pivot point for identical performance characteristics with air flowing in either direction through the damper.
 8. Blade edge seals shall be extruded silicon rubber permanently bonded to the blade edges. Jambs shall be flexible stainless steel compression type.

9. Linkages shall be concealed in the jamb.
 10. Axles shall be minimum 1/2 in. diameter plated steel. Frames shall be galvanized steel in the gauge required by manufacturer's UL listing.
 11. Dampers shall be supplied as single assembly with an integral factory sleeve.
 12. Dampers shall be supplied with factory retaining angles sized to provide installation overlap in accordance with the manufacturer's UL listing.
 13. Axle bearing shall be sintered bronze sleeve type rotating in polished extruded holes in the damper frame.
 14. Damper actuators shall be externally mounted 120 VAC,, two-position, fail closed.
 15. Dampers shall be installed in accordance with the manufacturer's UL installation instructions, labeling and NFPA 90A at the locations indicated on the drawings. All damper installations not in accordance with the manufacturer's UL installation instructions must be approved prior to installation.
 16. Dampers must be accessible to allow inspection, adjustment, and replacement of components. General Contractor shall furnish any access doors required in walls, ceilings, or other general building construction. Access points shall not affect the integrity of the fire-resistance rated assemblies nor reduce the actual fire resistance rating of the assembly. Access points shall be permanently identified on the exterior by a label having letters not less than 1/2 in. high reading "FIRE/SMOKE DAMPER".
 17. Coordination with Electrical:
 - a. Where combination fire/smoke dampers are installed in ducts, an approved smoke detector shall be installed in the same duct within 5 feet of the damper with no air outlets or inlets between the detector and damper. Detectors shall be listed for the air velocity, temperature and humidity anticipated at the point where it is installed.
- I. Volume Dampers:
1. Provide manually adjustable rectangular parallel blade dampers for duct heights less than 12" with factory-installed locking hand quadrants extended 2" for all dampers installed in externally insulated duct:
 - a. On each supply, return and general duct take-off.
 - b. At each take-off to register, grille or diffuser (not all are shown on Drawings for clarity).
 2. Volume dampers shall be manufactured approximately 5/16" smaller in width and 1/8" smaller in height than size of duct in which they are installed; e.g., nominal damper size is 24" x 10"; actual size is approximately 23-11/16" x 9-7/8".
 3. Volume damper frames shall be constructed of #6063 extruded aluminum reinforced channel with minimum thickness of 0.050". Opposed damper blades shall be #6063 extruded aluminum with minimum thickness of 0.050" and shall include reinforcing ribs. Each blade shall be supported in the damper frame by individual Teflon axle bearings, and shall be driven by stainless steel connecting slide linkage controlled by 3/8" square steel control shaft.

4. All required volume dampers may not be indicated on Drawings, but volume dampers shall be provided as necessary for systems balancing.
5. Dampers 12" and larger in height shall be opposed multi-blade type.
6. Where volume dampers are inaccessible, use locking type ceiling regulators and miter gear or worm gear for all horizontal dampers. Bearing coupling for bottom duct control may be used for shaft on vertical blade dampers. The 3/8" rod between ceiling regulator and damper shall be provided by Contractor.
7. Damper blades shall be two gauges heavier than adjoining ductwork, and shall be riveted to supporting rods. Hem over edges parallel to rods.
8. Brackets shall be galvanized metal, secured to ductwork with sheetmetal screw with locking quadrant arms (see Seal Class Section for additional requirements). Provide 2" handle extension for all dampers on externally insulated ductwork.
9. Note: All required volume dampers may not be indicated on Drawings but dampers shall be provided as necessary for system balancing.

J. Remote Control Operated Balancing Dampers:

1. Round remote control operated balancing dampers applicable for use in HVAC systems with velocities to 2,600 fpm by United Enertech model i-3, Young Regulators or equal as approved by engineer.
2. Submit manufacturer's product data including performance data.
 - a. Include differential pressure ratings and maximum system velocity.
 - b. Indicate materials, dimensions, construction, and installation details.
 - c. Include damper pressure drop data based on procedures performed in accordance with AMCA 500-D.
3. Ratings:
 - a. Temperature Rating 35°F to 120°F (2°C to 49°C)
 - b. Maximum Velocity: 2600 fpm (13.2 m/s)
 - c. Maximum Differential Pressure Rating: 3" w.g.
4. Construction:
 - a. Frame: Min. 24 ga. galvanized steel, 8" deep
 - b. Blade: Round, minimum 24 ga. galvanized steel, mechanically fastened to blade
 - c. Axels: Zinc Plated Steel Pins
 - d. Bearings: Nylon 6/6 Molded synthetic
 - e. Mounting: Vertical and/or Horizontal
 - f. Actuator: DC voltage, Direct Drive, Electronic pulse
 - g. Remote: Portable hand held power pack with RJ-11 cable

- h. Finish: Mill Galvanized
- 5. Accessories and Options (Engineer to select and edit as required)
 - a. Custom RJ-11 cable length: 120 inches.
 - b. Aluminum construction
 - c. Stainless Steel construction
 - d. Oval damper in lieu of round
 - e. Choice of RJ-11 cable terminal points: J50, J100, or J150
- 6. Installation
 - a. Install dampers at locations indicated in the drawings and in accordance with manufacturer's instructions.
 - b. Install dampers round and free from racking. Do not stretch or compress damper frame or sleeve into the opening or duct.
 - c. Handle dampers using the sleeve or frame. Do not move or lift the damper by the blades, cable, or actuator
 - d. Install remote options (if applicable) of Model J50, J100, or J150 Terminal points.
 - e. Connect RJ-11 cable from the damper to the female outlet, making sure cable is secured and cannot be pulled out of the terminal.
 - f. Coordinate power requirements with electrician.
- K. Automatic Dampers: Install automatic dampers furnished under Automatic Temperature Control Paragraph of this Section, as shown on Drawings, and as specified. Provide sealed wall penetrations for Seal Class A ductwork.
- L. Diffusers, Registers and Grilles:
 - 1. Provide diffusers, registers and grilles for supply, return and exhaust outlets, of size, type and design shown on Drawings. Acceptable manufacturers shall be, Price, Metal-Aire, or Titus. Refer to Drawing schedules for additional requirements.
 - 2. Equipment shall be tested and rated per ASHRAE 91-70.
 - 3. Equipment shall handle air quantities at operating velocities:
 - a. With maximum diffusion within space supplied or exhausted.
 - b. Without objectionable air movement as determined by Architect.
 - c. With sound pressure level not to exceed NC 30.
 - 4. Supply registers shall have two (2) sets of directional control blades.
 - 5. Diffusers within same room or area shall be of same type and style to provide Architectural uniformity.
 - 6. Diffusers, registers and grilles shall be furnished with gaskets and installed with faces set level and

plumb, tightly against mounting surface.

7. All finishes shall be as directed by the Architect.
8. Coordinate diffusers, registers and grilles with ceiling and wall construction. Refer to Architectural Drawings for exact lengths and for framing and mitering arrangements that may differ from those shown on Mechanical Drawings.

M. Branch Duct Take-off Fittings:

1. Contractor shall provide bellmouth take-offs at all branch duct locations.
2. Bellmouth fitting shall be provided with damper.
3. Bellmouths shall be constructed of heavy-duty galvanized steel. Bellmouths shall include an airtight neoprene gasket to ensure a tight fitting with minimal leakage. Pre-drilled holes shall be provided for quick mounting.
4. Standard damper hardware to be constructed of 26-gauge galvanized material with a quadrant damper and tight-fitting gasketing to ensure minimal leakage at damper pivot points.
5. Optional heavy-duty hardware shall be provided at locations of higher static pressure where shown on the Drawings.
6. Ninety-degree (90°) take-offs are not permitted on this project.

2.2 ACOUSTICAL DUCT LINING

A. Provide 2" thick acoustical lining by Certain-teed, Knauf, Owens Corning or Manville for following ductwork:

1. Supply and return ductwork, including plenums for minimum of 20 feet from dedicated outdoor air unit. Supply and return main duct from air handlers shall be lined.
2. Other ductwork indicated as lined on Drawings.
3. Increase duct dimensions to accommodate lining while maintaining inside clear dimensions shown on the Drawings.

4. Lining shall be as follows:

Lining for	Material	Minimum NRC	Maximum K-Factor At 75° F Mean
Low-pressure ductwork (below 4" S.P.)	Black, Matfaced, 2 lb. density, flexible glass	0.75	0.24
Medium and high-pressure ductwork (above 4" S.P.)	Black, Matfaced, 3 lb. density, rigid board	0.75	0.23

5. Materials and installation shall meet following standards, as applicable:

- a. NFPA-90A, UL723, NFPA-255.
 - b. SMACNA Duct Liner Applications Standard.
 - c. SMACNA Mechanical Fasteners Standard.
 - d. Adhesive and Sealant Council: Adhesives Standard for Duct Liner – ASC-A-7001A
 - e. ASTM E-84 fire hazard classifications of 25 flame spread, 50 smoke developed and 50 fuel contributed.
6. Duct liner shall be installed without interruptions or gaps, using 100% coverage of adhesive and mechanical fasteners. Mechanical fasteners shall be welded or secured mechanically to duct on 12" maximum centers.
7. Cut liner to ensure overlapped and compressed longitudinal joints at corners. Transverse joints in liner shall abut precisely. Seal joints against fiber entrainment with approved adhesive, as recommended by manufacturer. Use sheetmetal nosing at beginning of lining (in direction of flow) to prevent erosion.
8. The Contractor shall ensure the integrity of acoustical lining when slip-in duct heaters are installed; loose lining shall not flap about in the airstream. Secure edges of lining with sheetmetal nosing, where liner is interrupted to make room for slip in heaters.
9. Submit samples and catalog data for duct liner, mechanical fasteners and adhesives to Architect for approval.
10. Friction coefficient correction factor at 1000 FPM shall be no greater than 1.1. Liner shall be Certain-teed Ultra Liner, Knauf Duct Liner M or Johns Manville Linacoustic. Other liners from these manufacturers with friction coefficient correction factors greater than listed above, are not acceptable.
11. Mylar used for vapor barrier shall meet ASTM E-84 classification.
12. Any cut liner due to duct take-offs and branches shall be totally sealed at edges (with sheetmetal nose pieces) to prevent entrainment of loose fibers.

13. Do not insulate lined duct.

B. Acoustical Duct Wrap:

1. Where designated with specific notation on drawings, or as otherwise specified, provide acoustical duct wrap for noise control. Duct wrap shall be Sound Seal B10 Series, B-10 LAG/QFA-3 or equal.
2. Wrap shall be composite material with flexible one-pound per square foot reinforced-foil faced loaded vinyl noise barrier bonded to a 1-inch thick quilted fiberglass sound absorber.
 - a. Nominal thickness: 1 inch.
 - b. Standard width: 54 inches.
 - c. Roll length: 30 ft.
 - d. Weight: 1.2 lb / sqft.
 - e. Temperature range: -20°F to +220°F.
 - f. "R" factor: 4.0.
 - g. Flammability: Class A (or 1) per ASTM E-84, Smoke Density index 19.5, Flame spread index 12.5.

3. Acoustical Performance:

- a. Sound transmission loss:

Product	OCTAVE BAND FREQUENCIES (Hz)						STC
	125	250	500	1000	2000	4000	
B-10 Lag/QFA-3	18	18	23	30	39	46	29

4. Where acoustical duct wrap is used on portions of the ductwork, it shall replace standard insulation use per "Duct Insulation" section below.
5. Seal all seams to provide a continuous sound and vapor barrier.

2.3 DUCT INSULATION

A. General:

1. Insulation shall be Certain-Teed, Knauf, Manville or Owens Corning. Install insulation, mastics, adhesives, coatings, covers, weather-protection and other work exactly as required by manufacturer's recommendations. Materials shall meet requirements of Adhesive and Sealant Council Standards and SMACNA.
2. Apply insulation after systems have been tested, proved tight and approved by Architect. Remove dirt, scale, oil, rust and other foreign matter prior to installation of insulation.
3. Leaks in vapor barrier or voids in insulation will not be accepted.
4. ASTM E-84 minimum fire hazard ratings shall be 25 flame-spread, 50 fuel contributed and 50 smoke developed.

5. Where ducts are insulated, flexible connections to ducts shall be insulated.
6. Insulate standing seams with same material and thickness as duct.
7. Acoustically lined ductwork shall not be insulated externally, except as noted otherwise.
8. Return ductwork in ceiling plenums shall not be insulated.
9. Insulation shall be continuous through wall and ceiling openings and in sleeves.
10. Transmission rates of vapor barriers shall not exceed 0.02 perms.

B. Concealed Rectangular, Flat Oval and Circular Ductwork:

1. Insulate supply and return air ductwork and plena in concealed spaces and return ductwork not in ceiling plenum with glass duct wrap; with foil-Kraft flame-resistant vapor barrier.
2. Insulation shall provide a minimum R-8 value when located in unconditioned spaces and a minimum R-12 value when located outside the building.
3. If insulation does not have pre-cut lap, make lapped butt joints by cutting 2" strip of insulation away from vapor barrier. Apply 6" strips of approved adhesive on 16" centers and wrap duct with insulation. Staple lapped joint with outward-clinching staples. Seal stapled joints airtight with approved matching pressure-sensitive tape.
4. For rectangular duct 24" or larger in any dimension, augment application method specified in item 3 with approved mechanical fasteners, such as weld pins with speed washers, on 18" centers on bottom of duct.
5. Cover breaks in vapor material with patches of same material, secured with adhesive and staples. Seal staples with approved pressure sensitive tape.
6. Fill voids in insulation at jacket penetrations and seal with pressure sensitive tape.
7. Seal and flash terminations and punctures with fibrous glass cloth between two (2) coats of pressure sensitive tape.
8. Terminate vapor barrier and extend insulation at standoff brackets.

C. Outdoor Duct Insulation and Waterproofing

1. Provide flexible unicellular elastomeric foam rubber sheet insulation by Armstrong (Armaflex), Manville, Owens Corning of Halstead-Nomaco (Insultube), with maximum K-factor of 0.27. Install as recommended by manufacturer.
2. Insulate standing seams with same thickness as duct.
3. Adhere insulation to duct and seal butt joints with full coverage of Armstrong 520 or approved pressure sensitive tape.
4. Insulation shall have an R-value of 6.0 per inch at 75 degrees f per ASTM c1289. Minimum outdoor

duct insulation R-value shall be 12.

5. Impale insulation on mechanical fasteners applied to duct surface on 12" centers. Use at least two (2) rows of fasteners on each side of duct. Provide fastener rows within 3" of seams and edges. Secure insulation with suitable speed washers or clips firmly embedded in insulation. Provide additional fasteners as necessary on cross-broken ducts.
6. Extend insulation to standing seams, reinforcing and other vertical projections 1" and less; do not carry over. Vapor barrier jacket shall be continuous across seams, reinforcing and projections. Insulation and jacket shall be carried over projections that exceed insulation thickness.
7. Transverse joints shall be butted tightly. Longitudinal joints shall be butted, ship-lapped or 45 mitered. Seal joints with 4" wide strips of approved vapor barrier patch material and adhesive, or with approved pressure sensitive vapor barrier tape.
8. Cover breaks, ribs and standing seam penetrations with patch of jacket material no less than 2" beyond break; secure with adhesive and staple. Seal staples and joints with approved pressure sensitive tape.
9. Fill voids in insulation at jacket penetrations and seal with approved pressure sensitive tape.
10. Seal and flash-terminations and punctures with fibrous glass cloth between two (2) coats of approved pressure sensitive tape.
11. Terminate vapor barrier and extend insulation at standoff brackets.
12. Seal weather tight with 3m Ventureclad system product number 1579 GCW or engineer approved equal.

2.4 DUCT SILENCERS

A. General:

1. Provide duct sound attenuators as manufactured by Kinetics Noise Control or approved equal. As a condition of approval, alternate manufacturers shall submit to the project engineer silencer test reports for a silencer tested in accordance with ASTM E477-13 in a test facility that is NVLAP-accredited for ASTM E477-13.

B. Performance Requirements:

1. The silencer manufacturer shall provide, for approval, acoustical system path calculations for all duct systems with silencers to demonstrate the submitted silencers will reduce mechanical fan noise to required NC-Levels in the occupied space. Use sound power levels of actual equipment to be installed on project. Analysis shall include breakout noise calculations.
2. Supplier shall include system effect pressure loss of the installed silencer based on duct conditions upstream and downstream of the silencer to ensure required airflow is provided. Supplier shall submit detailed pressure drop analysis for the installation and detailed procedure outlining methodology for site measurement of overall system pressure loss for approval prior to manufacture.
3. Maintain rooms NC level as defined in the ASHRAE Handbook-HVAC Applications.

4. Source quality-control reports:
 - a. Silencer manufacturer to provide a copy of their laboratory NVLAP accreditation certificate for the ASTM E-477-06a test standard with the submittals. Data from non-NVLAP accredited test facilities will not be accepted.
5. The pressure loss of silencers shall not exceed those scheduled at the specified design flow rates. Airflow measurements shall be made in accordance with ASTM specification E-477 and applicable portions of ASME, AMCA, and ADC airflow test codes.

C. Construction:

1. Description: Duct section with solid, sheet metal outer casing, sound absorbing fill material, and inner splitter (baffle) of perforated sheet metal; incorporating interior splitter, baffles of similar construction. Fabricate in accordance with SMACNA HVAC Duct Construction Standards. Silencers shall include double retainers between each splitter (baffle).
2. Silencer manufacturer to provide submittal drawings detailing all duct silencer data specified in the mechanical drawing schedule.
3. General Requirements:
 - a. Silencers shall be of the size, configuration, capacity, and acoustic performance as scheduled on the drawings. All silencers shall be factory fabricated and supplied by the same manufacturer.
 - b. Silencer inlet and outlet connection dimensions must be equal to the duct sizes shown on the drawings. Duct transitions at silencers are not permitted unless shown on the contract drawings.
 - c. Silencers shall be constructed in accordance with ASHRAE and SMACNA standards for the pressure and velocity classification specified for the air distribution system in which it is installed. Material gauges noted in other sections are minimums. Material gauges shall be increased as required for the system pressure and velocity classification. The silencers shall not fail structurally when subjected to a differential air pressure of 8 inches water gauge.
 - d. All casing seams and joints shall be lock-formed, lock-formed and sealed, or stitch welded and sealed as noted on schedule. Airtight construction shall be achieved by use of a duct-sealing compound supplied and installed by the contractor at the jobsite.
 - e. All perforated steel shall be adequately stiffened to insure flatness and form. All spot welds shall be located on maximum, 3-inch, spacing and factory protected with a corrosion resistant (zinc rich) coating.
 - f. Fire-Performance Characteristics: Silencer assemblies, including acoustic media fill, film liner, sealants, and acoustical spacer, shall have flame-spread index not exceeding 25 and smoke-developed index not exceeding 50 when tested according to ASTM E 84, NFPA 255 or UL 723.
 - g. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1-2007.
4. Rectangular Silencers as Scheduled shall be ASTM A 653/A 653m, G90 galvanized sheet steel, 22 gauge, unless otherwise noted on drawings or silencer schedule. All acoustical splitters (baffles) shall be internally radiused and aerodynamically designed for efficient turning of the air. Half and full splitters (baffles) are required as necessary to achieve the scheduled insertion loss. All elbow silencers with a turning cross-section dimension greater than 48" shall have at least two half splitters and one full

splitter. Silencers shall include double retainers between each splitter (baffle).

5. Transitional Silencers as Scheduled, Outer casing shall be ASTM A 653/A 653M, G90 galvanized sheet steel, 22 gauge, unless otherwise noted on drawings or silencer schedule. Transitioning shall occur internal to the silencer such that the height of the gap or air passage is uniformly changing with the length of the splitters (baffles).
6. Inner perforated metal liner: ASTM A 653/A 653M, G90 galvanized sheet steel.
 - a. Rectangular Straight Silencers: 22 gauge.
 - b. Rectangular Elbow Silencers: 22 gauge.
 - c. Transitional Silencers: 22 gauge.
 - d. Round Silencers: 22 gauge.
7. Principal Sound-Absorbing Mechanism
 - a. Dissipative and Film Lined/Encapsulated Silencers
 - 1) Media shall be of acoustic quality, shot-free glass fiber insulation with fibers bonded with a thermosetting resin. Glass fiber density and compression shall be as required to insure conformance with laboratory test data. Glass fiber shall be packed with a minimum of 10% compression during silencer assembly. Media shall be resilient such that it will not crumble or break and conform to irregular surfaces. Media shall not cause or accelerate corrosion of aluminum or steel. Mineral wool will not be permitted as a substitute for glass fiber.
 - 2) Where indicated on the silencer schedule, media shall be lined/encapsulated in glass fiber cloth to help prevent shedding, erosion, and impregnation of the glass fiber
 - 3) The acoustic media shall be lined/encapsulated with polymer film (Tedlar) to help prevent shedding, erosion, and impregnation. The film shall be separated from the perforated metal by a factory-installed acoustically transparent spacer.
 - 4) The spacer shall be flame retardant and erosion resistant.
 - 5) Mesh, screen or corrugated perforated liner will not be acceptable as a substitute for the specified spacer.
8. Alternative Silencer Materials
 - a. Where indicated on the drawing or silencer schedule. Type 304 or 316 stainless steel or aluminum 3003 H14 material can be used.
9. HTL Casing
 - a. Where indicated on the silencer schedule, silencers shall have high transmission loss (HTL) outer casing to assure quality-controlled transmission loss. If requested by the Engineer, breakout noise calculations for each air handling and fan system shall be provided with the silencer submittal to ensure compliance with the room noise criteria. Breakout noise calculations shall be based on the sound power levels of the specified equipment.

D. Installation of Silencers:

1. Provide silencers where shown. Ensure that silencers are installed with airflow directional arrows in the

direction of airflow.

2. Support each silencer independent of connecting ductwork.
3. Properly layout ductwork for silencer locations to provide a minimum of five diameters of straight duct upstream of the silencer and ten diameters of straight duct downstream of the silencer.
4. Unless otherwise shown, do not install silencers in walls or slabs.
5. Where crosstalk silencers penetrate partition walls, seal the joint between the perimeter of the silencer and the wall, on both sides of the wall, with proper acoustic caulking.
6. Seal all silencer connections to ducts with proper fire/smoke rated duct sealer.
7. When silencer installations are complete, arrange and pay for the silencer manufacturer to examine the silencer installations. Do any corrective work required by the manufacturer, then obtain from the manufacturer and submit a signed letter certifying proper installation and operation of all silencers. Refer to the article entitled Equipment and System Manufacturer's Certification in the Mechanical Work General Instructions Section.

2.5 PIPING AND FITTINGS

A. General: Pipe materials and fitting materials shall be as indicated in Schedule of Pipe and Fitting Materials.

B. Schedule of Pipe and Pipe Fitting Materials:

Service	Systems Description	Pipe Size	Pipe Material	Joints	Fitting Material	Fitting Rating PSI/Class/ Weight
Hot Water	HWS/R	2" and under	Copper, B88, Type L	Soldered 95/5 Tin/ Antimony or Press	Wrought copper, B16.22	Class 150
Condensate Drain	CD	All	PVC. Schedule 40 Note 2	Solvent Welded	PVC, Schedule 40	Class 150
Refrigerant	R	All	Copper, ACR	Silver Brazed	Wrought Copper	200 PSI
Vents	V	All	Gal. St. A53 or A120, Smls or ERW, Schedule 40	Threaded	Gal. Malleable Iron, B16.3	Class 150

Note 1: Grooved piping systems may be used in lieu of welded piping for CHWS/R and CWS/R, HWS/R systems for sized 2-1/2" and over subject to the requirements listed in the Grooved Piping Section and in PART 4 of the Specification.

C. Connections:

1. Provide dielectric fittings at connections of dissimilar materials.
2. Provide eccentric reducing couplings to bring pipes flush on top for water service and flush on bottom for steam service.
3. Branch lines in welded piping shall be made with welding tees except that branch lines less than one half diameter of main may be made with Weld-O-Lets or Sock-O-Lets.
4. Nipples shall be same material, make and thickness as pipe with which they are used. Close nipples shall not be used.
5. Make piping connections 2-1/2" diameter and larger to valves and equipment with welding neck flanges, ANSI B16.5, pressure rating to match system, flat or raised face as required.
6. Make piping connections 2" diameter and smaller to valves and equipment with steel body, 300 psi brass seat unions on steel piping and with heavy semi-finished brass unions on copper tubing.
7. Fit flanged joints with Johns-Manville or approved equal full-face gaskets. Flanges shall be faced and drilled to ASA standards and fitted with semi-finished hexagon machine bolts and nuts of proper number and size.
8. Make screw joints tight with Teflon (polytetrafluoroethylene) tape or litharge-glycerin mixture applied to male threads. Use tapered threads.
9. Make fusion welded joints as required by ANSI B31.1. Make changes in direction of pipe with welded fittings only. Bevel connections before welding, mechanically or by flame cutting.

2.6 CHEMICAL TREATMENT – WATER SYSTEMS

- A. Provide treatment systems and service for primary water systems. Do not operate systems without water treatment. Water treatment chemicals shall be by Barclay, Dearborn, Olin or Mogul. Pump and chemical drums shall be by the manufacturers of the chemicals or Liquid Metronics. Dearborn and Liquid Metronics model numbers are used to establish standards of quality.
- B. Provide piping necessary for complete systems.
- C. Water treatment shall include feeding devices necessary to feed chemical solution into piping system and bring chemical properties of water to within manufacturer's recommended operating limits, in order to minimize corrosion and reduce buildup of slime or other contaminants.
- D. Furnish and install a coupon rack capable of accepting six (6) coupons in each chemically treated system. The Chemical Treatment Contractor shall make recommendations as to the use of coupons and shall include the furnishing and analysis of the coupons/system (steel and copper) each month.

E. The closed loop systems (chilled water and heating hot water) shall have water treatment consisting of Dearborn Model Type AV By-Pass Shot Feeder, to feed chemical solution into each piping system. Chemicals shall be Dearborn B-524 (Nitride Corrosion Inhibitor) to maintain control limits at 800-1,000 parts per million of sodium nitrite). A 2 gallon shot-feeder shall be provided.

F. Water treatment for open condenser water system shall consist of:

1. Equipment:

a. Provide one (1) Hydac Modu-Max Control System, or equal by Uniloc, Lakewood or Great Lakes consisting of:

- 1) Control box enclosure, NEMA 12 cabinet, 20 amperes 115V with internal circuit breakers.
- 2) PH-TDS Conductivity Monitor and Control Module.
- 3) Flow-through type probe assembly with flow control shutoff; pressurized, pre-piped and mounted.
- 4) Digital display and readout for conductivity and PH controller.
- 5) Electric contacting water meter.
- 6) Water meter totalizer.
- 7) Solenoid bleed valve, suitable for outdoor environment.
- 8) Counter timer control module for inhibitor feed.
- 9) Biocide programmable module – dual pumps.

b. Water meter and solenoid bleed valve shall be sizes as follows:

System Capacity	Solenoid Bleed Valve Size	Water Meter Size	Water Meter Gallons Per Contact
Less than 400 tons	3/4"	3/4"	10
401 – 900 tons	3/4"	1"	50
901- 1,500 tons	1"	1-1/2"	100
1,501 – 3,000 tons	1-1/2"	2"	100

c. Provide three (3) chemical metering pumps as follows:

- 1) System size under 900 tons: Liquid Metronics AISI-191S, 24 gpd, 110 psi.
- 2) System size above 900 tons: Liquid Metronics B111-95S, 30 gpd, 150 psi.
- 3) If local water conditions warrant, provide an additional caustic or acid pump, of capacities listed above.

2. Chemical:

a. Provide Dearborn C-381 cooling water inhibitor maintaining control limits of 100-125 parts per million and pH of 8.0 to 8.5.

- b. Provide Dearborn A-100 and A-111 algaecides or provided equal.
- G. Flush and clean all systems with Dearborn BC-45 cleaner after completion of installation. After cleaning, add Dearborn B-524 nitrite inhibitor to closed loop systems, control nitrite strength to 800-1,800 ppm maximum. Submit written report indicating that systems have been thoroughly cleaned and charged with corrosion inhibitor.
- H. Effluent from HVAC system discharged to sewer shall meet requirements of applicable Local, State, and National Water Quality Standards.
- I. One (1) year service shall include, but not be limited to, the following:
 - 1. Delivery and maintenance of water treatment chemicals for one (1) year.
 - 2. Collection and analysis of samples of circulating water every 30 days for one (1) year, and adjustments to the rate of chemical feed to suit each system.
 - 3. Inspection and maintenance of chemical feeding devices for one (1) year. Inspection and maintenance should be performed at minimum intervals of every 30 days.
 - 4. Water tests according to project requirements.
- J. The Mechanical Contractor shall provide the steel support shelf for the chemical feed pumps.
- K. Electrical Wiring and Controls Interlocking: Provide all necessary interlocking between solenoid bleed valve and respective conductivity controller. Provide power wiring for solenoid valves, pumps and controller.
- L. Closed loop systems with glycol shall be filled to a 35% concentration of propylene glycol/water solution. An extra 55 gallon drum shall be provided to the Owner.

2.7 VALVES AND STRAINERS

- A. Valves on hot water services shall be 125 psi unless noted otherwise. Pressure ratings of valves for steam and condensate services shall be as specified. Provide balancing valves where shown on Drawings.
- B. Valves shall have name of manufacturer and guaranteed working pressure cast or stamped on bodies. Valves of similar type shall be by single manufacturer.
- C. Provide bronze-body ball valves with reinforced Teflon seats, seals, bearings and packing. Ball valves shall be used for hot water services in sizes 2" and smaller. Do not use ball valves for balancing service. Valves on insulated piping shall have 2" extended stems. Valves shall be as manufactured by Apollo, Cannon, Nibco, Milwaukee or Watts. Valves shall be rated 600 psi W.O.G.
- D. Check valves 2" and smaller shall be bronze, screwed ends, swing pattern. Check valves for hot water pump discharge shall be spring loaded, silent check, as manufactured by APCO, Milwaukee, Mueller or Stockham.
- E. Relief valves shall be brass with external lever, ASME-approved. Pipe discharge to floor drain with open connection at floor. Pipe chiller refrigerant relief devices through roof to atmosphere.

F. Strainers:

1. Strainers 2" and smaller shall be 250 lb. bronze body, stainless steel, screen with 20 mesh screen opening, Y-pattern, screwed ends, as manufactured by Sarco Type BT, Mueller, Watts or Armstrong.
2. Provide blow-off valve on each strainer.
3. Pump suction strainers 2" and smaller shall have a 0.062 screen opening.
4. Strainer gaskets shall not contain asbestos.

G. Provide threaded vacuum breakers with ball, spring, O-ring flexible seat and screen. Ball shall be 440 stainless steel; seat shall be EPR. Spring shall be 316 stainless steel, screen and cap shall be 304 stainless steel and threaded collar shall be 416 stainless steel. Body shall be brass. Vacuum breakers shall be as manufactured by Johnson Series VB8 size 1-1/4 IPS, or equivalent by Watts or ITT Hoffman.

H. Provide unions for threaded end valves to facilitate removal from pipe.

I. Automatic Flow Control Valves:

1. Provide automatic pressure compensating flow control valves by Griswold, or Auto-flow where indicated on the Drawings. Valves shall have the capacities and pressure differential characteristics, as indicated, and conform to the following Specifications. Valves 2" and smaller shall be threaded bronze.
2. Valves shall be factory set and shall automatically limit the rate of flow to required engineered capacity within + 5% accuracy over an operating pressure differential of at least 14 times the minimum required for control.
3. The control mechanism of the valve shall consist of self-contained, open-chamber cartridge assembly with unobstructed flow passages that eliminate accumulation of particles and debris. All internal working parts shall be stainless steel or nickel-plated brass. Body shall be ductile iron, cast iron, or bronze.
4. The cartridge assembly shall consist of a spring-loaded cup. The cup shall utilize the full available differential pressure across the valve to actuate the cup and, thereby, reduce friction and hysteresis and eliminate binding.
5. Valves shall be available in minimum of three (3) pressure differential ranges, with the minimum range requiring less than 2 psig to control flow. Valve bodies shall be provided with inlet and outlet tapings suitable for connection of instruments for verification of flow rates and temperature and shall be marked to show direction of flow. Valve bodies shall be rated for use at not less than 150% of system designed operating pressures.
6. Certified performance data for the flow control valve, based on independent laboratory tests, supervised and witnessed by a registered Professional Engineer, shall be available.
7. All flow control valves shall be supplied by a single source responsibility.
8. Each automatic flow control valve shall be furnished with a valve kit consisting of 1/4" x 2" minimum

size nipples, quick-disconnect valves (to be located outside of insulation), and fittings suitable for use with the measuring instruments specified, as well as temperature.

9. Provide a metal identification tag, with chain, for each installed valve. The tag to be marked with zone identification, valve model number and rated flow in GPM.
10. Flow control valve shall be warranted for period of five (5) years from date of startup.
11. Provide Owner with dual hose meter kit including pressure gauge with 4-1/2" dial, 3-way push button operated valve, 5 foot long dual connection hoses, dual shutoff and vent valves, dual special valves for connection to standard valve kit, flow conversion chart and carrying case.

J. Suction Diffusers:

1. Suction diffusers/strainers shall have 200 psi cast iron body and stainless steel strainer with 5/32" perforations. Units shall include flanged connections, removable gasketed cover and straightening vanes. Diffusers shall be as manufactured by Taco, B&G or Mueller.
2. Provide 16 mesh startup strainer.
3. Provide blow-off tapping on bottom of unit.
4. Provide full size inlet and outlet.

K. Combination Balancing/Flow Measurement/Shut-off Valves:

1. Valves shall be Y-pattern style with multi-turn hand-wheel.
2. Valves shall be capable of being installed in any direction without affecting flow measurement and shall provide the following functions:
 - a. Precise flow measurement.
 - b. Precision flow balancing.
 - c. Positive shut-off with no drip seat.
 - d. 3/4" drain port suitable for hose bib fitting. (Sizes 2" and below.)
3. Valves shall have four (4) 360° adjustment turns (2" and below). Hand-wheels shall have digital indicators with hidden memory and tamper-proof setting features.
4. Valves 2" and below shall be non-ferrous, pressure die-cast, non-porous Ametal copper alloy, with soldered ends.
5. Pressure ratings shall be 300 psi for 2" and below, 250 psi for flanged and 300 psi for grooves ends.
6. Each valve shall have pressure/temperature readout ports with EPDM seals and attached shut-off valves.
7. One (1) computerized hand-held balancing meter shall be furnished to the Owner. The Testing and Balancing Contractor shall utilize this instrument for his work. The meter shall include the following:

- a. Flow measurement direct in GPM.
 - b. Differential pressure measurement.
 - c. Temperature measurement.
 - d. Automatic calibration.
 - e. Automatic air purging.
 - f. Extended data logging functions.
8. Balance valves 2" and under shall be Tour and Anderson Model STAS. Valves 2-1/2" and over shall be Tour and Anderson Models STAF-SG or STAG. The hand-held meter shall be Tour and Anderson Model CBI with PCB data logging features. Balance valves manufactured by Armstrong or Victaulic shall be considered equivalent.

2.8 PIPE INSULATION

- A. Insulation shall be fibrous glass insulation with factory-applied fire retardant vapor barrier jacket by Owens Corning, Certain-Teed, Manville or Knauf, installed as required by manufacturer. ASTM E-84 fire hazard ratings shall be 25 flame spread, 50 smoke developed and 50 fuel contributed.
- B. Apply insulation after systems have been tested, proved tight and approved by the Architect. Remove dirt, scale, oil, rust and foreign matter prior to installation of insulation.
- C. Provide fibrous dual temperature insulation with factory applied vapor barrier jacket on condensate drain piping, unless noted otherwise.
- D. Drain piping shall have 1/2" thick insulation.
- E. Insulation Table:

TABLE C403.2.8

Minimum Pipe Insulation Thickness (thickness in inches)^a

Fluid Operating Temperature Range and Usage (°F)	Insulation Conductivity		Nominal Pipe or Tube Size (Inches)				
	Conductivity Btu – In./(h . ft ² . °F) ^b	Mean Rating Temperature, °F	<1	1 to <1½	1½ to < 4	4 to < 8	< 8
141 – 200	0.25 – 0.29	125	1.5	1.5	2.0	2.0	2.0
105 - 140	0.21 – 0.28	100	1.0	1.0	1.5	1.5	1.5
40 – 60	0.21 – 0.27	75	0.5	0.5	1.0	1.0	1.0
<40	0.20 – 0.26	75	0.5	1.0	1.0	1.0	1.5

1. For piping smaller than 1½ inch (38 mm) and located in partitions within conditioned spaces, reduction of these thicknesses by 1 inch (25 mm) shall be permitted (before thickness adjustment required in footnote b) but not to a thickness less than 1 inch (25 mm).
2. For insulation outside the stated conductivity range, the minimum thickness (T) shall be determined as follows:
 - a. $T = r (1 + t/r)K/k - 1$ where:
 - 1) T = minimum insulation thickness,
 - 2) r = actual outside radius of pipe,
 - 3) t = insulation thickness listed in the table for applicable fluid temperature and pipe size,
 - 4) K = conductivity of alternate material at mean rating temperature indicated for the applicable fluid temperature (Btu x in/h x ft² x °F) and
 - 5) k = the upper value of the conductivity range listed in the table for the applicable fluid temperature.
- F. Provide longitudinal lap and 6" wide vapor barrier joint seal strips secured with approved adhesive.
- G. Seal ends of pipe insulation and seal insulation to pipe with approved fire retardant vapor barrier, at flanges, valves and fittings and at intervals of no more than 21 feet on continuous runs of piping.
- H. Secure covers on concealed pipe with metal bands at least ¾" wide and no more than 18" apart, spaced to hold ends and center of each section.
- I. Insulation on Fittings, Valves and Flanges:
 1. Fittings, valves and flanges shall be insulated with pre-cut, factory-supplied fibrous glass, by Certain-Teed, Knauf, Owens Corning or Manville.
 2. Fittings, valves and flanges shall be insulated with same material and to same thickness as adjoining pipe insulation.
 3. Pipe fittings shall be pre-tested, clean and dry before insulation.
 4. Installation of insulation on fittings shall be as follows, in order:
 - a. Wrap insulation around fitting and tuck ends into fitting throat.
 - b. Edges of adjacent insulation shall be tufted and tucked in, to fully insulate fitting to thickness of adjacent pipe insulation. Use two or more thicknesses if necessary.
 - c. If two layers of insulation are used on fittings, wrap and secure first layer with twine before applying second layer.
 - d. Top layer of insulation shall be covered with one (1) piece PVC, Zeston molded fitting cover. Secure cover with stainless steel tack fasteners inserted into jacket thread overlap seam.
 - e. Tape joints with pressure-sensitive vapor barrier tape; tape shall extend 2" on either side of joint.
 5. Prior to taping of joints on chilled water lines, apply vapor barrier mastic (brushed on) to fitting cover, throat overlap and edges. Also apply vapor barrier mastic to pipe insulation jacket ends.

6. For strainers and other valves or fittings which need maintenance, provide preformed removable insulation section.

J. Refrigeration Line Insulation:

1. Suction lines, hot bypass lines and outdoor liquid lines shall be insulated with 0.5" thick on pipes less than 1" and 1" thick on pipes greater than 1" rigid closed cell foam insulation. Armstrong Rigid Armaflex, Manville, Owens Corning or Halstead/Nomaco (Insultube), except in computer room plena.
2. Installation shall meet manufacturer's recommendations. Seal butt joints with insulation manufacturers approved adhesive.
3. Outside above ground insulation shall be protected with two (2) coats of approved vinyl lacquer coating over woven glass mesh adhered to insulation with Insulcolor or approved equal lagging adhesive, as recommended by manufacturer.
4. Refrigerant piping in hung ceiling and under floor supply and return plena shall be insulated with 1" thick fibrous glass insulation that meets applicable requirements of this paragraph.
5. VRF systems require all refrigerant lines to be insulated from the outdoor unit to the indoor terminal units.

2.9 HIGH EFFICIENCY GAS-FIRED BOILERS

A. General:

1. This section includes gas-fired, high efficiency condensing hot water boilers with cast aluminum heat exchangers. Boilers shall be factory packaged low pressure hot water boilers as manufactured by Patterson-Kelley or as approved and accepted by the Engineer. An approved equal or alternate must demonstrate compliance with the requirements of this specification.
2. Quality Assurance:
 - a. The equipment shall, at a minimum, be in strict compliance with the requirements of this specification, shall perform as specified and shall be the manufacturer's standard commercial product unless specified otherwise.
 - b. Electrically operated components specified are to be "Listed" and/or "Labeled" as defined by NFPA 70, Article 100.
 - c. Boiler shall bear an ASME "H" stamp in accordance with ASME Section IV.
 - d. Boiler shall be CSA certified to the ANSI Z21.13 / CSA 4.9 standard for Gas Fired Low Pressure Steam and Hot Water Boilers and shall bear an authorized CSA rating label.
 - e. Boiler shall be AHRI listed and certified in accordance with the Commercial Boiler program and the BTS-2000 testing standard.
 - f. Boiler shall be SCAQMD certified (*relevant jurisdictions*).
 - g. Boiler shall undergo a Full Function Factory Fire Test and bear a fire test label.
 - h. Boiler shall be registered through the National Board from the factory.

- i. The manufacturer shall make available, upon request, all quality assurance documentation and results of Full Function Factory Fire Test based on the boiler's serial number.
3. Coordination:
 - a. Equipment shall be handled, stored and installed in accordance with the manufacturer's instructions.
 - b. Factory Authorized Start-up must be completed after all appliance connections are completed, e.g. gas piping, hydronic piping, exhaust venting & electrical.
4. Warranty:
 - a. The boiler manufacturer shall warrant each boiler, including boiler, trim, boiler control system, and all related components, accessories, and appurtenances against defects in workmanship and material for a period of twelve (12) months from date of startup, provided that startup is completed within six (6) months of shipment and the start-up report is furnished to the manufacturer within thirty (30) days of startup.
 - b. The boiler manufacturer shall warrant the boiler's fuel burner for a period of five (5) years from date of startup, provided that startup is completed within six (6) months of shipment and the start-up report is furnished to the manufacturer within thirty (30) days of startup.
 - c. The boiler manufacturer shall warrant the boiler's heat exchanger for a period of ten (10) years from date of startup, provided that startup is completed within six (6) months of shipment and the start-up report is furnished to the manufacturer within thirty (30) days of startup.
 - d. The boiler manufacturer shall also warrant the boiler's heat exchanger against failure due to thermal shock for a period of ten (10) years from date of startup, provided that startup is completed within six (6) months of shipment and the start-up report is furnished to the manufacturer within thirty (30) days of startup.
5. Certification:
 - a. Manufacturer's Certification - The boiler manufacturer shall certify the following:
 - 1) The products and systems furnished are in strict compliance with the specifications.
 - 2) The boiler, burner and other associated mechanical and electrical equipment have all been properly coordinated and integrated to provide a complete and operable boiler.
 - 3) The boiler shall be in compliance with ANSI Z21.13 / CSA 4.9 (latest edition).
 - 4) The boiler shall be CSA certified for at least 92% efficiency based on operating conditions specified for testing under ANSI Z21.13 / CSA 4.9.
 - 5) The boiler shall be in compliance with ASME Section IV (latest edition).
 - 6) The boiler shall be in compliance with ASME CSD-1 (latest edition).
 - b. Contractor's Certification - The installing contractor shall certify the following:
 - 1) The products and systems installed are in strict compliance with the specifications and all applicable local and/or state codes.
 - 2) The specified field tests have been satisfactorily performed by a factory authorized startup agent.
 - 3) The equipment furnished contains inter-changeable parts with the specified equipment so that

all major equipment parts can be obtained from the specified manufacturer.

B. Components:

1. Cabinet Enclosure:

- a. Each boiler shall feature a fully assembled cabinet enclosure fabricated from Carbon Steel or Aluminum sheet metal (minimum 16 Gauge) with powder coat finish.
- b. The boiler's cabinet enclosure shall not exceed 32" in width and the completed boiler shall fit through a standard 32" wide doorway.
- c. The boiler's cabinet enclosure shall feature removable access panels / doors with quarter-turn type latches that can be easily opened with a coin or flathead screwdriver.
- d. The boiler's cabinet enclosure shall eliminate the use of refractory or other insulating materials by baffling the combustion air around the heat exchanger and the outer surface temperature shall not exceed 20°F above ambient temperature.
- e. The boiler's cabinet enclosure shall prominently display all required safety, instruction, compliance and factory runout labels.

2. Heat Exchanger:

- a. Each hot water boiler shall contain an ASME Section IV heat exchanger with an "H" stamp designed for a maximum allowable working temperature of 220°F and a maximum allowable working pressure of 80 PSIG.
- b. The boiler's completed heat exchanger shall be cast from an Aluminum alloy (AC43000 / EN ALSi10Mg or approved equal) that is suitable to resist the corrosive gases produced from flue gas condensation. The casting shall be a counter-flow design to maximize heat transfer with multiple flow paths arranged in a reverse-return configuration to ensure balanced flow through each section. Boiler designs that incorporate a primary and secondary heat exchanger assembly are not acceptable.
 - 1) Each completed heat exchanger shall be of the "Mono-Block" type, consisting of a single, contiguous Aluminum casting. In addition, each completed heat exchanger shall include a molded PolyPropylene condensate pan/collector, condensate drain, removable burner assembly, inlet temperature sensor, outlet temperature sensor, flue gas temperature sensor, heat exchanger temperature sensor, automatic air vent, low water cutoff probe, thermowell for high temperature limit capillary, and all necessary assembly hardware.
- c. The boiler's completed heat exchanger shall be of the water tube style and incorporate thousands of extended fireside surface area "pins" in order to maintain flue gas turbulence across the entire firing range and provide no less than the total fireside heating surface area.
- d. Each Aluminum casting shall incorporate waterside geometry designed to maintain water turbulence at the full published range of acceptable flow rates at various boiler conditions as described below:
 - 1) The maximum allowable flow rate will generate a 20°F ΔT when the boiler is operating at full capacity.
 - 2) The minimum allowable flow rate at full boiler capacity will generate a 40°F ΔT .
 - 3) The minimum allowable flow rate at ignition will generate a 40°F ΔT .

- 4) The minimum allowable flow rate will generate a 20°F ΔT at low fire.
 - e. The boiler's completed heat exchanger shall be capable of operating with a minimum outlet water temperature of 42°F.
 - f. Each heat exchanger must be hydrostatically tested by the manufacturer to a minimum of 1-1/2 times the maximum allowable working pressure for a minimum of 5 minutes. During this hydrostatic pressure test, the operator will inspect the pressure gauge and visually verify there are no water leaks.
 - g. Each completed heat exchanger shall be assembled and tested by the boiler manufacturer. Heat exchangers assembled by a 3rd party are not acceptable.
3. Main Gas Train:
- a. Boilers configured for single fuel operation shall be equipped with an integral main gas valve train capable of burning either Natural Gas or Propane Gas.
 - b. Each single fuel gas valve train shall include at least the following:
 - 1) One (1) upstream manual shutoff valve for field-connection.
 - 2) One (1) combination Air-Gas ratio control and safety shutoff valve with dual solenoids (in-series) that can be independently energized for leak testing and integrated into a single body design. The combination gas valve shall operate as a "Zero Governor" and control to a neutral gas pressure inside the gas valve.
 - 3) One (1) low gas pressure switch (manual reset).
 - 4) One (1) high gas pressure switch (manual reset).
 - 5) Two (2) gas pressure test ports.
 - 6) One (1) downstream manual shutoff valve.
 - c. Boilers configured for dual fuel operation shall be equipped with two integral gas valve trains; the first capable of burning Natural Gas and the second capable of burning Propane Gas. Dual fuel boiler types shall feature a NG / LP toggle switch allowing the user to quickly change between the two fuel types. Operation of this switch shall not require the boiler to be powered off prior to changeover.
 - d. Each gas train shall be completely independent and include dedicated safety devices, shutoff valves, etc. Each gas train shall be individually identified by the manufacturer with labels and dedicated paint colors (Yellow = Natural Gas & Red = Propane Gas).
 - e. Each dual fuel gas valve train shall include at least the following:
 - 1) One (1) upstream manual shutoff valve for field-connection to Natural Gas.
 - 2) One (1) upstream manual shutoff valve for field-connection to Propane Gas.
 - 3) One (1) Natural Gas combination Air-Gas ratio control and safety shutoff valve with dual solenoids (in-series) that can be independently energized for leak testing and integrated into a single body design. The combination gas valve shall operate as a "Zero Governor" and control to a neutral gas pressure inside the gas valve.
 - 4) One (1) Propane Gas combination Air-Gas ratio control and safety shutoff valve with dual solenoids (in-series) that can be independently energized for leak testing and integrated into a single body design. The combination gas valve shall operate as a "Zero Governor" and control

to a neutral gas pressure inside the gas valve.

- 5) One (1) low gas pressure switch (manual reset) for Natural Gas.
 - 6) One (1) low gas pressure switch (manual reset) for Propane Gas.
 - 7) One (1) high gas pressure switch (manual reset) for Natural Gas.
 - 8) One (1) high gas pressure switch (manual reset) for Propane Gas.
 - 9) Two (2) gas pressure test ports for Natural Gas.
 - 10) Two (2) gas pressure test ports for Propane Gas.
 - 11) One (1) downstream manual shutoff valve for Natural Gas.
 - 12) One (1) downstream manual shutoff valve for Propane Gas.
- f. The main gas valve train(s) shall be factory assembled, piped, and wired and allow for operation at full rated boiler capacity from 4.0" W.C. up to the maximum inlet gas pressure of 14.0" W.C.
 - g. If the supplied gas pressure exceeds 14" W.C., the contractor shall supply a suitable intermediate gas pressure regulator of the lock-up type to reduce the gas pressure to acceptable levels.
4. Power Burner:
- a. The boiler manufacturer must furnish an integral power type fuel burner with each boiler. The complete power fuel burner assembly must consist of a gas burner, combustion air blower, main gas valve train, and ignition system. The burner manufacturer must fully coordinate the burner design with the boiler's heat exchanger and the boiler control system in order to provide the required capacities, efficiencies, and performance specified. Boilers shipped without a power burner and field-equipped with a 3rd party power burner are not acceptable.
 - b. Each burner must be installed horizontally inside the combustion chamber with combustion gases flowing downward through the heat exchanger. The burner must consist of a stainless steel flange and woven fiber mesh cylindrical design.
 - c. The burner must incorporate fuel/air ratio control system to preserve exhaust oxygen levels as per boiler schedule, maintaining consistent flue dew point.
 - d. The system must be linkage-less without the use of electronic control loops and electronic oxygen sensors requiring calibration and renewal.
 - e. Low NOx burner must be certified by SCAQMD for NOx levels listed on schedule when O2 is corrected to 3%. No additional setup or adjustment, such as increasing excess air, will be necessary to achieve level listed
 - f. Each boiler must be equipped with direct spark ignition. Main flame must be monitored and controlled by a flame rod / ionization probe (rectification) system.
5. Boiler Safety and Trim Devices:
- a. The boiler manufacturer shall furnish and test the following safety and trim devices with each boiler:
 - 1) Safety relief valve shall be provided in compliance with the ASME code. Contractor is required to pipe the relief valve discharge piping to an acceptable drain.
 - 2) Water pressure/temperature gauge.

- 3) Low Water / Flow cutoff.
 - 4) Manual reset high limit water temperature controller.
 - 5) Operating temperature control to control the sequential operation of the burner.
 - 6) High and Low Gas Pressure switches.
 - 7) Flame rod / ionization probe (rectification) system.
 - b. The boiler manufacturer shall provide a CSD-1 form identifying each safety and trim device.
 - c. The boiler shall be capable of interfacing with the following external safety devices:
 - 1) Auxiliary Low Water Cutoff device.
 - 2) Combustion Air Damper End Limit Switch.
 - 3) Emergency Stop (E-Stop) switch.
 - 4) External Safety Device w/ contact closure.
6. Boiler Control System:
- a. Each boiler shall be provided with all necessary controls, all necessary programming sequences, and all safety interlocks. Each boiler control system shall be properly interlocked with all safeties.
 - b. Each boiler shall be provided with a "Full Modulating" firing control system whereby the firing rate is infinitely proportional at any firing rate between low fire and high fire as determined by the pulse width modulation input control signal. Both fuel input and air input must be sequenced in unison to the appropriate firing rate without the use of mechanical linkage.
 - c. The boiler's control system shall provide the minimum capabilities:
 - 1) 7" color touchscreen display with one or more USB ports.
 - 2) Standard on-board Ethernet port for wired internet connectivity and embedded wireless driver for optional wireless internet connectivity to remote monitoring and software update services.
 - 3) Parameter uploads and downloads via external USB flash drive.
 - 4) Software updates via external USB flash drive.
 - 5) Capture screen shots from the control's display by saving digital image files to external USB flash drive.
 - 6) Local Representative Screen can be programmed to provide contact information for the local boiler manufacturer's representative.
 - 7) Programmable Relay Outputs for direct control of pumps, control valves, dampers and other auxiliary devices.
 - 8) Multiple boiler "cascade" network up to 24 boilers without any external control panel. The installation of external sequencing control panels is not acceptable.
 - 9) Automatic hybrid system control for multiple boiler "cascade" systems with both condensing and non-condensing boilers. This control logic prioritizes condensing boilers at low water temperatures and prioritizes non-condensing boilers at high water temperatures.
 - 10) Auxiliary Boiler Relay for multiple boiler "cascade" systems which can be used to enable a 3rd party boiler platform in the event the "cascade" system is unable to satisfy the heating load.

- 11) Programmable Boiler and System pump control for multiple boiler “cascade” systems installed in a Primary-Secondary piping arrangement.
 - 12) Programmable Control Valve logic for multiple boiler “cascade” systems installed in a Primary-Only piping arrangement.
 - 13) Integration with external Building Management Systems (BMS) via MODBUS[®] RTU protocol. **NOTE:** Optional Protocol Converter for communication via LONWORKS[®] and BACnet[®] must be available for purchase from the boiler manufacturer.
 - 14) Hardwire integration with Building Management Systems (BMS) via 4-20mA analog control signal for temperature or firing rate control.
 - 15) Intuitive “Setup Wizards” ask the user a series of questions and allow for step-by-step configuration of the boiler control.
 - 16) On-Screen error notifications with a comprehensive description of all alarm conditions and several troubleshooting steps.
 - 17) Automatic flue gas temperature and outlet (supply) temperature compensation to prevent over-firing of the boiler equipment.
 - 18) Automatic differential temperature compensation to prevent over-firing of the boiler equipment in a low flow condition.
 - 19) Automatically adjust the temperature set point and shutdown the boiler based on the outdoor air temperature conditions.
 - 20) Night Setback functionality via external point of closure (or BMS integration) for unique “Occupied” and “Unoccupied” temperature setpoint values.
 - 21) Maintain single temperature set point with a minimum outlet (supply) water temperature of 42°F up to a maximum outlet (supply) water temperature of 194°F.
 - 22) On-Board DHW Priority capable of seamless transition between Comfort Heat (CH) and Domestic Hot Water (DHW) operation.
 - 23) On-Board CH&DHW operation for simultaneous Comfort Heat (CH) and Domestic Hot Water (DHW) operation.
 - 24) Alarm Relay Output to announce alarm conditions which require manual reset.
 - 25) Programmable Low Fire Delay to prevent excessive short-cycling of the boiler equipment.
 - 26) Local Manual Operation.
- d. The boiler control system shall be capable of interfacing with the following external control devices:
- 1) Building Management System (MODBUS[®]). **NOTE:** Optional Protocol Converter for communication via LONWORKS[®] and BACnet[®] must be available for purchase from the boiler manufacturer.
 - 2) Domestic Hot Water Break-on-Rise Aquastat (Normally Closed).
 - 3) Domestic Hot Water Tank Temperature Sensor (12k Ω).
 - 4) External Header Temperature Sensor (12k Ω).
 - 5) Outdoor Air Temperature Sensor (12k Ω).

2.10 VARIABLE SPEED PUMPS

A. Subject to compliance with these specifications, the following manufacturers shall be acceptable:

1. Taco, Inc.
2. ITT Bell & Gossett
3. Grundfos

B. Manufactured Units

1. The self-sensing product shall consist of a factory prepackaged and preprogrammed pump, drive, motor, and integral controls package.
2. The drive shall be mounted and integral to the motor. It shall be mounted with rubber vibration mounts. The mounting and packing of the drive shall be done in a manner that transmitted acceleration levels will be three times below the allowable limits published by the drive manufacturer. These limits will apply to a frequency range of 0-10,000 HZ.
3. The performance speed of this package shall 1750 RPM nominal as standard. Exceptions for 3600 RPM will be noted in the schedules. 3600 RPM shall NOT be an allowable substitution for a specified 1750 PRM package. 3600 RPM products might be considered as a substitution for 1750 RPM only if that manufacturer provides a spare motor, drive, and seal for each pumping unit.
4. Pump logic controller, variable frequency drives, sensor/transmitters and related equipment shall be installed by the mechanical contractor as shown on the plans.

C. Components

1. Pump Logic Controller.
 - a. The controller operation shall operate the system using a tested and proven program that safeguards against undesirable or damaging conditions including:
 - 1) Motor overload
 - 2) Pump flow surges
 - 3) Hydraulic cycling (hunting).
 - 4) End of curve unstable operation: The pump logic controller, through a factory pre-programmed algorithm, shall be capable of protecting the pumps from hydraulic damage due to operation beyond their published end-of-curve. This feature requires a flow meter for activation. The operator interface shall include an owner adjustable flow setpoint to set the parameters for this routine.
 - b. The pump logic controller shall be capable of starting, unloading, and stopping pumps based on a system performance program that will minimize energy consumption , provide reliable performance and bumpless transitions.
 - c. The integrated logic controller shall be capable of running four different hydronic optimization sub-routines

- 1) Setup one: This subroutine shall allow the pump package to track a quadratic system curve and will optimize a secondary distribution loop. It shall use a technology that allows the pump, drive, and motor package to translate the hydronic data from both a pump and system curve and translate it to electrical data. This allows the drive to know exactly where it is in the hydronic world.
 - a) Setup two: This subroutine shall allow two pumps to run as backup for each other and shall alternate the pumps based on a real time clock.
 - b) Setup three: This subroutine shall allow the package to run in a customer defined flow rate. The package will always seek to run at the user defined flow even with fouling causing system changes. It shall use a technology that allows the pump, drive, and motor package to translate the hydronic data from both a pump and system curve and translate it to electrical data. This allows the drive to know exactly where it is in the hydronic world.
 - c) Setup four: This subroutine shall incorporate a traditional external sensing and control platform. It shall allow the option of controlling the pumps with three zones of differential pressure or central plant differential temperature. This optional setup shall allow the owner the option of external sensing without adding an external controller. This feature shall be equal to Taco System Logic (TSL) or equal.
 - d) The control platform shall include a subroutine equal to the Taco Self-Sensing Series with ProBalance™. This subroutine shall allow for the automatic balancing of secondary system distribution pumps. The package shall automatically run system distribution pumps to a user defined duty point and will recognize that duty point and hold the pumps at a speed that matches the actual installed system quadratic system curve. The package will then use this data to set up a new duty point as the max point for the quadratic control curve. Use of external balancing devices or contractors will not be needed.
- d. The package shall serve as a flow metering device and will display pump flow at the user interface.
- e. Shall have optional ProView controller that automates pump balancing.
2. Software – ProView: A pre-programmed interface module that will easily integrate HVAC components into any Building Automation System (BAS).
 - a. Features
 - 1) Pump Monitoring
 - a) Horsepower (Power from the drive to the motor (not motor plus drive)
 - b) KW
 - c) Energy
 - d) Runtime hours w/reset
 - e) Head
 - f) Flow
 - g) Speed Hz, RPM, %
 - h) Amps
 - i) Volts
 - 2) Single button OneTouch ProBalance - Remote pump/system balancing controlled by Building

Automation System (BAS) that is activated by a web-based user interface.

- 3) BTU Monitoring
 - a) Shall allow for BTU monitoring
 - b) VFD drive shall allow (2) UI's which will be used for Delta-T readings.
- 4) Monthly calculations
 - a) Software shall automatically have trends and graphs set up for the following:
 - b) Software shall provide graphical load profile display – bar chart normal-distribution
- 5) Mode Selection
 - a) Variable Flow
 - b) Constant Flow
 - c) Constant Pressure
 - d) Standby
- 6) Pump Fault Monitoring
 - a) Software shall display Application Faults, System Faults and Warnings
 - b) Software shall initiate E-mail alerts
 - c) Software shall provide system and pump performance snapshot at alarm point of entry

3. User Interface

a. Hardware

- 1) GCI/JENE-based - ProView shall be based on the Taco Graphical Controller Interface (GCI). The GCI itself consists of a Taco-specific-device and software templates, settings, and graphics.

2) Capabilities

- a) DDC Integration into existing 3rd party controls platform
- b) The GCI allows for integration into the following Building Automation System (BAS) networks:

- (1) BACnet
- (2) LonWorks
- (3) Modbus
- (4) N2

b. Supported Interfaces:

- 1) Desktop Web: Views formatted for a computer screen. Visible through any Java-enabled web browser.

c. User interface screen shall have the following layout features:

- 1) Monitoring Tab
 - a) Dynamic graphical display of system pump performance point
 - b) Dynamic graphical display of system performance curve
 - c) Graphical display of pump performance range
 - d) Dynamic graphical cost and energy comparison of SelfSensing variable speed pump and constant speed pump
 - e) Status Tab
- 2) 2nd Monitoring Page for additional “Pump Monitoring” data points and Status Bits and Extended Status bits.
- 3) ProBalance Tab
 - a) Button for One-Touch ProBalance
 - b) Fields to enter setpoints:
 - (1) Active Setup
 - (2) Design Flow
 - (3) No-flow Head
 - (4) Max VFD speed
 - (5) Min VFD Speed
 - (6) Control head
 - (7) Mode Selection
 - (8) Setup Tab
 - c) BTU Setup
- 4) Maintenance Tab
 - a) Monitor cycles –
 - (1) GCI to monitor number of cycles since last Seal change and bearing check/change
 - b) Maintenance data logger
 - (1) GCI PM reminder for seal change / Bearing maintenance
 - (2) GCI based historical record of technician’s notes e.g. note & timestamp
 - (3) Alarms Tab:
 - c) Pump Faults/Warnings

D. PUMPS (See pump schedule on plans for exact model, type, and duty points.)

1. Vertical Split Coupled Pumps.

- a. Pumps shall be Taco Model KS or approved equal. The pumps shall be single stage vertical inline design. The seal shall be serviceable without disturbing the piping connections. The capacities and characteristics shall be as called for in the plans/schedules.
 - 1) Pump casing shall be constructed of ASTM A48 class 30 cast iron. The pump casing/volute shall be rated for 250 psi working pressure for all jobs. The pump flanges shall be matched to suit the working pressure of the piping components on the job, with either ANSI Class 125 flanges or ANSI class 250 flanges. The pump casing shall be drilled and tapped for gauge ports on both the suction and discharge connections and for a drain port at the bottom of the casing. The casing shall have an additional tapping on the discharge connection to allow for the installation of a seal flush line. The pump cover shall be drilled and tapped to accommodate a seal flush line which can be connected to the corresponding tapping on the discharge connection, or to an external source to facilitate cooling and flushing of the seal faces.
 - 2) All casings shall be flanged. Threaded casings not allowed unless extra unions and fittings are provided to allow servicing.
 - 3) The pump shall have a factory installed vent/flush line to insure removal of trapped air from the casing and mechanical seal cooling. The vent/flush line shall run from the seal chamber to the pump discharge.
 - 4) The impeller shall be ASTM B584-836/875 bronze and hydraulically balanced. The impeller shall be dynamically balanced to ANSI Grade G6.3 and shall be fitted to the shaft with a key. The impeller shall be cast by the hydraulically efficient lost foam technique to ensure repeatability of high quality.
 - 5) The pump shall be manufactured with AISI 416 Stainless Steel shaft.
 - 6) The pump shall be fitted with a single mechanical seal, with EPT elastomers and Carbon/Ceramic faces, rated up to 250°F. The mechanical seal shall be an inside type seal yet engineered and applied in a manner that is as or more accessible than a specialty outside seal. This seal must be capable of being flushed externally via a tapping in the pump cover adjacent to the seal cavity. The entire pump line shall use no more than three different sizes of seals. Outside mechanical seals are NOT acceptable.
 - 7) The pump shall be coupled via a high tensile aluminum split style coupling. The design must permit easy replacement of the mechanical shaft seal without removal of the motor. The motor mount must be designed to accept several different motor frame standards; CZ and HP. The motor shall be a TEFC, inverter rated motor with class F insulation and shaft grounding ring.
 - 8) In order to both simplify and reduce the total cost of ownership, the manufacturer shall standardize on no more than three sizes of mechanical seals throughout the entire range of the family of pumps. The manufacturer shall not use multiple part numbers for the same part.

E. Variable Frequency Drives

1. The VFD shall convert incoming fixed frequency three-phase ac power into an adjustable frequency and voltage for controlling the speed of three-phase ac motors. The motor current shall closely approximate a sine wave. Motor voltage shall be varied with frequency to maintain desired motor magnetization current suitable for the driven load and to eliminate the need for motor derating. When properly sized, the VFD shall allow the motor to produce full rated power at rated motor voltage, current, and speed without using the motor's service factor. VFDs utilizing sine weighted/coded modulation (with or without 3rd harmonic injection) must provide data verifying that the motors will not draw more than full load current during full load and full speed operation.

2. The VFD shall include an input full-wave bridge rectifier and maintain a fundamental (displacement) power factor near unity regardless of speed or load.
3. The VFD shall have a dual 5% impedance DC link reactor on the positive and negative rails of the dc bus to minimize power line harmonics and protect the VFD from power line transients. The chokes shall be non-saturating. Swinging chokes that do not provide full harmonic filtering throughout the entire load range are not acceptable. VFDs with saturating (non-linear) dc link reactors shall require an additional 3% AC line reactor to provide acceptable harmonic performance at full load, where harmonic performance is most critical.
4. The VFD's full load output current rating shall meet or exceed nec table 430-150. The VFD shall be able to provide full rated output current continuously, 110% of rated current for 60 seconds and 120% of rated torque for up to 0.5 second while starting.
5. The VFD shall provide full motor torque at any selected frequency from 20 hz to base speed while providing a variable torque v/hz output at reduced speed. This is to allow driving direct drive fans without high speed derating or low speed excessive magnetization, as would occur if a constant torque v/hz curve was used at reduced speeds. Breakaway current of 160% shall be available.
6. A programmable automatic energy optimization selection feature shall be provided standard in the VFD. This feature shall automatically and continuously monitor the motor's speed and load to adjust the applied voltage to maximize energy savings.
7. The VFD must be able to produce full torque at low speed to operate direct drive fans.
8. Output power circuit switching shall be able to be accomplished without interlocks or damage to the VFD.
9. An automatic motor adaptation algorithm shall measure motor stator resistance and reactance to optimize performance and efficiency. It shall not be necessary to run the motor or de-couple the motor from the load to perform the test.
10. Galvanic isolation shall be provided between the VFD's power circuitry and control circuitry to ensure operator safety and to protect connected electronic control equipment from damage caused by voltage spikes, current surges, and ground loop currents. VFDs not including either galvanic or optical isolation on both analog i/o and discrete digital i/o shall include additional isolation modules.
11. VFD shall minimize the audible motor noise through the use of an adjustable carrier frequency. The carrier frequency shall be automatically adjusted to optimize motor and VFD operation while reducing motor noise. VFDs with fixed carrier frequency are not acceptable.
12. All VFDs shall contain integral EMI filters to attenuate radio frequency interference conducted to the ac power line.
13. The drive enclosure shall be standard as NEMA 12 (IP 55) and optional shall be NEMA 4X (IP 66). See schedules for project requirements.
14. Protective features
 - a. A minimum of class 20 i2t electronic motor overload protection for single motor applications shall be provided. Overload protection shall automatically compensate for changes in motor speed.

- 1) Protection against input transients, loss of AC line phase, output short circuit, output ground fault, over voltage, under voltage, VFD over temperature and motor over temperature. The VFD shall display all faults in plain language. Codes are not acceptable.
- 2) Protect VFD from input phase loss. The VFD should be able to protect itself from damage and indicate the phase loss condition. During an input phase loss condition, the VFD shall be able to be programmed to either trip off while displaying an alarm, issue a warning while running at reduced output capacity, or issue a warning while running at full commanded speed. This function is independent of which input power phase is lost.
- 3) Protect from under voltage. The VFD shall provide full rated output with an input voltage as low as 90% of the nominal. The VFD will continue to operate with reduced output, without faulting, with an input voltage as low as 70% of the nominal voltage.
- 4) Protect from over voltage. The VFD shall continue to operate without faulting with a momentary input voltage as high as 130% of the nominal voltage.
- 5) The VFD shall incorporate a programmable motor preheat feature to keep the motor warm and prevent condensation build up in the motor when it is stopped in a damp environment by providing the motor stator with a controlled level of current.
- 6) VFD shall include a "signal loss detection" algorithm with adjustable time delay to sense the loss of an analog input signal. It shall also include a programmable time delay to eliminate nuisance signal loss indications. The functions after detection shall be programmable.
- 7) VFD shall function normally when the keypad is removed while the VFD is running. No warnings or alarms shall be issued as a result of removing the keypad.
- 8) VFD shall catch a rotating motor operating forward or reverse up to full speed without VFD fault or component damage.
- 9) Selectable over-voltage control shall be provided to protect the drive from power regenerated by the motor while maintaining control of the driven load.
- 10) VFD shall include current sensors on all three output phases to accurately measure motor current, protect the VFD from output short circuits, output ground faults, and act as a motor overload. If an output phase loss is detected, the VFD will trip off and identify which of the output phases is low or lost.
- 11) If the temperature of the VFD's heat sink rises to 80°C, the VFD shall automatically reduce its carrier frequency to reduce the heat sink temperature. It shall also be possible to program the VFD so that it reduces its output current limit value if the VFD's temperature becomes too high.
- 12) In order to ensure operation during periods of overload, it must be possible to program the VFD to automatically reduce its output current to a programmed value during periods of excessive load. This allows the VFD to continue to run the load without tripping.
- 13) The VFD shall have temperature controlled cooling fan(s) for quiet operation, minimized losses, and increased fan life. At low loads or low ambient temperatures, the fan(s) may be off even when the VFD is running.
- 14) The VFD shall store in memory the last 10 alarms. A description of the alarm, and the date and time of the alarm shall be recorded.
- 15) When used with a pumping system, the VFD shall be able to detect no-flow situations, dry pump conditions, and operation off the end of the pump curve. It shall be programmable to take

appropriate protective action when one of the above situations is detected.

b. Internal Control Algorithm

- 1) This is a standard HVAC drive that has been upgraded and modified by pump experts for Hydronic applications. It is set up with a closed loop internal control sequence that will optimize life cycle, system comfort, and minimize energy consumption.

c. Interface Features

- 1) Hand, off and auto keys shall be provided to start and stop the VFD and determine the source of the speed reference. It shall be possible to either disable these keys or password protect them from undesired operation.
 - a) There shall be an "info" key on the keypad. The info key shall include "on-line" context sensitive assistance for programming and troubleshooting.
 - b) The VFD shall be programmable to provide a digital output signal to indicate whether the VFD is in hand or auto mode. This is to alert the building automation system whether the VFD is being controlled locally or by the building automation system.
 - c) Password protected keypad with alphanumeric, graphical, backlit display can be remotely mounted. Two levels of password protection shall be provided to guard against unauthorized parameter changes.
 - d) All VFDs shall have the same customer interface. The keypad and display shall be identical and interchangeable for all sizes of VFDs.
 - e) To set up multiple VFDs, it shall be possible to upload all setup parameters to the VFD's keypad, place that keypad on all other VFDs in turn and download the setup parameters to each VFD. To facilitate setting up VFDs of various sizes, it shall be possible to download from the keypad only size independent parameters. Keypad shall provide visual indication of copy status.
 - f) Display shall be programmable to communicate in multiple languages including English, Spanish and French.
 - g) A red fault light, a yellow warning light and a green power-on light shall be provided. These indications shall be visible both on the keypad and on the VFD when the keypad is removed.
 - h) A quick setup menu with factory preset typical HVAC parameters shall be provided on the VFD. The VFD shall also have individual fan, pump, and compressor menus specifically designed to facilitate start-up of these applications.
 - i) A four-feedback PID controller to control the speed of the VFD shall be standard. This controller shall accept up to four feedback signals. It shall be programmable to compare the feedback signals to a common setpoint or to individual setpoints and to automatically select either the maximum or the feedback signal as the controlling signal. It shall also be possible to calculate the controlling feedback signal as the average of all feedback signals or the difference between a pair of feedback signals.
 - j) The VFD shall be able to apply individual scaling to each feedback signal.
 - k) For fan flow tracking applications, the VFD shall be able to calculate the square root of any or all individual feedback signals so that a pressure sensor can be used to measure air flow.

- l) The VFD's PID controller shall be able to actively adjust its setpoint based on flow. This allows the VFD to compensate for a pressure feedback sensor which is located near the output of the pump rather than out in the controlled system.
 - m) The VFD shall have three additional PID controllers which can be used to control damper and valve positioners in the system and to provide setpoint reset.
 - n) Floating point control interface shall be provided to increase/decrease speed in response to contact closures.
 - o) Five simultaneous meter displays shall be available. They shall include at a minimum, frequency, motor current, motor voltage, VFD output power, VFD output energy, VFD temperature in degrees, among others.
 - p) Programmable sleep mode shall be able to stop the VFD. When its output frequency drops below set "sleep" level for a specified time, when an external contact commands that the VFD go into sleep mode, or when the VFD detects a no-flow situation, the VFD may be programmed to stop. When the VFD's speed is being controlled by its PID controller, it shall be possible to program a "wake-up" feedback value that will cause the VFD to start. To avoid excessive starting and stopping of the driven equipment, it shall be possible to program a minimum run time before sleep mode can be initiated and a minimum sleep time for the VFD.
 - q) A run permissive circuit shall be provided to accept a "system ready" signal to ensure that the VFD does not start until dampers or other auxiliary equipment are in the proper state for VFD operation. The run permissive circuit shall also be capable of initiating an output "run request" signal to indicate to the external equipment that the VFD has received a request to run.
 - r) VFD shall be programmable to display feedback signals in appropriate units, such as inches of water column (in-wg), pressure per square inch (psi) or temperature (°f).
 - s) VFD shall be programmable to sense the loss of load and signal this condition via a keypad warning, relay output and/or over the serial communications bus. To ensure against nuisance indications, this feature must be based on motor torque, not current, and must include a proof timer to keep brief periods of no load from falsely triggering this indication.
 - t) Standard Control And Monitoring Inputs And Outputs
- 2) Six dedicated, programmable digital inputs shall be provided for interfacing with the systems control and safety interlock circuitry.
- a) Two terminals shall be programmable to act as either as digital outputs or additional digital inputs.
 - b) Two programmable relay outputs, Form C 240 V AC, 2 A, shall be provided for remote indication of VFD status.
 - c) Each relay shall have an adjustable on delay / off delay time.
 - d) Two programmable analog inputs shall be provided that can be either direct-or-reverse acting.
 - e) Each shall be independently selectable to be used with either an analog voltage or current signal.

- f) The maximum and minimum range of each shall be able to be independently scalable from 0 to 10 V dc and 0 to 20 mA.
 - g) A programmable low-pass filter for either or both of the analog inputs must be included to compensate for noise.
 - h) The VFD shall provide front panel meter displays programmable to show the value of each analog input signal for system set-up and troubleshooting,
 - i) One programmable analog current output (0/4 to 20 mA) shall be provided for indication of VFD status. This output shall be programmable to show the reference or feedback signal supplied to the VFD and for VFD output frequency, current and power. It shall be possible to scale the minimum and maximum values of this output.
 - j) It shall be possible through serial bus communications to read the status of all analog and digital inputs of the VFD.
 - k) It shall be possible to command all digital and analog output through the serial communication bus.
 - l) Optional Control And Monitoring Inputs And Outputs
- 3) It shall be possible to add optional modules to the VFD in the field to expand its analog and digital inputs and outputs.
 - a) These modules shall use rigid connectors to plug into the VFD's control card.
 - b) The VFD shall automatically recognize the option module after it is powered up. There shall be no need to manually configure the module.
 - c) Modules may include such items as:
 - d) Additional digital outputs, including relay outputs
 - e) Additional digital inputs
 - f) Additional analog outputs
 - g) Additional analog inputs, including Ni or Pt temperature sensor inputs
 - h) It shall be possible through serial bus communications to control the status of all optional analog and digital outputs of the VFD.
 - i) Standard programmable firefighter's override mode allows a digital input to control the VFD and override all other local or remote commands. It shall be possible to program the VFD so that it will ignore most normal VFD safety circuits including motor overload. The VFD shall display firemode whenever in firefighter's override mode. Firemode shall allow selection of forward or reverse operation and the selection of a speed source or preset speed, as required to accommodate local fire codes, standards and conditions.
- d. A real-time clock shall be an integral part of the VFD.
 - 1) It shall be possible to use this to display the current date and time on the VFD's display.
 - a) Ten programmable time periods, with individually selectable ON and OFF functions shall be available. The clock shall also be programmable to control start/stop functions, constant speeds, PID parameter setpoints and output relays. It shall be possible to program unique events that occur only during normal work days, others that occur only on non-work days, and others that occur on specific days or dates. The manufacturer shall provide free PC-based software to set up the calendar for this schedule.

- b) All VFD faults shall be time stamped to aid troubleshooting.
 - c) It shall be possible to program maintenance reminders based on date and time, VFD running hours, or VFD operating hours.
 - d) The real-time clock shall be able to time and date stamp all faults recorded in the VFD fault log.
 - e) The VFD shall be able to store load profile data to assist in analyzing the system demand and energy consumption over time.
- e. The VFD shall include a sequential logic controller to provide advanced control interface capabilities. This shall include:
 - 1) Comparators for comparing VFD analog values to programmed trigger values
 - a) Logic operators to combine up to three logic expressions using Boolean algebra
 - b) Delay timers
 - c) A 20-step programmable structure
 - d) The VFD shall include a cascade controller which allows the VFD to operate in closed loop setpoint (PID) control mode one motor at a controlled speed and control the operation of 3 additional constant speed motor starters.
- f. Serial communications
 - 1) The VFD shall include a standard eia-485 communications port and capabilities to be connected to the following serial communication protocols at no additional cost and without a need to install any additional hardware or software in the VFD:
 - a) Johnson Controls Metasys N2
 - b) Modbus RTU
 - c) Siemens FLN
 - d) BACnet MS/TP
 - e) Optional communication shall include:
 - f) LonWorks Free Topology (FTP)
 - 2) VFD shall have standard USB port for direct connection of Personal Computer (PC) to the VFD. The manufacturer shall provide no-charge pc software to allow complete setup and access of the VFD and logs of VFD operation through the USB port. It shall be possible to communicate to the VFD through this USB port without interrupting VFD communications to the building management system.
 - 3) The VFD shall have provisions for an optional 24 v DC back-up power interface to power the VFD's control card. This is to allow the VFD to continue to communicate to the building automation system even if power to the VFD is lost.
- g. Adjustments
 - 1) The VFD shall have a manually adjustable carrier frequency that can be adjusted in 0.5 khz increments to allow the user to select the desired operating characteristics. The VFD shall also be programmable to automatically reduce its carrier frequency to avoid tripping due to thermal loading.

- a) Four independent setups shall be provided.
 - b) Four preset speeds per setup shall be provided for a total of 16.
 - c) Each setup shall have two programmable ramp up and ramp down times. Acceleration and deceleration ramp times shall be adjustable over the range from 1 to 3,600 seconds.
 - d) Each setup shall be programmable for a unique current limit value. If the output current from the VFD reaches this value, any further attempt to increase the current produced by the VFD will cause the VFD to reduce its output frequency to reduce the load on the VFD. If desired, it shall be possible to program a timer which will cause the VFD to trip off after a programmed time period.
 - e) If the VFD trips on one of the following conditions, the VFD shall be programmable for automatic or manual reset: external interlock, under-voltage, over-voltage, current limit, over temperature, and VFD overload.
 - f) The number of restart attempts shall be selectable from 0 through 20 or infinitely and the time between attempts shall be adjustable from 0 through 600 seconds.
 - g) An automatic "start delay" may be selected from 0 to 120 seconds. During this delay time, the VFD shall be programmable to either apply no voltage to the motor or apply a DC braking current if desired.
 - h) Four programmable critical frequency lockout ranges to prevent the VFD from operating the load at a speed that causes vibration in the driven equipment shall be provided. Semi-automatic setting of lockout ranges shall simplify the set-up.
 - i) Optional features
- 2) All optional features shall be built and mounted by VFD manufacturer. All optional features shall be UL listed by the VFD manufacturer as a complete assembly and carry a UL label.
- a) All panels shall be marked for their short circuit current rating in compliance with UL.
 - b) Service conditions
- 3) Ambient temperature, continuous, full speed, full load operation:
- a) -10 to 45°C (14 to 113°F) through 125 HP @ 460 and 600 volt, through 60 HP @ 208 volt
 - b) -10 to 40°C (14 to 104°F) 150 HP and larger
 - c) 0 to 95% relative humidity, non-condensing.
 - d) Elevation to 3,300 feet without derating.
 - e) AC line voltage variation, -10 to +10% of nominal with full output.
 - f) No side clearance shall be required for cooling.
 - g) All power and control wiring shall be done from the bottom.
 - h) All VFDs shall be plenum rated.

2.11 PIPE HANGERS AND SUPPORTS

- A. Provide pipe stands, supports, hangers and other supporting devices in accordance with ANSI B31.9 and MSS-69, as necessary to support work required by Contract Documents.

B. Secure vertical piping to building construction to prevent sagging or swinging.

C. Space hangers for horizontal piping as follows:

Pipe Size	Rod Diameter	Maximum Spacing
Up to 1-1/4"	3/8"	8 ft.-0"
1-1/2" and 2"	3/8"	10 ft.-0"
2-1/2" and 3"	1/2"	10 ft.-0"
4" and 5"	5/8"	12 ft.-0"
6"	3/4"	12 ft.-0"
8" and over	7/8"	12 ft.-0"

D. Horizontal copper tubing shall have maximum hanger spacing of 5 ft. for tubing 1-1/4" diameter and smaller and 10' for tubing 1-1/2" and larger. Maximum spacing for PVC pipe hanger shall be 4".

E. Reduce spacing to a maximum of 10'-0" apart, regardless of pipe size, as necessary for fittings, valves and other concentrated loads.

F. Support piping 4" diameter and larger from structure with pipe roll hangers with adjustable steel rod hangers, sized to accommodate insulation.

G. Support piping 3" diameter and under from structure with Carpenter and Patterson Fig. 100 clevis hangers or approved equal.

H. Hangers shall be as manufactured by Carpenter and Patterson, F&S or Grinnell Co. Figure numbers of Carpenter and Patterson are specified to establish standards of quality for performance and materials.

I. Provide spring hangers with travel stops as specified in Vibration Isolation Paragraph, where necessary and where shown on Drawings.

J. Pipe supports for 4" and larger pipe and insulated high-temperature piping shall have welded inserts of equal thickness to insulation to prevent compression of insulation. Other insulated pipe shall have 12", 14 ga. shields at hangers, composed of 180° coverage of galvanized sheetmetal and high density, preformed rigid insulation. Where rollers are required, shield shall be steel pipe.

K. Hangers for horizontal lines shall be vertically adjustable to obtain pitch requirements of Piping Paragraph.

2.12 SLEEVES AND PENETRATIONS

A. Pipe Sleeves:

1. Sleeves through floors and through exterior, structural and fire-rated construction shall be hot-dipped galvanized Schedule 40 steel pipe.

2. Sleeves through partitions and non-rated construction shall be 26-gauge galvanized steel with lock longitudinal seams, or approved plastic pipe.
3. Provide waterproofing membrane locking devices at floors. Provide 150 lb. slip-on welding flanges at exterior wall penetrations.

B. Duct Sleeves and Openings:

1. Sleeves through floors, through exterior structure, through fire-rated construction and through smoke partitions that require smoke dampers shall be Schedule 40 galvanized steel pipe for round duct and shall meet the SMACNA Fire Damper and Heat Stop Guide for rectangular ducts. Fireproof packing shall be applied to seal any openings between sleeve and wall. Materials shall maintain the fire rating of the wall, and shall be installed in accordance with the SMACNA Fire Damper and Heat Stop Guide.
2. Openings in walls, partitions and other fire-rated construction that do not require smoke dampers shall meet NFPA 90A, Section 3-3.8.
3. Materials for prepared openings in partitions shall match construction penetrated.

C. Pipe Sleeve Packing:

1. Packing between the pipe and the sleeve (or wall or slab opening) in fire-rated walls or slabs shall be a combination of fireproof insulation and fireproof caulk. The combination of materials shall have the same fire rating, in hours, as the wall or slab, as tested in accordance with the latest edition of ASTM E-814 (UL 1479). The combination of materials shall be classified by UL, (fill, void or cavity materials) for the fire rating required and shall be listed as a numbered system in the UL Fire Resistance Director. Fiberglass shall not be used as the insulation material.
2. Refer to Penetration and Firestopping 07 84 13 Section for acceptable fireproof insulation materials.
3. Packing for sleeves that do not require maintenance of fire rating shall be oakum, silicate foam, ceramic fiber or mineral fiber with approved sealant. Pack or foam to within 1" of both wall surfaces. Seal penetration packing with approved caulking and paintable waterproof mastic surface finish or silicone caulking.
4. All materials must be installed in accordance with manufacturer' instructions; all gaps must be sealed. Finish caulk flush with wall or slab surface if piping runs exposed.

2.13 ESCUTCHEONS AND DUCT COLLARS

- A. Provide adjustable escutcheons on exposed piping that passes through finished floors, walls and ceilings. Escutcheons shall be chromium-plated cast brass, sized to cover sleeve opening and to accommodate pipe and insulation.
- B. Provide 4" wide, 20 gauge galvanized sheetmetal collars at sleeves and prepare openings, sized to cover entire duct penetration including sleeve and seal, and to accommodate duct and insulation as necessary. Edges shall have milled lips ground smooth. Paint to match finish of duct or as directed by the Architect.
- C. Provide #316 stainless steel/No. 4 finish collar for emergency generator exhaust piping which passes through exterior wall.

2.14 HOT WATER COILS

- A. Provide hot water coils suitable for duct installation with capacities, pressure drops and leaving air temperatures as shown on Drawings. Acceptable manufacturers shall be Trane, Aerofin, or Capital Coil.
- B. Coil shall be 1/2" or 5/8" copper tube expanded mechanically into continuous aluminum fin collars, with copper or bronze headers and galvanized steel casings.
- C. Proof test at 300 psi and leak test at 250 psi air pressure under water. Certify suitability for 200 psi working pressure.
- D. Coil shall meet requirements of ARI 410-74.

2.15 UNIT HEATER (HYDRONIC)

- A. Furnish and install, where indicated or schedules on plans, Sterlin model HAS horizontal hot water unit heaters. Units shall be equipped as specified herein. All units shall be installed neat and workmanlike manner in accordance with this specification and the manufacturer's installation instructions.
- B. Casing:
 - 1. Casings shall be 20 gauge die-formed steel. Pain finish shall be of lead-free, chromate free, polyester melamine resin base. Finish shall be baked at 400°F.
- C. Coil Sizes 108A-136A:
 - 1. Coil is a serpentine design with seamless copper tubing.
 - 2. Aluminum fins shall have drawn collars to assure permanent bond with expanded tubes.
 - 3. Tubing connection shall be 3/8 in copper tubing, type "M" (0.500 OD).
 - 4. Coils shall be factory tested at 200 PSI.
 - 5. Coils have a max operating temperature of 320°F.
- D. Motors:
 - 1. Motors shall be totally enclosed fan cooled, resilient mounted with class "B" windings.
 - 2. All motors shall be designed for horizontal mounting.
- E. Fans:
 - 1. Fans shall be of aluminum blade type, designed and balanced to assure maximum air delivery, low motor horsepower requirements and quiet operation.
 - 2. OSHA Fan Guards:
 - a. OSHA fan guards shall be welded steel, zinc plated or painted.

- b. OSHA fan guards shall be standard on sizes 108A through 136A.

2.16 CABINET UNIT HEATER (HYDRONIC)

- A. The contractor shall furnish and install Sterling Cabinet Unit Heaters as specified by engineer to meet or exceed job requirements. The Cabinet Unit Heaters will conform to the items listed below and will be certified under CSA/UL certification guidelines.
- B. Cabinets:
 - 1. All cabinets will be constructed with 18-gauge cold rolled steel, side panels and top. The front panel shall be furnished in 16-gauge cold rolled steel. It will have 1/2", 1-1/2 pound density insulation with a neoprene coated side in front of coil.
 - 2. The internal cabinet shall be furnished in 18-gauge galvanized steel. Adequate work area for installation of control valves or electrical equipment shall be provided on both sides of the internal cabinet.
 - 3. The cabinet shall be provided with a neutral eggshell baked powder prime coat as standard. Optional powder coated finish in designer colors, as selected from standard color selector will be provided as specified. All cabinets shall be supplied with adjustable rear mounting brackets which will provide adjustment to correct alignment of the unit at installation to non-square or out of true walls, joists, studs or surfaces. Floor mounted cabinet units will be provided with adjustable leveling legs (two each base leg) when specified.
- C. Coils:
 - 1. Standard One Row Coil –
 - a. Coils will have 1/2" O.D. copper tubes that are mechanically expanded to the aluminum fins. All coil header joints are brazed.
 - b. The coil assembly is submersion tested at factory at 250 PSI and is rated at a working pressure of 300 PSI.
 - c. All units are designed so that field modifications can be made to reverse the coil position if required.
 - 2. High Capacity Two Row Coil –
 - a. High Capacity, two row coil, option, as specified for hot water systems only, will have 1/2" O.D. copper tubes that are mechanically expanded to the aluminum fins. All coil header joints are brazed.
 - b. The coil assembly is submersion tested at factory at 250 PSI and is rated at a working pressure of 300 PSI.
 - c. All units are designed so that field modifications can be made to reverse the coil position if required.
 - 3. Coil Connections:
 - a. Coil connections provided will be 1-1/4" Nominal copper tube and will be factory installed for

connecting on the left hand side of the unit. Available as specified for right hand connection.

4. Electrical:

- a. All primary internal wiring shall be done at the factory. All units will be connected to electrical power to assure that all standard and optional electrical components operate as required at the factory prior to shipping.

D. Motors:

1. Standard PSC motors shall have integral thermal protection and start at 78% of rated voltage. PSC, High Static motors will be provided when specified and will be capable of operating in high static conditions up to .4 inches of water column. ECM and ECM high static motors provided as specified will have a solid state, digital control board and a 3 speed switch.

E. Fans:

1. Fan wheels will be centrifugal, forward curved, double width of nylon or electro galvanized steel. Fan housings shall be of formed galvanized sheet metal.

F. Filters:

1. All filters supplied as standard will be washable and reusable aluminum media with a 69% arrestance level. Filters shall be slide in type which will be secured into position with a cotter pin.

G. Cabinets:

1. RECESSED WALL UNITS:

- a. All recessed wall units shall be supplied with a wall seal assembly. The wall seal assembly will provide protection to the wall construction material. The wall seal will be supplied in an eggshell baked powder prime coat as standard.
- b. When specified, optional baked powder designer colors may be selected from the standard color selector.

2. CEILING MOUNT OR RECESSED UNITS:

- a. All "C" and "RC" units shall be supplied with a hinged front panel. The multiple hinges shall provide full swing through 90°. A safety chain shall be provided as standard to prevent the face panel from swinging fully open accidentally. This chain must be easily detached to allow full access for servicing.
- b. All recessed ceiling units shall be supplied with a wall seal assembly. The wall seal assembly will provide protection to the wall or ceiling construction material. The wall seal will be supplied in an eggshell baked powder prime coat as standard.
- c. When specified, optional baked powder designer colors may be selected from the standard color selector. The variable speed control switch will be packaged and placed inside the unit. A wiring diagram will be included for field installation at a desired location.

2.17 VIBRATION ISOLATION AND SEISMIC RESTRAINTS

A. General:

1. Intent:

- a. All mechanical equipment, piping and ductwork as noted on the equipment schedule or in the specification shall be mounted on vibration isolators to prevent the transmission of vibration and mechanically transmitted sound to the building structure. Vibration isolators shall be selected in accordance with the weight distribution so as to produce reasonably uniform deflections.
- b. All isolators and isolation materials shall be of the same manufacturer and shall be certified by the manufacturer.
- c. It is the intent of the seismic portion of this specification to keep all mechanical and electrical building system components in place during a seismic event.
- d. All such systems must be installed in strict accordance with seismic codes, component manufacturer's recommendations and building construction standards. Whenever a conflict occurs between the manufacturer's recommendations or construction standards, the most stringent shall apply.
- e. This specification is considered to be minimum requirements for seismic consideration and is not intended as a substitute for legislated, more stringent, national, state or local construction requirements (i.e. California Title 24, California OSHPD, Canadian Building Codes, or other requirements).
- f. Any variance or non-compliance with these specification requirements shall be corrected by the contractor in an approved manner.

2. The work of this section includes but is not limited to the following:

- a. Vibration isolation elements.
- b. Equipment isolation bases.
- c. Piping flexible connections.
- d. Seismic restraints for isolated and non-isolated mechanical and electrical items.
- e. Certification of seismic restraint designs and installation supervision.
- f. Certification of seismic attachment of housekeeping pads.
- g. All Mechanical and Electrical systems. Equipment buried underground is excluded but entry of services through the foundation wall is included.

3. Qualifications:

- a. Only firms having five years' experience designing and manufacturing seismic devices shall be capable of work in this specification.

4. Definitions:

a. Life Safety Systems:

- 1) All systems involved with fire protection including sprinkler piping, fire pumps, jockey pumps, fire pump control panels, service water supply piping, water tanks, fire dampers and smoke

- exhaust systems.
- 2) All systems involved with and/or connected to emergency power supply including all generators, transfer switches, transformers and all flow paths to fire protection and/or emergency lighting systems.
- 3) All medical and life support systems.
- 4) Fresh air relief systems on emergency control sequence including air handlers, conduit, duct, dampers, etc.
- b. Positive Attachment:
 - 1) A positive attachment is defined as a cast-in anchor, a drill-in wedge anchor, a double sided beam clamp loaded perpendicular to a beam, or a welded or bolted connection to structure. Single sided "C" type beam clamps for support rods of overhead piping, ductwork, fire protection, electrical conduit, bus duct, or cable trays, or any other equipment are not acceptable on this project as seismic anchor points.
- c. Transverse Bracing:
 - 1) Restraint(s) applied to limit motion perpendicular to the centerline of the pipe, duct or conduit.
- d. Longitudinal Bracing:
 - 1) Restraint(s) applied to limit motion parallel to the centerline of the pipe, duct or conduit.
- e. Failure:
 - 1) For the purposes of this project, failure is defined as the discontinuance of any attachment point between equipment or structure, vertical permanent deformation greater than 1/8" (3mm) and/or horizontal permanent deformation greater than 1/4" (6mm).
- 5. Submittals:
 - a. Submittal material shall include copies of descriptive data for all products and materials including but not limited to the following:
 - 1) Descriptive Data:
 - a) Catalog cuts or data sheets on vibration isolators and specific restraints detailing compliance with the specification.
 - b) An itemized list showing the items to be isolated and/or seismically restrained, product type or model number to be used and loading and deflection data.
 - 2) Shop Drawings:
 - a) Submit fabrication details for equipment bases including dimensions, structural member sizes and support point locations.
 - b) Provide Drawings showing methods of suspension and support guides for conduit, piping, ductwork and ceiling hung equipment.
 - c) Where walls, floors, slabs or supplementary steel work are used for seismic restraint locations, details of acceptable attachment methods for ducts, conduit and pipe must be included and approved before the condition is accepted for installation. Restraint manufacturers' submittals must include spacing, static loads and seismic loads at all attachment and support points.

- d) Provide specific details of seismic restraints and anchors; include number, size and locations for each piece of equipment.
 - e) Drawings showing methods for isolation of conduits, pipes and ductwork penetrating walls and floor slabs.
 - f) Specific details of restraints including anchor bolts for mounting and maximum loading at each location, for each piece of equipment and/or pipe and duct locations.
- 3) Seismic Certification and Analysis:
- a) Seismic restraint calculations must be provided for all connections of equipment to the structure. Calculations must be stamped by a registered professional engineer with at least five years of seismic design experience, licensed in the state of the job location.
 - b) All restraining devices shall have a preapproval number from California OSHPD or some other recognized government agency showing maximum restraint ratings. Preapprovals based on independent testing are preferred to preapprovals based on calculations. Where preapproved devices are not available, submittals based on independent testing are preferred. Calculations (including the combining of tensile and shear loadings) to support seismic restraint designs must be stamped by a registered professional engineer with at least five years of seismic design experience and licensed in the state of the job location. Testing and calculations must include both shear and tensile loads as well as one test or analysis at 45 degrees to the weakest mode.
 - c) Analysis must indicate calculated dead loads, static seismic loads and capacity of materials utilized for connections to equipment and structure. Analysis must detail anchoring methods, bolt diameter, embedment and/or welded length. All seismic restraint devices shall be designed to accept, without failure, the forces detailed in section 1.06 acting through the equipment center of gravity. Overturning moments may exceed forces at ground level.
6. Contractor's Responsibilities:
- a. Contractor to have the following responsibilities:
 - 1) Determine vibration isolation and seismic restraint sizes and locations per specifications.
 - 2) Provide and install isolation systems and seismic restraints as scheduled or specified.
 - 3) Guarantee specified isolation system deflection.
 - 4) Provide installation instructions, drawings and field supervision to assure proper installation and performance.
 - 5) Provide installation instructions, drawings and trained field supervision to insure proper installation and performance.
 - 6) Substitution of "Internally Isolated" mechanical equipment in lieu of the specified isolation of this section is acceptable.
7. Seismic Force Levels:
- a. Installations shall be designed to safely accept external forces determined in accordance with the International Building Code –2009, Section 16 in any direction for all rigidly supported equipment without failure and permanent displacement of the equipment. Seismic restraints shall not short circuit vibration isolation systems or transmit objectionable vibration or noise.

8. Project Record Documents:

- a. Submit under provision of Division 1.
- b. Record actual locations and installation of vibration isolators and seismic restraints including attachment points.

B. Products:

1. Manufacturers:

- a. Mason Industries Inc. (basis for model numbers listed below).
- b. Novia Associates or equal.

2. Product Descriptions:

a. Vibration Isolators and Seismic Restraint Specifications:

1) Specification 1 – Neoprene Pad:

- a) Two layers of 3/4" (19mm) thick neoprene pad consisting of 2" (50mm) square waffle modules separated horizontally by a 16 (1.5mm) gauge galvanized shim. Load distribution plates shall be used as required.
- b) Pads shall be Type Super "W" as manufactured by Mason Industries, Inc.

2) Specification 2 – Bridge-Bearing Neoprene Mountings:

- a) Bridge-bearing neoprene mountings shall have a minimum static deflection of 0.2" (5mm) and all directional seismic capability. The mount shall consist of a ductile iron casting containing two separated and opposing molded neoprene elements. The elements shall prevent the central threaded sleeve and attachment bolt from contacting the casting during normal operation. The shock absorbing neoprene materials shall be compounded to bridge-bearing specifications. Mountings shall have an Anchorage Preapproval "R" Number from OSHPD in the State of California verifying the maximum certified horizontal and vertical load ratings.
- b) Mountings shall be Type BR as manufactured by Mason Industries, Inc.

3) Specification 3 – Bushing Assemblies:

- a) Sheet metal panels shall be bolted to the walls or supporting structure by assemblies consisting of a neoprene bushing cushioned between 2 steel sleeves. The outer sleeve prevents the sheet metal from cutting into the neoprene. Enlarge panel holes as required. Neoprene elements pass over the bushing to cushion the back panel horizontally. A steel disc covers the inside neoprene element and the inner steel sleeve is elongated to act as a stop so tightening the anchor bolts does not interfere with panel isolation in 3 planes. Bushing assemblies can be applied to the ends of steel cross members where applicable. All neoprene shall be bridge bearing quality.
- b) Bushing assemblies shall be type PB as manufactured by Mason Industries, Inc.

4) Specification 4 - Neoprene Bushing:

- a) A one piece molded bridge bearing neoprene washer/bushing. The bushing shall surround the anchor bolt and have a flat washer face to avoid metal to metal contact.
- b) Neoprene bushings shall be type HG as manufactured by Mason Industries, Inc.

5) Specification 5 – Spring Isolators:

- a) Spring isolators shall be free standing and laterally stable without any housing and complete with a molded neoprene cup or 1/4" (6mm) neoprene acoustical friction pad between the baseplate and the support. All mountings shall have leveling bolts that must be rigidly bolted to the equipment. Spring diameters shall be no less than 0.8 of the compressed height of the spring at rated load. Springs shall have a minimum additional travel to solid equal to 50% of the rated deflection. Submittals shall include spring diameters, deflection, compressed spring height and solid spring height.
- b) Mountings shall be Type SLF as manufactured by Mason Industries, Inc.

6) Specification 6 – Restrained Spring Mountings:

- a) Restrained spring mountings shall have an SLF mounting as described in Specification 5, within a rigid housing that includes vertical limit stops to prevent spring extension when weight is removed. The housing shall serve as blocking during erection. A steel spacer shall be removed after adjustment. Installed and operating heights are equal. A minimum clearance of 1/2" (12mm) shall be maintained around restraining bolts and between the housing and the spring so as not to interfere with the spring action. Limit stops shall be out of contact during normal operation. Since housings will be bolted or welded in position there must be an internal isolation pad. Housing shall be designed to resist all seismic forces. Mountings shall have Anchorage Preapproval "R" Number from OSHPD in the state of California certifying the maximum certified horizontal and vertical load ratings.
- b) Mountings shall be SLR as manufactured by Mason Industries, Inc.

7) Specification 7 – Spring Mountings:

- a) Spring mountings as in specification 5 built into a ductile iron or steel housing to provide all directional seismic snubbing. The snubber shall be adjustable vertically and allow a maximum of 1/4" (6mm) travel in all directions before contacting the resilient snubbing collars. Mountings shall have an Anchorage Preapproval "R" number from OSHPD in the State of California verifying the maximum certified horizontal and vertical load ratings.
- b) Mountings shall be SSLFH as manufactured by Mason Industries, Inc.

8) Specification 8 – Air Springs:

- a) Air Springs shall be manufactured with upper and lower steel sections connected by a replaceable flexible nylon reinforced neoprene element. Air spring configuration shall be multiple bellows to achieve a maximum natural frequency of 3 Hz. Air Springs shall be designed for a burst pressure that is a minimum of three times the published maximum operating pressure. All air spring systems shall be connected to either the building control air or a supplementary air supply and equipped with three leveling valves to maintain leveling within plus or minus 1/8" (3mm). Submittals shall include natural frequency, load and damping tests performed by an independent lab or acoustician.
- b) Air Springs shall be Type MT and leveling valves Type LV as manufactured by Mason Industries, Inc.

9) Specification 9 – Restrained Air Springs:

- a) Restrained air spring mountings shall have an MT air spring as described in Specification

8, within a rigid housing that includes vertical limit stops to prevent air spring extension when weight is removed. The housing shall serve as blocking during erection. A steel spacer shall be removed after adjustment. Installed and operating heights are equal. A minimum clearance of 1/2" (12mm) shall be maintained around restraining bolts and between the housing and the air spring so as not to interfere with the air spring action. Limit stops shall be out of contact during normal operation. Housing shall be designed to resist all seismic forces.

- b) Mountings shall be SLR-MT as manufactured by Mason Industries, Inc.

10) Specification 10 – Hangers:

- a) Hangers shall consist of rigid steel frames containing minimum 1 1/4" (32mm) thick neoprene elements at the top and a steel spring with general characteristics as in specification 5 seated in a steel washer reinforced neoprene cup on the bottom. The neoprene element and the cup shall have neoprene bushings projecting through the steel box. To maintain stability the boxes shall not be articulated as clevis hangers nor the neoprene element stacked on top of the spring. Spring diameters and hanger box lower hole sizes shall be large enough to permit the hanger rod to swing through a 30o arc from side to side before contacting the rod bushing and short circuiting the spring. Submittals shall include a hanger drawing showing the 30o capability.
- b) Hangers shall be type 30N as manufactured by Mason Industries, Inc.

11) Specification 11 – Hangers:

- a) Hangers shall be as described in 10, but they shall be pre-compressed and locked at the rated deflection by means of a resilient seismic upstop to keep the piping or equipment at a fixed elevation during installation. The hangers shall be designed with a release mechanism to free the spring after the installation is complete and the hanger is subjected to its full load. Deflection shall be clearly indicated by means of a scale. Submittals shall include a drawing of the hanger showing the 30o capability.
- b) Hangers shall be type PC30N as manufactured by Mason Industries, Inc.

12) Specification 12 - Seismic Cable Restraints:

- a) Seismic Cable Restraints shall consist of galvanized steel aircraft cables sized to resist seismic loads with a minimum safety factor of two and arranged to provide all-directional restraint. Cables must be pre-stretched to achieve a certified minimum modulus of elasticity. Cable end connections shall be steel assemblies that swivel to final installation angle and utilize two clamping bolts to provide proper cable engagement. Cables must not be allowed to bend across sharp edges. Cable assemblies shall have an Anchorage Preapproval "R" Number from OSHPD in the State of California verifying the maximum certified load ratings.
- b) Cable assemblies shall be Type SCB at the ceiling and at the clevis bolt, SCBH between the hanger rod nut and the clevis or SCBV if clamped to a beam all as manufactured by Mason Industries, Inc.

13) Specification 13 – Seismic Solid Braces:

- a) Seismic solid braces shall consist of steel angles or channels to resist seismic loads with a minimum safety factor of 2 and arranged to provide all directional restraint. Seismic solid brace end connectors shall be steel assemblies that swivel to the final installation angle and

utilize two through bolts to provide proper attachment. Seismic solid brace assembly shall have anchorage preapproval "R" number from OSHPD in the state of California verifying the maximum certified load ratings.

- b) Solid seismic brace assemblies shall be type SSB as manufactured by Mason Industries, Inc.

14) Specification 14 – Rod Clamp Assemblies:

- a) Steel angles, sized to prevent buckling, shall be clamped to pipe or equipment rods utilizing a minimum of three ductile iron clamps at each restraint location when required. Welding of support rods is not acceptable. Rod clamp assemblies shall have an Anchorage Preapproval "R" Number from OSHPD in the State of California.

- b) Rod clamp assemblies shall be Type SRC as manufactured by Mason Industries, Inc.

15) Specification 15 – Clevis Hanger Cross Brace:

- a) Pipe clevis cross bolt braces are required in all restraint locations. They shall be special purpose preformed channels deep enough to be held in place by bolts passing over the cross bolt. Clevis cross braces shall have an Anchorage Preapproval "R" Number from OSHPD in the State of California.

- b) Clevis cross brace shall be type CCB as manufactured by Mason Industries, Inc.

16) Specification 16 - All-Directional Seismic Snubbers:

- a) All-directional seismic snubbers shall consist of interlocking steel members restrained by a one-piece molded neoprene bushing of bridge bearing neoprene. Bushing shall be replaceable and a minimum of 1/4" (6mm) thick. Rated loadings shall not exceed 1000 psi (.7kg/mm²). A minimum air gap of 1/8"(3mm) shall be incorporated in the snubber design in all directions before contact is made between the rigid and resilient surfaces. Snubber end caps shall be removable to allow inspection of internal clearances. Neoprene bushings shall be rotated to insure no short circuits exist before systems are activated.

Snubbers shall have an Anchorage Preapproval "R" Number from OSHPD in the State of California verifying the maximum certified horizontal and vertical load ratings.

- b) Snubber shall be Type Z-1225 as manufactured by Mason Industries, Inc.

17) Specification 17 - All-Directional Seismic Snubbers:

- a) All directional seismic snubbers shall consist of interlocking steel members restrained by shock absorbent rubber materials compounded to bridge bearing specifications. Elastomeric materials shall be replaceable and a minimum of 3/4" (19mm) thick. Rated loadings shall not exceed 1000 psi (.7kg/mm²). Snubbers shall be manufactured with an air gap between hard and resilient material of not less than 1/8" (3mm) nor more than 1/4" (6mm). Snubbers shall be installed with

factory set clearances. The capacity of the seismic snubber at 3/8" (9mm) deflection shall be equal or greater than the load assigned to the mounting grouping controlled by the snubber multiplied by the applicable "G" force. Submittals shall include the load deflection curves up to 1/2" (12mm) deflection in the x, y and z planes. Snubbers shall have an anchorage preapproval "R" number from OSHPD in the state of California verifying the maximum certified horizontal and vertical load ratings.

- b) Snubbers shall be series Z-1011 as manufactured by Mason Industries, Inc.

18) Specification 18 – Stud Wedges:

- a) Stud wedge anchors shall be manufactured from full diameter wire, not from undersized wire that is "rolled up" to create the thread. The stud anchor shall also have a safety shoulder which fully supports the wedge ring under load. The stud anchors shall have an evaluation report number from the I.C.B.O Evaluation Service, Inc. verifying its allowable loads.
- b) Drill-in stud wedge anchors shall be type SAS as manufactured by Mason Industries, Inc.

19) Specification 19 – Female Wedge Anchors:

- a) Female wedge anchors are preferred in floor locations so isolators or equipment can be slid into place after the anchors are installed. Anchors shall be manufactured from full diameter wire, and shall have a safety shoulder to fully support the wedge ring under load. Female wedge anchors shall have an evaluation report number from the I.C.B.O Evaluation Service, Inc. verifying its allowable loads.
- b) Drill-in female wedge anchors shall be type SAB as manufactured by Mason Industries, Inc.

20) Specification 20 – Equipment Bases:

- a) Vibration isolation manufacturer shall furnish integral structural steel bases. Rectangular bases are preferred for all equipment. Centrifugal refrigeration machines and pump bases may be T or L shaped where space is a problem. Pump bases for split case pump shall include supports for suction and discharge elbows. All perimeter members shall be steel beams with a minimum depth equal to 1/10 of the longest dimension of the base. Base depth need not exceed 14" (350mm) provided that the deflection and misalignment is kept within acceptable limits as determined by the manufacturer. Height saving brackets shall be employed in all mounting locations to provide a base clearance of 1" (25mm).
- b) Bases shall be type WF as manufactured by Mason Industries, Inc.

21) Specification 21 – Inertia Foundations:

- a) Vibration isolation manufacturer shall furnish rectangular steel concrete pouring forms for floating and inertia foundations. Bases for split case pumps shall be large enough to provide for suction and discharge elbows. Bases shall be a minimum of 1/12 of the longest dimension of the base but not less than 6" (150mm). The base depth need not exceed 12" (300mm) unless specifically recommended by the base manufacturer for mass or rigidity. Forms shall include minimum concrete reinforcing consisting of 1/2" (12mm) bars welded in place on

6" (150mm) centers running both ways in a layer 1 1/2" (38mm) above the bottom. Forms shall be furnished with steel templates to hold the anchor bolts sleeves and anchors while concrete is being poured. Height saving brackets shall be employed in all mounting locations to maintain a 1" (25mm) clearance below the base. Wooden formed bases leaving a concrete rather than a steel finish are not acceptable.
- b) Base shall be type BMK or K as manufactured by Mason Industries, Inc.

22) Specification 22 – Curbs:

- a) Curb mounted rooftop equipment shall be mounted on spring isolation curbs. The lower member shall consist of a sheet metal Z section containing adjustable and removable steel springs that support the upper floating section. The upper frame must provide continuous support for the equipment and must be captive so as to resiliently resist wind and seismic

forces. All directional neoprene snubber bushings shall be a minimum of 1/4" (6mm) thick. Steel springs shall be laterally stable and rest on 1/4" (6mm) thick neoprene acoustical pads. Hardware must be plated and the springs provided with a rust resistant finish. The curbs waterproofing shall consist of a continuous galvanized flexible counter flashing nailed over the lower curbs waterproofing and joined at the corners by EPDM bellows. All spring locations shall have access ports with removable waterproof covers. Lower curbs shall have provision for 2" (50mm) of insulation. The roof curbs shall be built to seismically contain the rooftop unit. The unit must be solidly fastened to the top floating rail, and the lower Z section anchored to the roof structure. Curb shall have anchorage preapproval "R" from OSHPD in the state of California attesting to the maximum certified horizontal and vertical load ratings.

- b) Curb shall be type RSC as manufactured by Mason Industries, Inc.

23) Specification 23 – Expansion Joints:

- a) Flexible spherical expansion joints shall employ peroxide cured EPDM in the covers, liners and Kevlar7 tire cord frictioning. Any substitutions must have equal or superior physical and chemical characteristics. Solid steel rings shall be used within the raised face rubber flanged ends to prevent pullout. Flexible cable bead wire is not acceptable. Sizes 2" (50mm) and larger shall have two spheres reinforced with a ductile iron external ring between spheres. Flanges shall be split ductile iron or steel with hooked or similar interlocks. Sizes 16" (400mm) to 24" (600mm) may be single sphere. Sizes 3/4" (19mm) to 1 2" (38mm) may have threaded two piece bolted flange assemblies, one sphere and cable retention. Connectors shall be rated at 250 psi (1.72MPa) up to 170o F (77oC) with a uniform drop in allowable pressure to 215 psi (1.48MPa) at 250o F (121oC) in sizes through 14" (350mm). 16" (400mm) through 24" (600mm) single sphere minimum ratings are 180 psi (1.24MPa) at 170o F (77oC) and 150 psi (1.03 MPa) at 250o F (121oC). Higher rated connectors may be used to accommodate

service conditions. All expansion joints must be factory tested to 150% of rated pressure for 12 minutes before shipment. Safety factors to burst and flange pullout shall be a minimum of 3/1. Concentric reducers to the above ratings may be substituted for equal ended expansion joints.

- b) Expansion joints shall be installed in piping gaps equal to the length of the expansion joints under pressure. Control rods need only be used in unanchored piping locations where the manufacturer determines the installation exceeds the pressure requirement without control rods. If control rods are used, they must have 2" (12mm) thick Neoprene washer bushings large enough in diameter to take the thrust at 1000 psi (.7 kg/mm²) maximum on the washer area.
- c) Submittals shall include two test reports by independent consultants showing minimum reductions of 20 DB in vibration accelerations and 10 DB in sound pressure levels at typical blade passage frequencies on this or a similar product by the same manufacturer. All expansion joints shall be installed on the equipment side of the shut off valves.
- d) Expansion joints shall be SAFEFLEX SFDEJ, SFEJ, SFDCR or SFU and Control Rods CR as manufactured by Mason Industries, Inc.

24) Specification 24 – Flexible Stainless Steel Hoses

- a) Flexible stainless steel hose shall have stainless steel braid and carbon steel fittings. Sizes 3" (75mm) and larger shall be flanged. Smaller sizes shall have male nipples. Minimum

lengths shall be as tabulated:

<u>Flanged</u>		<u>Male Nipples</u>	
3 x 14	10 x 26	1/2 x 9	1 1/2 x 13
4 x 15	12 x 28	3/4 x 10	2 x 14
5 x 19	14 x 30	1 x 11	2 1/2 x 18
6 x 20	16 x 32	1 1/4 x 12	
8 x 22			

- b) Hoses shall be installed on the equipment side of the shut-off valves horizontally and parallel to the equipment shafts wherever possible.
- c) Hoses shall be type BSS as manufactured by Mason Industries, Inc.

25) Specification 25 - All-Directional Acoustical Pipe Anchor:

- a) All-directional acoustical pipe anchor, consisting of two sizes of steel tubing separated by a minimum 1/2" (12mm) thick 60 durometer neoprene. Vertical restraint shall be provided by similar material arranged to prevent vertical travel in either direction. Allowable loads on the isolation material should not exceed 500 psi (.35 kg/mm²) and the design shall be balanced for equal resistance in any direction.
- b) All-directional anchors shall be type ADA as manufactured by Mason Industries, Inc.

26) Specification 26 – Pipe Guides:

- a) Pipe guides shall consist of a telescopic arrangement of two sizes of steel tubing separated by a minimum 1/2" (12mm) thickness of 60 durometer neoprene. The height of the guides shall be preset with a shear pin to allow vertical motion due to pipe expansion or contraction. Shear pin shall be removable and reinsertable.

to allow for selection of pipe movement. Guides shall be capable of + 1 5/8" (41mm) motion, or to meet location requirements.
- b) Pipe guides shall be type VSG as manufactured by Mason Industries, Inc.

27) Specification 27 - Split Wall Seals:

- a) Split Wall Seals consist of two bolted pipe halves with minimum 3/4" (19mm) thick neoprene sponge bonded to the inner faces. The seal shall be tightened around the pipe to eliminate clearance between the inner sponge face and the piping. Concrete may be packed around the seal to make it integral with the floor, wall or ceiling if the seal is not already in place around the pipe prior to the construction of the building member. Seals shall project a minimum of 1" (25mm) past either face of the wall. Where temperatures exceed 240o F (115oC), 10# (4.5kg) density fiberglass may be used in lieu of the sponge.
- b) Seals shall be Type SWS as manufactured by Mason Industries, Inc.

28) Specification 28 - Horizontal Thrust Restraint:

- a) The horizontal thrust restraint shall consist of a spring element in series with a neoprene molded cup as described in specification 5 with the same deflection as

specified for the mountings or hangers. The spring element shall be designed so it can be preset for thrust at the factory and adjusted in the field to allow for a maximum of 1/4" (6mm) movement at start and stop. The assembly shall be furnished with 1 rod and angle brackets for attachment to both the equipment and the duct work or the equipment and the structure. Horizontal restraints shall be attached at the centerline of thrust and symmetrical on either side of the unit.

- b) Horizontal thrust restraints shall be type WBI/WBD as manufactured by Mason Industries, Inc.

C. Execution:

1. General:

- a. Vibration isolators and seismic restraint systems shall control excessive noise and vibration in the buildings due to the operation of machinery or equipment, and/or due to interconnected piping, ductwork, or conduit. [The installation of all vibration isolators and seismic restraint units, and associated hangers and bases, shall be under the direct supervision of the vibration isolation manufacturer's representative.]
- b. All vibration isolators and seismic restraint systems must be installed in strict accordance with the manufacturers written instructions and all certified submittal data.
- c. Installation of vibration isolators and seismic restraints must not cause any change of position of equipment, piping or ductwork resulting in stresses or misalignment.
- d. No rigid connections between equipment and the building structure shall be made that degrades the noise and vibration control system herein specified.
- e. The contractor shall not install any equipment, piping, duct or conduit that makes rigid connections with the building unless isolation is not specified. "Building" includes, but is not limited to, slabs, beams, columns, studs and walls.
- f. Coordinate work with other trades to avoid rigid contact with the building.
- g. Any conflicts with other trades that will result in rigid contact with equipment or piping due to inadequate space or other unforeseen conditions should be brought to the architects/engineers attention prior to installation. Corrective work necessitated by conflicts after installation shall be at the responsible contractor's expense.
- h. Bring to the architects/engineers attention any discrepancies between the specifications and the field conditions or changes required due to specific equipment selection, prior to installation. Corrective work necessitated by discrepancies after installation shall be at the responsible contractor's expense.
- i. Correct, at no additional cost, all installations that are deemed defective in workmanship and materials at the contractor's expense.
- j. Overstressing of the building structure must not occur because of overhead support of equipment. Contractor must submit loads to the structural engineer of record for approval. Generally bracing may occur from:
 - 1) Flanges of structural beams.
 - 2) Upper truss cords in bar joist construction.
 - 3) Cast in place inserts or wedge type drill-in concrete anchors.

- k. Specification 12 cable restraints shall be installed slightly slack to avoid short circuiting the isolated suspended equipment, piping or conduit.
 - l. Specification 12 cable assemblies are installed taut on non-isolated systems. Specification 13 seismic solid braces may be used in place of cables on rigidly attached systems only.
 - m. At locations where specification 12 or 13 restraints are located, the support rods must be braced when necessary to accept compressive loads with specification 14 braces.
 - n. At all locations where specification 12 or 13 restraints are attached to pipe clevis's, the clevis cross bolt must be reinforced with specification type 15 braces.
 - o. Drill-in concrete anchors for ceiling and wall installation shall be specification type 18, and specification type 19 female wedge type for floor mounted equipment.
 - p. Vibration isolation manufacturer shall furnish integral structural steel bases as required. Independent steel rails are not permitted on this project. Each fan and motor assembly shall be supported on a single structural steel frame.
 - q. Hand built elastomeric expansion joints may be used when pipe sizes exceed 24" or specified movements exceed specification 23 capabilities.
 - r. Where piping passes through walls, floors or ceilings the vibration isolation manufacturer shall provide specification 27 wall seals.
 - s. Air handling equipment and centrifugal fans shall be protected against excessive displacement which results from high air thrust in relation to the equipment weight. Horizontal thrust restraint shall be specification type 28 (see selection guide).
 - t. Locate isolation hangers as near to the overhead support structure as possible.
 - u. Provide resiliently mounted equipment, piping, and ductwork with seismic snubbers. Each inertia base shall have minimum of four seismic snubbers located close to isolators. 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).
2. Vibration Isolation and Seismic Restraint Installation:
- a. Horizontal pipe isolation: The first three pipe hangers in the main lines near the mechanical equipment shall be as described in specification 11. Specification 11 hangers must also be used in all transverse braced isolated locations. Brace hanger rods with SRC clamps specification 14. Horizontal runs in all other locations throughout the building shall be isolated by hangers as described in specification 10. Floor supported piping shall rest on isolators as described in specification 6. Heat exchanger's and expansion tanks are considered part of the piping run. The first three isolators from the isolated equipment will have the same static deflection as specified for the mountings under the connected equipment. If piping is connected to equipment located in basements and hangs from ceilings under occupied spaces the first three hangers shall have 0.75" (19mm) deflection for pipe sizes up to and including 3" (75mm), 1 1/2" (38mm) deflection for pipe sizes up to and including 6" (150mm), and 2 1/2" (64mm) deflection thereafter. Hangers shall be located as close to the overhead structure as practical. Where piping connects to mechanical equipment install specification 23 expansion joints or specification 24 stainless hoses if 23 is not suitable for the service.
 - b. Riser isolation: Risers shall be suspended from specification 10 hangers or supported by specification 5 mountings, anchored with specification 25 anchors, and guided with specification

26 sliding guides. Steel springs shall be a minimum of 0.75" (19mm) except in those expansion locations where additional deflection is required to limit load changes to + 25% of the initial load. Submittals must include riser diagrams and calculations showing anticipated expansion and contraction at each support point, initial and final loads on the building structure, spring deflection changes and seismic loads. Submittal data shall include certification that the riser system has been examined for excessive stresses and that none will exist in the proposed design.

- c. Building expansion joints: Install swing joints at piping crossing expansion joints and brace piping either side of the expansion joint.
- d. Seismic Restraint of Piping:
 - 1) Seismically restrain all piping listed as a, b or c below. Use specification 12 cables if isolated. Specification 12 or 13 restraints may be used on unisolated piping.
 - a) Fuel oil piping, gas piping, medical gas piping, and compressed air piping that is 1" (25mm) I.D. or larger.
 - b) Piping located in boiler rooms, mechanical equipment rooms, and refrigeration equipment rooms that is 1 1/4" (32mm) I.D. and larger.
 - c) All other piping 2 1/2" (64mm) diameter and larger.
 - 2) Transverse piping restraints shall be at 40' (12m) maximum spacing for all pipe sizes, except where lesser spacing is required to limit anchorage loads.
 - 3) Longitudinal restraints shall be at 80' (24m) maximum spacing for all pipe sizes, except where lesser spacing is required to limit anchorage loads.
 - 4) Where thermal expansion is a consideration, guides and anchors may be used as transverse and longitudinal restraints provided they have a capacity equal to or greater than the restraint loads in addition to the loads induced by expansion or contraction.
 - 5) For fuel oil and all gas piping transverse restraints must be at 20' (6m) maximum and longitudinal restraints at 40' (12m) maximum spacing.
 - 6) Transverse restraint for one pipe section may also act as a longitudinal restraint for a pipe section of the same size connected perpendicular to it if the restraint is installed within 24" (600mm) of the elbow or TEE or combined stresses are within allowable limits at longer distances.
 - 7) Hold down clamps must be used to attach pipe to all trapeze members before applying restraints in a manner similar to clevis supports.
 - 8) Branch lines may not be used to restrain main lines.
 - 9) Cast iron pipe of all types, glass pipe and any other pipes joined with a four band shield and clamp assembly in Zones 2B, 3 and 4 shall be braced as in sections 3.2.D.2 and 3. For Zones 0, 1 and 2A, 2 band clamps may be used with reduced spacings of 1/2 of those listed in sections 3.2.D.2 and 3.
- e. Vibration Isolation of Ductwork:
 - 1) All discharge runs for a distance of 50' (15m) from the connected equipment shall be isolated from the building structure by means of specification 10 hangers or specification 5 floor isolators. Spring deflection shall be a minimum of 0.75" (19mm).
 - 2) All duct runs having air velocity of 1000 fpm (5 m/s) or more shall be isolated from the building structure by specification 11 hangers or specification 5 floor supports. Spring

deflection shall be a minimum of 0.75" (19mm).

- 3) Flexible duct connections shall be provided at inlet and discharge ducts. Refer to Section 15 91 00.
- f. Seismic Restraint of Ductwork:
 - 1) Seismically restrain all duct work with specification 12 or 13 restraints as listed below:
 - a) Restrain rectangular ducts with cross sectional area of 6 sq.ft. (.5 m²) or larger.
 - b) Restrain round ducts with diameters of 28" (700mm) or larger.
 - c) Restrain flat oval ducts the same as rectangular ducts of the same nominal size.
 - 2) Transverse restraints shall occur at 30' (9m) intervals or at both ends of the duct run if less than the specified interval. Transverse restraints shall be installed at each duct turn and at each end of a duct run.
 - 3) Longitudinal restraints shall occur at 60' (18m) intervals with at least one restraint per duct run. Transverse restraints for one duct section may also act as a longitudinal restraint for a duct section connected perpendicular to it if the restraints are installed within 4' (1.2m) of the intersection of the ducts and if the restraints are sized for the larger duct. Duct joints shall conform to SMACNA duct construction standards.
 - 4) The ductwork must be reinforced at the restraint locations. Reinforcement shall consist of an additional angle on top of the ductwork that is attached to the support hanger rods. Ductwork is to be attached to both upper angle and lower trapeze.
 - 5) A group of ducts may be combined in a larger frame so that the combined weights and dimensions of the ducts are less than or equal to the maximum weight and dimensions of the duct for which bracing details are selected.
 - 6) Walls, including gypsum board non-bearing partitions, which have ducts running through them may replace a typical transverse brace. Provide channel framing around ducts and solid blocking between the duct and frame.
 - 7) Chimneys and stacks passing through floors are to be bolted at each floor level or secured above and below each floor with riser clamps and specification type 13 for seismic solid brace restraints.
 - 8) Chimneys and stacks running horizontally to be braced every 30' with specification type 12 seismic cable restraints or specification type 13 for seismic solid brace restraints.
- g. Seismic Restraint of Electrical Services:
 - 1) All electrical conduit 2 1/2" (64mm) in diameter and larger shall be restrained with specification type 12 seismic cable restraints or specification type 13 for seismic solid brace restraints.
 - 2) All electrical bus ducts, cable trays and ladder trays shall be restrained with specification type 12, seismic cable restraints or specification 13 seismic solid brace restraints.
 - 3) Transverse restraints shall occur at 30' (9m) intervals or both ends if the electrical run is less than the specified interval. Transverse restraints shall be installed at each electrical services turn and at each end of the electric run.
 - 4) Longitudinal restraints shall occur at 60' (9m) intervals with at least one restraint per electric run. Transverse restraints for one electric section may also act as a longitudinal restraint for a

duct for an electric section connected perpendicular to it if the restraints are installed within 4' (1.2m) of the intersection of the electric run and if the restraints are sized for the larger electric run.

- 5) All rigid floor mounted equipment must have a resilient media between the equipment mounting hole and the anchor bolt. Anchor bolts shall be designed in accordance with section 1.9 seismic forces. Neoprene bushings shall be specification type 4 and anchor bolts shall be specification type 18 or 19.
 - 6) Wall mounted panels shall be mounted with specification type 3 bushings. Floor mounted panels shall be mounted on specification type 4 bushings. Anchor bolts shall be specification type 18 or 19.
 - h. All fire protection piping shall be braced in accordance with NFPA 13 and 14.
 - i. Vibration Isolation and Seismic Restraint of Mechanical Equipment
 - 1) All mechanical equipment shall be vibration isolated and seismically restrained as per the schedules in part 3.5 of this specification.
 - 2) Equipment mounted on housekeeping pads: Pads shall be properly doweled or expansion shielded to deck to meet acceleration criteria.
 - 3) Requirements for installation on concrete inertia bases shall be as follows:
 - a) Minimum operating clearance between concrete inertia and base and housekeeping pad or floor shall be 2".
 - b) The equipment structural steel or concrete inertia base shall be placed in position and supported temporarily by blocks or shims, as appropriate, prior to the installation of the machine or isolators.
 - c) The isolators shall be installed without raising the machine and frame assembly.
 - d) After the entire installation is complete and under full operational load, the isolators shall be adjusted so that the load is transferred from the blocks to the isolators. When all isolators are properly adjusted, the blocks or shims shall be barely free and shall be removed.
 - e) Install equipment with flexibility in wiring connection.
 - f) Verify that all installed isolator and mounting systems permit equipment motion in all directions. Adjust or provide additional resilient restraints to flexibly limit start-up equipment lateral motion to 1/4".
 - g) Prior to start-up, clean out all foreign matter between bases and equipment. Verify that there are no isolation short circuits in the base, isolators, or seismic restraints.
3. Seismic Restraint Exclusions:
- a. General: All mechanical and electrical components and systems that are considered exempt from the requirement for seismic restraint, in accordance with The International Building Code – 2003, Section 1621, shall not require seismic restraint.
 - b. Piping:
 - 1) Piping in boiler and mechanical rooms less than 1 1/4" (32mm) inside diameter.
 - 2) All other piping less than 2 1/2" (64mm) inside diameter.

- 3) All piping suspended by individual hangers 12" (300mm) or less as measured from the top of the pipe to the bottom of the support where the hanger is attached. However, if the 12" (300mm) limit is exceeded by any hanger in the run, seismic bracing is required for the run.
 - 4) The 12" (300mm) exemption applies for trapeze supported systems if the top of each item supported by the trapeze qualifies.
- c. Ductwork:
- 1) Rectangular and square and ducts that are less than 6 square feet in cross sectional area.
 - 2) Oval ducts that are less than 6 square feet (.5m²) in cross sectional area based on nominal size.
 - 3) Round duct less than 28" (.5m²) in diameter.
 - 4) All duct suspended by hangers 12" (300mm) or less in length as measured from the top of the duct to the point of attachment to the structure. Hangers must be attached within 2" (50mm) of the top of the duct with a minimum of two #10 sheet metal screws. If the 12" (300mm) limit is exceeded by any hanger in the run, seismic bracing is required for the run.
- d. Electrical:
- 1) All conduit less than 2 1/2" (64mm) diameter suspended by individual hanger rods.
 - 2) All conduits suspended by individual hangers 12" (300mm) or less as measured from the top of the conduit to the bottom of the support where the hanger is attached. However, if the 12" (300mm) limit is exceeded by any hanger in the run, seismic bracing is required for the run.
 - 3) The 12" (300mm) exemption applies for trapeze supported systems if the top of each item supported by the trapeze qualifies.
4. Inspection:
- a. Examine systems under provisions of Division 1.
 - b. On completion of installation of all vibration isolation devices herein specified, the local representative shall inspect the completed system and report in writing any installation error, improperly elected isolation devices, or other faults in the system that could affect the performance of the system. Contractor shall submit a report to the Owner, including the manufacturers representatives' final report, indicating all isolation reported as properly installed or requiring correction, and include a report by the Contractor on steps taken to properly complete the isolation work.

5. Schedules:

SPECIFICATION SELECTION GUIDE	ISOLATION, DEFLECTION AND SEISMIC RESTRAINT CRITERIA FOR SOLID CONCRETE FLOORS 4" AND THICKER (NOTE 7)									
	Ground Supported Slab or Basement		20' Floor Span Possible Floor Defl. – 0.67"		30' Floor Span Possible Floor Defl. – 1.0"		40' Floor Span Possible Floor Defl. – 1.33"		50' Floor Span Possible Floor Defl. – 1.67"	
	Isol. & Seismic Spec.	Isol. Defl.	Isol. & Seismic Spec.	Isol. Defl.	Isol. & Seismic Spec.	Isol. Defl.	Isol. & Seismic Spec.	Isol. Defl.	Isol. & Seismic Spec.	Isol. Defl.
REFRIG. MACHINES Reciprocating Chillers or Heat Pumps 500 rpm to 750 rpm 751 rpm and Over	6-23	0.75	6-23	1.5	6-23	1.5	6-20-23	2.5	6-20-23	3.5
	6-23	0.75	6-23	0.75	6-20-23	1.5	6-20-23	2.5	6-20-23	3.5
PUMPS Closed Coupled Thru 5 hp 7 ½ hp and Larger	2-21-23	0.35	5-16- 21-23	0.75	5-16- 21-23	0.75	5-16- 21-23	1.5	5-16- 21-23	1.5
	5-16- 21-23	0.75	5-16- 21-23	0.75	5-16- 21-23	1.5	5-16- 21-23	1.5	5-16- 21-23	2.5
FACTORY ASSEMBLED H & V UNITS Curb Mounted Roof Top Units Suspended Units (for Fan Heads see Blowers Guide) Thru 5 hp 7 ½ hp and Larger – 275 rpm to 400 rpm			22	1.0	22	2.5	22	2.5	22	2.5
	10-12	1.0	10-12	1.0	10-12	1.0	10-12	1.0	10-12	1.0
	10-12	1.5	10-12	1.5	10-12	1.5	10-12	1.5	10-12	1.5

SPECIFICATION SELECTION GUIDE	ISOLATION, DEFLECTION AND SEISMIC RESTRAINT CRITERIA FOR SOLID CONCRETE FLOORS 4" AND THICKER (NOTE 7)									
	Ground Supported Slab or Basement		20' Floor Span Possible Floor Defl. – 0.67"		30' Floor Span Possible Floor Defl. – 1.0"		40' Floor Span Possible Floor Defl. – 1.33"		50' Floor Span Possible Floor Defl. – 1.67"	
	Isol. & Seismic Spec.	Isol. Defl.	Isol. & Seismic Spec.	Isol. Defl.	Isol. & Seismic Spec.	Isol. Defl.	Isol. & Seismic Spec.	Isol. Defl.	Isol. & Seismic Spec.	Isol. Defl.
7 ½ hp and Larger – 401 rpm and Over	10-12	1.0	10-12	1.0	10-12	1.0	10-12	1.5	10-12	2.5
AIR COMPRESSOR										
Tank Mounted Type	5-16- 21-24	0.75	5-16- 21-24	0.75	5-16- 21-24	1.5	5-16- 21-24	2.5	5-16- 21-24	3.5
V – W Type Horz, Vert, 1 or 2 Cylinders	5-16- 21-24	0.75	5-16- 21-24	0.75	5-16- 21-24	1.5	5-16- 21-24	2.5	5-16- 21-24	3.5
275 rpm to 499 rpm	5-16- 21-24	2.5	5-16- 21-24	2.5	5-16- 21-24	2.5	5-16- 21-24	3.5	5-16- 21-24	3.5
500 rpm to 800 rpm	5-16- 21-24	1.5	5-16- 21-24	1.5	5-16- 21-24	2.5	5-16- 21-24	3.5	5-16- 21-24	3.5

SPECIFICATION SELECTION GUIDE	DEFLECTION AND MOUNTING CRITERIA FOR SOLID CONCRETE FLOORS 4" OR THICKER (NOTE 7)				
	Ground Supported Slab or Basement	20' Floor Span Possible Floor Defl. – 0.67"	30' Floor Span Possible Floor Defl. – 1.0"	40' Floor Span Possible Floor Defl. – 1.33"	50' Floor Span Possible Floor Defl. – 1.67"
	Min Static Defl (in) (note 1)	Engineer Specifications and Minimum Static Deflection as tabulated below (note 1)			
Blowers					
Utilities Set					

SPECIFICATION SELECTION GUIDE	DEFLECTION AND MOUNTING CRITERIA FOR SOLID CONCRETE FLOORS 4" OR THICKER (NOTE 7)				
	Ground Supported Slab or Basement	20' Floor Span Possible Floor Defl. – 0.67"	30' Floor Span Possible Floor Defl. – 1.0"	40' Floor Span Possible Floor Defl. – 1.33"	50' Floor Span Possible Floor Defl. – 1.67"
	Min Static Defl (in) (note 1)	Engineer Specifications and Minimum Static Deflection as tabulated below (note 1)			
Floor Mounted (note 5)	2	0.35	Spec 7 for 0.75" and 1/5" deflection and Spec 5-20-16 for over 1.5" deflection with deflection from Blower Minimum Deflection Guide, but not to exceed 2.5"		
Roof Mounted			Spec 5-21-16 with deflection from Blower Minimum Deflection Guide. If roof will not handle concrete base load use Spec 6 for 0.75 and 1.5" deflection and Spec 6-20 for over 1.5" deflection		
Suspended Unit (note 5)			Spec 10-12 with deflection from Blower Minimum Deflection Guide, not to exceed 2.5" deflection		
Centrifugal Blowers (note 6)	2-21	0.35	Spec 5-21-16 with deflection from Blower Minimum Deflection Guide		
Fan Heads					
Floor Mounted	2-28	0.35	Spec 7-28 if 0.75" or 1.5" deflection or Spec 5-20-16-28 for deflection over 1.5" to 4.5" from Blower Minimum Deflection Guide.		
Suspended Units			Spec 10-12-28 with deflection from Blower Minimum Deflection Guide		
Tubular Centrifugal and Axial Fans					
Suspended Units			Spec 10-12 with deflection from Blower Minimum Deflection Guide, Spec 10-12-28 for over 4" static pressure		
Floor Mounted with Motor on/in Fan Casing	2	0.35	Spec 7 for 0.75" to 1.5" deflection and Spec 5-20-16 for over 1/5" deflection with deflection from Blower Minimum Deflection Guide, Spec 5-21-16 or 5-16-28 for over 4" static pressure		
Floor Mounted Arrangement 1 or any Separately Mounted Motor	2-21	0.35	Spec 5-21-16 with deflection from Blower Minimum Deflection Guide		
Cooling Towers & Condensing Units	2	0.35	Spec 6 with deflection from Blower Minimum Deflection Guide		

Blower Minimum Deflection Guide					
Fan Speed RPM	Required Deflection for Ground Supported Slab or Basement	Required Deflection for 20' Floor Span	Required Deflection for 30' Floor Span	Required Deflection for 40' Floor Span	Required Deflection for 50' Floor Span
500 and up	0.35"	0.75"	1.5"	2.5"	3.5"
375-499	0.35"	1.5"	2.5"	3.5"	3.5"
300-374	0.35"	2.5"	2.5"	3.5"	3.5"
225-299	0.35"	3.5"	3.5"	3.5"	3.5"
175-225	0.35"	3.5"	4.5"	4.5"	4.5"
When blowers are 60 HP or larger, select deflection requirements for next larger span. A minimum of 2.5" should be used unless larger deflections are called for on the chart or these fans are located in the lowest sub-basement or on a slab on grade.					

6. Notes:

- a. Minimum deflection called for in this specification are not 'nominal' but certifiable minimums. The 0.75", 1.5", 2.5", 3.5", and 4.5" minimums should be selected from manufacturer's nominal 1", 2", 3", 4" and 5" series respectively. Air spring isolation specifications 8 & 9 may be substituted for steel springs above in highly sensitive noise free locations.
- b. Vacuum, Condensate or Boiler Feed Pumps shall be mounted with their tanks on a common spec. 21 base with deflections as specified for base mounted pumps.
- c. The base described in specification 20 is used under the drive side. Individual mountings as described in specification 6 are used under the Cooler and Condenser.
- d. This type of compressor is highly unbalanced and sometimes requires inertia bases weighing 5 to 7 times equipment weight to reduce running motion.
- e. Limit deflection f or utility sets 18" wheel diameter and smaller to 1 1/2".
- f. FLOATING CONCRETE INERTIA BASES. Floating concrete inertia bases do not reduce vibration transmitted to the structure through the mountings. These bases will reduce vibratory motion, provide a very rigid machine base and minimize spring reactions to fan thrust. Engineers preferring steel bases rather than the concrete mentioned above in specification 5-21 should change the designation to 5-20. Concrete is preferred for all fans operating at static pressure above 4" and on roof tops.
- g. LIGHT FLOOR CONSTRUCTION. When floors or roofs are lighter than 4" solid concrete a localized mass shall be introduce under the vibration mountings in the form of a sub-base. This sub-base should be 12" thick and 12" longer and wider than the mechanical equipment above it. When this mass is provided the 30' minimum static deflection requirements will suffice even in longer bays. The mass is also useful for unusually large bays over 50'. When floors are lighter than the 4" concrete or the location is in a particularly sensitive area and the mass described above cannot be introduced, select deflection requirements for the next larger span.
- h. For equipment where increased resiliency and decreased accelerations are required change

specification 16 snubbers to specification 17 snubbers.

2.18 ROOF PENETRATION SYSTEM

A. Manufacturers:

1. Acceptable Manufacturer: Roof Penetration Housings, or engineer approved equal.
2. Warranty: Product to Carry a 20-Year Limited Insured Warranty.

B. The Vault®:

1. Product: The Vault® by Roof Penetration Housings.
2. Construction:
 - a. 0.080 inch (2mm) thick aluminum housing and curb.
 - b. UV protected powder coated finish (2 mil (.05 mm) thick).
 - c. Stainless Steel. V.P. fasteners.
 - d. Gasketed lid to housing and housing to curb connection joints to ensure compliance to ICC 2015 Air Permeance Levels.
 - e. Standard Color: Bright White to meet an initial SRI of 88.2 .
 - f. Seismic Available upon request. Seismic calculations, conditions to be furnished to RPH by engineer.
 - g. Constructed to withstand wind to 225+ MPH, third party tested.

C. Style & Sizes:

1. Series AWI Vault – All Aluminum Construction, Zero Plastic, Wind rated to +225 mph and pre-insulated (R-2 for Condensate) V.P./S.S. Fasteners meets ICC 2015 Energy Code for Air Permeance Levels. Pre-Insulated curb, 6” Thick, R-40 Factor, to meet ICC – 2015 Energy Code.
 - a. Small Vault®
 - 1) Model: AWI-161010
 - 2) L – 16 ½” W – 9 ¾” H – 10”
 - b. Medium Vault®
 - 1) Model: AWI-201412
 - 2) L – 20 ½” W – 14 ½” H – 12”
 - c. Mega Vault®
 - 1) Model: AWI-343424
 - 2) L – 34” W – 34” H – 24”
- a) NOTES:

(1) Exit Seal capacities are dependent on size of seals required. Based on Series 5000.

- (2) Products shown may not reflect current design refinements. Dimensions may vary.
- d. ICE Pre-Insulated curb extension: Aluminum Extension between housing and curb is 7" wide on each side of Vault® to accommodate 6" Insulation (R-40 Rating) supplied by RPH on the outside of the curb, +1" to accommodate roofing material.
 - 1) NOTE: Sizes above – housing only – Specifier to choose:
 - a) 14" or 18" curb (18" recommended for AWI Series).
 - b) Add curb height to housing height less 3" for overlap.
 - 2. Exit Seals: Design: Weather tight seal for vertical surface/plane penetrations. Seal construction to be manufactured in all aluminum construction and 100% Sil-X-14 silicone gaskets.
 - a. Series 5000 - .25" to 1.90"
 - b. Series 6000 – 2" to 3.125"
 - c. Series 7000 – 3.5" Large Diameter Double Gasketed inside and out
 - d. Penetration Pipe Type as Applicable: Copper K and L, copper ACR, steel Schedule 40, PVC Schedule 40 and 80, electrical EMT, electrical rigid, aluminum, liquid light, and A/C or Plumbing Ducts.

2.19 DEDICATED OUTDOOR AIR SYSTEMS

A. General:

- 1. The supply and return openings shall be available as vertical airflow, vertical/horizontal airflow, or convertible between vertical/horizontal.
- 2. Cooling performance shall be rated in accordance with ETL testing procedures.
- 3. All units shall be factory assembled, internally wired, fully charged with R-410A, and 100% run tested to check cooling operation, fan and blow rotation, and control sequence before leaving the factory.
- 4. Wiring internal to the unit shall be colored and numbered for simplified identification.
- 5. Units shall be ETL listed and labeled, classified in accordance to UL 1995/CAN/CSA No. 236-M40 for Central Cooling Air Conditioners.
- 6. The basis of design shall be Trane. Acceptable equals shall be Carrier, Daikin or Greenheck.

B. Casing:

- 1. Unit casing shall be constructed of zinc-coated, heavy gauge, galvanized steel.
- 2. Exterior surfaces shall be cleaned, phosphatized, and finished with a weather-resistant baked enamel finish.
- 3. Unit's surface shall be tested 672 hours in a salt spray test in compliance with ASTM B117.
- 4. Unit shall have a 2-inch thick Antimicrobial Insulation with an R-value of 13. All insulation edges shall

be either captured or sealed.

5. The unit's base pan shall have no penetrations within the perimeter of the curb other than the raised downflow supply/return openings to provide an added water integrity precaution, if the condensate drain backs up.
6. The top cover shall be one piece construction or, where seams exist, it shall be double-hemmed and gasket-sealed. The ribbed top adds extra strength and enhances water removal from unit top.

C. Drain Pan:

1. The drain pan is a single-walled assembly made of Type 430 stainless steel.
2. It is sloped in two planes and is fully drainable.
3. The coils are mounted above the drain pan to allow easy inspection and cleaning of the drain pan.

D. Refrigeration and Dehumidification Systems:

1. Compressors:
 - a. All units shall have direct-drive, hermetic, scroll type compressors with centrifugal type oil pumps.
 - b. Motor shall be suction gas-cooled and shall have a voltage utilization range of plus or minus 10 percent of unit nameplate voltage.
 - c. Internal overloads shall be provided with the scroll compressors. Each compressor has a crankcase heater to minimize the amount of liquid refrigerant present in the oil sump during off cycles.
2. Evaporator and Condenser Coils:
 - a. Internally finned copper tubes mechanically bonded to a configured aluminum plate fin shall be standard.
 - b. Coils shall be leak tested at the factory to ensure the pressure integrity. The evaporator coil and condenser coil shall be leak tested to 500 psig and pressure tested to 500 psig.
 - c. The condenser coil shall have a fin design with slight gaps for ease of cleaning.
 - d. Evaporator coil will have four or six interlaced rows for superior sensible and latent cooling.
3. Refrigerant Capacity Control:
 - a. Units with standard scroll compressors shall be equipped with Refrigerant Capacity Control (RCC) on the lead circuit to ensure proper modulation of cooling.
 - b. The RCC uses mechanical means to monitor and inject hot gas into the suction side of the compressor, unloading the compressor in part load conditions.
 - c. The RCC is factory-set at 114 psig, which will maintain evaporator coil temperature at 38°F.
 - d. Units with eFlex™ variable speed scroll compressors are matched with a specially designed variable frequency drive that allows a modulating ratio of up to 4:1.
 - e. The eFlex compressors also include brushless permanent magnet motors designed to operate at higher efficiency resulting in significant part load energy savings.

- f. Units with digital scroll type compressors shall have direct-drive, hermetic compressors with centrifugal type oil pumps.
- g. Motor shall be suction gas-cooled and shall have a voltage utilization range of plus or minus 10 percent of unit nameplate voltage.
- h. Internal overloads shall be provided with the scroll compressors.
- i. Crankcase heaters shall be included. Compressor shall be able to fully modulate from 20 percent to 100 percent.

E. Total Energy Wheel:

- 1. The rotating wheel heat exchanger is composed of a rotating cylinder in an insulated cassette frame
- 2. complete with seals, drive motor, and drive belt.
- 3. The total-energy recovery wheel is coated with silica gel desiccant permanently bonded by a patented and proprietary process without the use of binders or adhesives, which may degrade desiccant performance. The substrate is a lightweight polymer and will not degrade nor require additional coatings for application in marine or coastal environments. Coated segments are washable with detergent or alkaline coil cleaner and water.
- 4. Desiccant will not dissolve nor deliquesce in the presence of water or high humidity.
- 5. As the wheel rotates between the ventilation and exhaust air streams it picks up sensible and latent heat energy and releases it into the colder air stream.
- 6. The driving force behind the exchange is the difference in temperatures between the opposing air streams which is also called the thermal gradient.
- 7. Bypass dampers will be provided on both the outside and exhaust air paths.

F. Supply and Exhaust Fan and Motors:

- 1. Fan motor shall be direct drive type with factory installed variable frequency drive. All motors shall be thermally protected. All indoor fan motors meet the U.S. Energy Policy Act of 2005 (EPACT).
- 2. Fan shall be high efficiency backward curved impeller. The motor shall be an electronic commuted motor (ECM) with integrated power electronics.

G. Condenser Fan and Motors:

- 1. The outdoor fan shall be direct-drive, statically and dynamically balanced, draw-through in the vertical discharge position.
- 2. The fan motor shall be permanently lubricated and shall have built-in thermal overload protection.

H. Dampers – Low Leak:

- 1. The outside air damper has a unit-controlled actuator with parallel-blades.

2. The blade construction is a 14-gage galvanized steel, roll-formed airfoil-type.

I. Electrical and Controls:

1. Controls:

- a. Unit is completely factory-wired with necessary controls and contactor pressure lugs for power wiring.
- b. Units will provide an external location for mounting fused disconnect device.
- c. Microprocessor controls are provided for all 24-volt control functions.
- d. The resident control algorithms will make all heating, cooling and/or ventilating decisions in response to electronic signals from sensors measuring outdoor temperature and humidity.
- e. The control algorithm maintains accurate temperature control, minimizes drift from set point, and provides better building comfort.
- f. A centralized micro-processor (RTRM) will provide anti-short cycle timing for a higher level of machine protection.
- g. Terminals are provided for a field installed dry contact or switch closure to put the unit in the Occupied or Unoccupied modes.

J. Indirect Gas-Fired Heating (Option):

1. Primary heat is supplied using indirect fired gas heating.
2. The heating section shall have a progressive tubular heat exchanger design using stainless steel burners and Type 409 stainless steel tubes.
3. An induced draft combustion blower shall be used to pull the combustion products through the firing tubes.
4. The heater shall use a direct spark ignition (DS) system. On initial call for heat, the combustion blower shall purge the heat exchanger for 20 seconds before ignition. After three unsuccessful ignition attempts, the entire heating system shall be locked out until manually reset at the unit.
5. Units shall be comply with the California requirement for low NOx emissions.
6. Unit shall be suitable for use with Natural Gas.

K. Filters (Option):

1. Adjustable 6-inch filter rack with 2-inch MERV-13 installed just upstream of the evaporator coil.
2. In addition, 2-inch aluminum mesh mist eliminators are located in the intake hood for OAD, OAK, and OAN; a bird screen is provided for OAB and OAG.
3. Other options include 120 V UVC downstream of the evaporator coil, and 2-inch, 24 V electrostatic filters.
4. Filter status switch: option shall be included and indicated when filters require cleaning or replacement.

The filter status switch triggers an information only diagnostic message on the human interface and will allow continued unit operation.

2.20 PACKAGED ROOFTOP HVAC UNITS

A. General:

1. The contractor shall furnish and install packaged rooftop units as shown and schedule on the Contract Documents. The units shall be installed in accordance with this specifications and perform at the specified conditions as scheduled.
2. Approved Manufacturers: Basis of design shall be Trane. Acceptable equals shall be Daikin or Carrier.
3. Unit(s) furnished and installed shall be DX cooling, gas heat packaged rooftop (s) as scheduled on contract documents and these specifications. Cooling capacity ratings shall be based on AHRI Standard. Unit(s) shall consist of insulated weather-tight casing with compressor(s), air-cooled condenser coil, condenser fans, evaporator coil, return-air filters, supply motors and unit controls.
4. Unit(s) shall be 100% factory run tested and fully charged with R-410A.
5. Unit(s) shall have labels, decals, and/or tags to aid in the service of the unit and indicate caution areas.
6. Units shall be convertible airflow design as manufactured.
7. Wiring internal to the unit shall be colored and numbered for identification.

B. Unit Casing:

1. Cabinet: Galvanized steel with baked enamel finish. Structural members with access doors and removable panels shall be a minimum 22 gauge.
2. Unit's cabinet surface shall be tested 672 hours in salt spray test in compliance with ASTM B117.
3. Cabinet construction shall allow for all service/ maintenance from one side of the unit.
4. Cabinet top cover shall be one piece construction or where seams exists, it shall be double-hemmed and gasket-sealed.
5. Access Panels: Water- and air-tight panels with handles shall provide access to filters, heating section, return air fan section, supply air fan section, evaporator coil section, and unit control section.
6. Unit's base pan shall have a raised 1 1/8 inch high lip around the supply and return openings for water integrity.
7. Provide 1/2 inch foil faced, fire retardant permanent, odorless glass fiber material. All edges must be captured so that there is no insulation exposed in the air stream.
8. The base pan shall have no penetrations within the perimeter of the curb other that the raised 1 1/8 inch high down flow supply/return openings to provide and added water integrity precaution.

9. Provide openings either on side of unit or through the base for power, control, condensate, and gas connections.
10. The base of the unit shall have 3 sides for forklift provisions. The base of the units shall have rigging/lifting holes for crane maneuvering.

C. Air Filters:

1. Air Filters: Factory installed filters shall mount integral within the unit and shall be accessible through access panels. Two-inch thick glass fiber disposable media filters shall be provided.
2. Two inch MERV 8 and MERV 13 media filters shall be available option.

D. Fans and Motors:

1. Provide evaporator fan section with forward curved, double width, double inlet, centrifugal type fan.
2. Provide self-aligning, grease lubricated, ball or sleeve bearings with permanent lubrication fittings.
3. Supply fan shall have variable speed direct drive motors. All indoor fan motors meet the U.S. Energy Policy Act of 1992 (EPACT).
4. Provide shafts constructed of solid hot rolled steel, ground and polished, with key-way, and protectively coated with lubricating oil.

E. Gas-fired Heating Section:

1. Completely assembled and factory installed heating system shall be integral to unit, UL or CSA approved specifically for outdoor applications for use downstream from refrigerant cooling coils. Threaded connection with plug or cap provided.
2. Heating section shall be factory run tested prior to shipment.
3. Induced draft combustion type with direct spark ignition system, redundant main gas valve, and 2-staged heat (6-10 ton).
4. Gas Burner Safety Controls: Provide safety controls for the proving of combustion air prior to ignition, and continuous flame supervision. Provide flame rollout switches.
5. Induced draft blower shall have combustion air proving switches and built-in thermal overload protection on fan motor.
6. Units shall be suitable for use with natural gas or propane (field-installed kit) and also comply with the California Requirement for low NOx emission (Gas/Electric only).
7. Heat Exchanger: Provide tubular section type Constructed of 409 stainless steel.
8. Through the base gas piping- the units shall include a standard through the base gas provision. This option shall have all piping necessary including black steel, manual gas shut off valve, elbows, and union. The manual shutoff valve shall include a 1/8 NPT pressure tap.

9. Burners: Burners shall be of the in-shot type constructed of stainless steel.
10. Limit controls: High temperature limit controls will shut off gas flow in the event of excessive temperatures resulting from restricted indoor airflow or loss of indoor airflow.

F. Evaporator Coil and Section:

1. Evaporator coil shall be constructed of copper tubes, mechanically bonded to aluminum fins.
2. Provide an independent expansion device for each refrigeration circuit. Factory pressure tested at 600 psig and leak tested at 465 psig.
3. Provide a removable, reversible, cleanable double sloped drain pan for base of evaporator coil constructed of PVC.
4. Provide clogged Filter Switch. The indication will be registered with either a zone sensor with status indication lights or an integrated comfort system. This option is available for microprocessor controlled units.
5. Provide Fan Failure Switch. The indication will be registered with either a zone sensor with status indication lights or an integrated comfort system. This option is available for microprocessor controlled units.
6. Provide Discharge Air Sensing Tube
7. Provide a removable, reversible, cleanable double sloped drain pan for base of evaporator coil constructed of Stainless Steel
8. Unit shall include a condensate overflow switch to shut the unit down in the event that a clogged condensate drain line prevents proper condensate removal from the unit.

G. Condenser Section:

1. Provide vertical discharge, direct drive fans with aluminum blades. Fans shall be statically balanced. Motors shall be permanently lubricated, with integral thermal overload protection in a weather tight casing.
2. Condenser coil shall be all aluminum microchannel.
3. Provide tool-less factory installed corrosion resistant louvered hail/vandalism guards to protect condenser coils from hail or physical damage.
4. Provide corrosion protected Condenser Coil Option that shall include an all-aluminum Microchannel. Condenser coil protection shall consist of a corrosion resistant coating that shall withstand ASTM B117 Salt spray test for 6000 Hours and ASTM G85 A2 cyclic Acidified salt for test for 2,400 hours. This coating shall be added after coil construction covering all tubes , headers and fin edges, therefore providing optimum protection in more corrosive environments.

H. Refrigeration System:

1. All units shall have direct drive hermetic, scroll type compressors with centrifugal type oil pumps. Motor shall be suction gas cooled and shall have a voltage utilization range of plus or minus 10 percent of unit nameplate.
2. 17 Plus series shall be 2 stage scroll type compressors with centrifugal type oil pumps. Motor shall be suction gas cooled and shall have a voltage utilization range of plus or minus 10 percent of unit nameplate.
3. E-flex variable speed compressor shall be capable of speed modulation from 15Hz to a maximum of 60Hz. The minimum unit capacity shall be 25% of full load. The compressor motor shall be a permanent magnet type. Each variable speed compressor shall be matched with a specially designed refrigerant cooled , variable frequency drive which modulates the speed of the compressor motor and provides several compressor protection functions.
4. Provide with thermostatic temperature motor winding control for protection against excessive temperatures caused by over/under voltage operation or loss of charge. Also provide high and low pressure switches.
5. Thermal Expansion valves are standard for all models.
6. Units shall have cooling capabilities down to 0 degree F as standard with microprocessor controls (40 degrees F with electromechanical controls. For field-installed low ambient accessory, the manufacturer shall provide a factory-authorized service technician that will assure proper installation and operation.
7. Provide each unit with <<CIRCUIT_AMOUNT>> refrigerant circuit(s) factory-supplied completely piped with liquid line filter-drier, suction and liquid line pressure ports.
8. For heat pump units, provide reversing valve, discharge muffler, flow control check valve, and electronic adaptive demand defrost control on all units.
9. Provide high efficiency unit with 3 stages of cooling.
10. Provide ultra-high efficiency with eflex variable speed technology

I. Outdoor Air Section:

1. Low leak Economizer with comparative enthalpy dampers shall be provided with airfoil blades. Dampers shall have a leakage rate of 3 CFM/sq-ft a 1.0 in WC differential.
2. Provide Fault Detection and Diagnostics (FDD) control.
3. Provide adjustable minimum position control located in the economizer section of the unit.

J. Operating Controls:

1. General: Microprocessor controls shall be provided for all 24 volt control functions. The resident control algorithms shall make all heating, cooling and ventilation decisions in response to electronic signals from sensors measuring indoor and outdoor temperatures. The control algorithm maintains

accurate temperature control, minimizes drift from setpoint and provides better building comfort. A centralized microprocessor shall provide anti-short cycle timing and time delay between compressors to provide a higher level of machine protection.

2. True / Multi-Zone VAV. Provide all necessary controls to operate a vav rooftop from supply air temperature including microprocessor controller and supply air sensor. The microprocessor shall coordinate the economizer control and stages of cooling with supply air temperature reset capability based upon temperature.
3. Ventilation Override: Provide factory installed, tested and commissioned ventilation override controls. Binary input from independent fire/life safety panel shall cause unit to override standard operation and assume one of two factory preset ventilation sequences: Purge or pressurization.
4. Clogged filter indication: Provide factory installed differential pressure switch to indicate filter replacement status. Differential pressure switch shall cause a contact closure to display a service indication and unit will continue to operate normally.
5. Discharge Air Temperature Sensing: Provides true discharge air temperature sensing in heating models. This sensor is a status indicator readable through Tracer or Tracker. For Microprocessor controlled units only.
6. Provide factory-installed indoor evaporator defrost control to prevent compressor slugging by interrupting compressor operation.
7. Economizer Preferred Cooling - Compressor operation is integrated with economizer cycle to allow mechanical cooling when economizer is not adequate to satisfy zone requirements. Compressors are enabled if space temperature is recovering to cooling setpoint at a rate of less than 0.2 degrees per minute. Compressor low ambient lockout overrides this function.

K. Staging Controls:

1. Provide programmable electronic microprocessor based zone control.
 - a. Zone control shall incorporate:
 - 1) Automatic changeover from heating to cooling.
 - 2) Set-up for at least 2 - sets of separate heating and cooling temperatures per day.
 - 3) Instant override of setpoint for continuous or timed period from one hour to 31 days.
 - 4) Switch selection features including Fahrenheit display, 12 or 24-hour clock, keyboard disable, remote sensor, fan on-auto.
 - 5) Smart Fan Operation: Allows the unit fan operation to default to the Auto Mode during unoccupied periods, regardless of the Fan switch position.
 - 6) Economizer Minimum Position Override: Allows the unit controller to override and close the minimum position setting on the economizer damper during unoccupied time periods.
 - b. Zone sensor display shall be capable of:
 - 1) Time of day.
 - 2) Actual room temperature.

- 3) Programmed temperature.
 - 4) Programmed time.
 - 5) Duration of timed override.
 - 6) Day of week.
 - 7) System mode indication: heating, cooling, low battery, and fan on.
2. Provide remote temperature sensor capability.
 3. Provide mixed air sensor in supply air to close outside air damper.
 4. Provide Wireless Zone Sensor: LCD display that provides heat, cool, auto or off. Includes two temperature setpoints and a lockable settings.

L. Roof Curbs:

1. Contractor shall provide factory supplied roof curb, 16 gauge perimeter made of zinc coated steel with supply and return air gasketing and wood nailer strips. Ship knocked down and provided with instructions for easy assembly.
2. Curb shall be manufactured in accordance with the National Roofing Contractors Association guidelines.

2.21 AUTOMATIC TEMPERATURE CONTROLS

A. Provide and install a Building Management System as outlined in subsequent section Facility Management & Control System (FMCS). Provide all sensors, wiring, relays and all required accessories for a complete operational networked control system as described herein.

B. Thermostats (space temperature sensors):

1. Units shall be low voltage (24 VAC) wired from the internal low voltage circuit of the equipment served plus include battery backup.
2. Mounting: (2) screws for unit back-plate wall mounting.
3. Each unit shall provide a backlit, liquid crystal display (LCD) touch-screen with the following minimum features:
 - a. 7-day programming.
 - b. Individual heating and cooling occupied and unoccupied setpoints.
 - c. Daily program schedules: (2) occupied cycles and (2) unoccupied cycles per day.
 - d. Temperature control override (defaults back to schedule and cycle temperature once next cycle becomes current).
 - e. Fan run status: ON/AUTO
 - f. 1°F control increment (1°F to 5°F dead band setpoints).
 - g. Change/check indicator icon for unit filter replacement/cleaning.

h. Non-volatile memory storage (permanent day and time).

C. Interconnecting Wire and Cable:

1. All wiring regardless of service and/or voltage shall comply with the Contract Document Division for Electrical System Specifications, the National Electric Code (NEC) and any/all applicable local codes and other Authorities Having Jurisdiction (AHJ).
2. All wiring regardless of service and/or voltage shall be in conduit in accordance with Electrical Specifications "Raceways and Boxes for Electrical Systems" and "Cable Trays for Electrical Systems" and shall be routed parallel to or at right angles with the structure, properly supported every six (6) feet at a minimum and installed in a workmanlike manner, except that exposed wiring in all spaces other than utility rooms, closets, and storage rooms shall be in raceway to match the raceway indicated in the Fire Alarm System portions of these contract documents.
3. Where permitted by all applicable specifications, local codes, NEC and AHJ; plenum-rated control cabling may be used where final application will be concealed but accessible. Where plenum-rated cable is allowed, it shall be routed parallel to or at right angles with the structure, properly supported every six (6) feet at a minimum and installed in a workmanlike manner.

D. General Field Devices:

1. Control relays shall be UL listed with contacts and coils rated for the application. Relays used for inline control start/stop of line voltage motors shall have a current rating at least 150% full load amps.
2. Control transformers shall be CSA and UL listed. Primary and secondary sides shall be fused in accordance with the NEC or shall be Class 2 current limiting type. Transformers shall be sized such that the connected load is not greater than 80% of the transformer rated capacity.
3. Emergency shut-off switches shall be heavy duty, two-position push-pull, maintained contact, and illuminated 1-3/8-inch in diameter mushroom style push button switch. Provide hinged easy open protective clear cover to prevent accidental operation of switch.

E. Analog Sensors:

1. Temperature sensors:
 - a. Linear precision element thermistor type.
 - b. Duct sensor (single point)- 316 stainless steel or platinum sensing element, junction box for wiring connections and gasket to prevent air leakage and vibration noise.
 - c. Outdoor air sensor- single device, ventilated non-metallic sun shield, utility box for termination and watertight gasket to prevent water seepage.
 - d. Space sensor- element within a ventilated cover.
 - e. Sensors shall be manually calibrated on site so that wiring length does not detract from the sensor accuracy specified.
 - f. Where necessary due to structural cavities, masonry walls, proximity to exterior openings, unconditioned spaces, etc., insulated mounting base shall prevent temperature of mounting location from affecting sensor temperature reading.

2. Pressure Sensors:

- a. Static air pressure sensor- linear output voltage signal, field adjustable "zero" and "span", tubing connected to pitot tube or other pressure/airflow sensing device (under no circumstances shall tubing pass through equipment housing or ductwork).
- b. Pitot tube probe shall be brass with 8 inch lead tube.
- c. Air differential sensors shall have linear output voltage signal, capable of over-pressurization to 10 PSI without zero-shift and have a field adjustable zero and span.
- d. Snubbers shall be required to prevent system pressure hammers and surges from being transmitted to the sensor.

3. Position Sensors:

- a. Damper position indicators- potentiometer mounted in housing. Damper position end switches shall employ mechanical position proving.
- b. Control valve position indicator- potentiometer mounted on valve actuator.
- c. Float type level switch with single pole-double (SPDT) throw snap acting contacts, housed in a watertight enclosure.
- d. Proximity limit switch- oil-tight, roller type, SPDT snap acting switch with adjustable trim arm.

F. Automatic Control Dampers:

1. All dampers shall bear AMCA seal indicating compliance with the AMCA Certified Ratings Program.
2. A single damper section shall have blades that do not exceed 48" in length and shall be no higher than 72". Damper blades shall not exceed 8" in width. Applications requiring larger dampers shall be achieved by combining single damper sections.
3. Frame construction shall be a minimum of #14 gauge galvanized steel formed into channels and welded, 14 gauge galvanized roll-formed steel or extruded aluminum at a minimum 4-1/2" by 1' by 0.125" thick.
4. Blades and baffles shall be fabricated of minimum 16 gauge steel with corrosion resistant galvanized finish or extruded aluminum 6" by 0.08".
5. All dampers shall be provided with nylon, cicoloy or oilite bearings, stainless steel or elastomeric side seals, and zinc plated hardware as standard.
6. Axles shall be a minimum of 1/2" diameter and be locked to blade with rivets or welded.
7. Dampers shall be made up of 6" or 8" blades or combination of the two. Dampers shall have a minimum of four blades running the entire length. Silicone or polyurethane blade edging shall be furnished on all dampers.
8. Maximum leakage rate through any 48" by 48" closed damper in any application shall not exceed 10.0 cfm per sq. ft. of damper face area at 4" of water pressure differential and a maximum closing torque of 4 inch-lbs./sq. ft. of damper face area. Damper leakage ratings shall be certified in accordance with AMCA Standard 500-D.

9. Blades mounted vertically shall be supported by thrust bearings.
10. All Automatic Control Dampers in modulating applications shall be sized so as to achieve linear airflow characteristics.
11. Automatic Flow Control Dampers specifically indicated to be provided by Mechanical Equipment manufacturer and/or as a component of packaged equipment shall not be provided by the Contractor.
12. To minimize leakage, blade edges shall be interlocked and blade seals shall be compressible at all contact points. Channel frames shall also be provided with jamb seals.
13. All Outdoor Air Damper components shall be suitable for applications operating in the temperature range of -40 deg. C (-40 deg. F) to 75 deg. C (167 deg. F).
14. Damper shall be rated for a minimum velocity of 2000 ft/min.
15. Mechanical Ventilation, Miscellaneous Utility Dampers (Parallel Blade Operational Style):
 - a. Parallel Blade Automatic Flow Control Dampers shall be permitted as indicated on the drawings for applications not requiring Opposed Blade operation pursuant with that specification section and for:
 - 1) Two-position (fully-open or fully-closed) applications.
 - 2) Applications where the damper constitutes the primary source of total system pressure loss.
 - 3) Applications where greater control is required at the upper end of airstream volume operating range.
 - 4) Mechanical Space ventilation and exhaust, combustion intake & exhaust, &c.
 - b. Shall comply with AMCA 500-D Class 4 and shall not leak in excess of 80cfm per sq/ft at 4inwc static pressure when closed.
 - c. Damper shall be rated for a minimum velocity of 1500 ft/min.
16. Operating Linkages and Damper Accessories:
 - a. All operating linkages and/or damper accessories required for installation and application in accordance with specification design intent and manufacturer's installation procedures shall be provided.
 - b. Operating linkages provided external to dampers (crank arms, connecting rods, shaft extensions, &c.) for transmitting motion from the actuator/operator to dampers shall be designed as to functionally operate a load equal to or in excess of 300% of the maximum required operating force for the damper.
 - c. Crank arms and connecting rods shall be adjustable. Linkages shall be brass, bronze, zinc-coated steel, or stainless steel.
 - d. Adjustments of Crank Arms shall control the position of the damper.
 - e. Use of Operating Linkages external to damper drive shaft shall neither delay nor impede operation of the damper in a manner of performance less than a direct-coupled damper actuator. Operating linkages shall not under any circumstances be permitted to flex, warp, shift and curve under normal operation of connected damper sections.

G. Automatic Control Damper Actuators:

1. Control damper actuators shall be electronic type. Actuators shall have a means for reversing drive direction and a manual override accessible at the front cover.
2. Single bolt or setscrew type fasteners are not acceptable.
3. The actuator shall have electronic overload or digital rotation sensing circuitry. Mechanical end switches or magnetic clutch to deactivate the actuator at the end of rotation are not acceptable.
4. For spring return fail-safe applications, an internal mechanical spring return mechanism shall be built into the actuator housing. Non-mechanical forms of fail-safe operation are not acceptable.
5. All non-spring return actuators shall have an external manual clutch/gear release to allow manual positioning of the damper when the actuator is not powered. Spring return actuators with more than 60 in-lb torque capacity shall have a manual crank for this purpose.

2.22 FACILITY MANAGEMENT & CONTROL SYSTEM (FMCS)

A. Summary:

1. The intent of this Specification is to provide an open source Facility Management Control System (FMCS) based on the Tridium Niagara Network Area Controller (NAC) and the Honeywell Spyder Interoperable Digital Controller/Interoperable BACnet Controller (IDC/IBC). The Honeywell Spyder Interoperable Digital Controller/Interoperable BACnet Controller (IDC/IBC) shall be fully programmable via the embedded Niagara WorkBench tool requiring only a web browser.
2. Products requiring a licensed, off site, non-embedded programming tool are not acceptable. Open source as referred to herein shall mean the Tridium Niagara Network Area Controller (NAC) and Honeywell Spyder Interoperable Digital Controller/Interoperable BACnet Controller (IDC/IBC) products are available from multiple contractor and vendor sources, affording the Owner freedom of choice and competitive bidding for the initial installation of the (FMCS) and future system expansions and modifications not limited by contractor, vendor or networking protocol. No territorially restricted OEM brands, single vendor or "branch only" products are acceptable.
3. Successful bidder shall demonstrate to the Owner via a product website dealer/contractor locator, that there are multiple contractors and vendors in the project geographic area to choose from. No exceptions to this requirement will be allowed.
4. Furnish all labor, materials, equipment, and service necessary for a complete and operating Temperature Control System (TCS) and Facility Management system (FMCS), utilizing Direct Digital Controls as shown on the drawings and as described herein. Drawings are diagrammatic only.
5. All labor, material, equipment and software not specifically referred to herein or on the plans, that is required to meet the functional intent of this Specification, shall be provided without additional cost to the Owner.

B. System Description:

1. The entire Temperature Control System (TCS) shall be comprised of a network of inter-operable,

stand-alone digital controllers communicating via BACnet communication protocols to a Network Area Controller (NAC). Temperature Control System products shall be manufactured by Tridium. Equivalent BACnet products must be approved in writing by the Consulting Engineer and be submitted for approval ten (10) days prior to the date of the bid submittal.

2. The Facility Management and Control System (FMCS) shall be comprised of Network Area Controller or Controllers (NAC) within each facility. The NAC shall connect to the Owner's local or wide area network, depending on configuration. Access to the system, either locally in each building, or remotely from a central site or sites, shall be accomplished through standard Web browsers, via the Internet and/or local area network. Each NAC shall communicate to BACnet (IBC) controllers and other open protocol systems/devices provided under Division 23 or Division 26.
3. The Facility Management and Control System (FMCS) as provided in this Division shall be based on the Tridium Niagara System incorporating the Niagara Framework™. Equivalent products must be approved in writing by the Consulting Engineer and be submitted for approval ten (10) days prior to the date of the bid submittal. Systems not developed on the Niagara Framework platform are unacceptable.

C. Submittal:

1. An electronic copy (.PDF) of shop drawings of the components and devices for the entire control system shall be submitted and shall consist of a complete list of equipment and materials, including manufacturers catalog data sheets and installation instructions for all controllers, valves, dampers, sensors, routers, etc. Shop drawings shall also contain complete wiring and schematic diagrams, software descriptions, and any other details required to demonstrate that the system has been coordinated and will properly function as a system. Terminal identification for all control wiring shall be shown on the shop drawings. A complete written Sequence of Operation shall also be included with the submittal package. Division 26 contractors supplying products and systems, as part of their packages shall provide catalog data sheets, wiring diagrams and point lists to the Division 23 contractor for proper coordination of work.
2. Submittal shall also include a trunk cable schematic diagram depicting operator workstations, control panel locations and a description of the communication type, media and protocol. Though the Division 23 and 26 contractors shall provide these diagrams for their portions of work, the Systems Integrator shall be responsible for integrating those diagrams into the overall trunk cable schematic diagrams for the entire Wide Area Network (WAN).
3. Submittal shall also include a complete point list of all points to be connected to the TCS and FMCS. Division 23 and 26 contractors shall provide necessary point lists, protocol documentation, and factory support information for systems provided in their respective divisions but integrated into the FMCS.
4. Upon completion of the work, provide a complete set of 'as-built' drawings and application software (Web-Supervisor only, if applicable) on compact disk. Drawings shall be provided as pdf files. Division 23 and 26 contractors shall provide as-builts for their portions of work. The Division 23 contractor shall be responsible for as-builts pertaining to overall TCS and FMCS architecture and network diagrams.

D. Specification Nomenclature:

1. Acronyms used in this Specification are as follows:

- a. FMCS: Facility Management and Control System
- b. TCS: Temperature Control System
- c. NAC: Network Area Controller
- d. IDC: Interoperable Digital Controller
- e. IBC: Interoperable BACnet Controller
- f. GUI: Graphical User Interface
- g. WBI: Web Browser Interface
- h. POT: Portable Operator's Terminal
- i. PMI: Power Measurement Interface
- j. DDC: Direct Digital Controls
- k. LAN: Local Area Network
- l. WAN: Wide Area Network
- m. OOT: Object Oriented Technology (Graphical Programming Language)
- n. PICS: Protocol Implementation Conformance Statement

E. Division of Work:

- 1. The Division 23 and 26 (if applicable) contractors shall be responsible for all controllers (IDC and IBC), control devices, control panels, controller programming, controller input/output and power wiring and controller network wiring.
- 2. The Division 23 contractor shall be responsible for the Network Area Controller(s) (NAC), software and programming of the NAC, graphical user interface software (GUI), development of all graphical screens, Web browser pages, setup of schedules, logs and alarms, LonWorks network management. The Division 23 contractor shall coordinate connection of the NAC to the Owner provided local or wide area network.

F. Related Work Specified Elsewhere:

- 1. Division 26, Electrical:
 - a. Providing motor starters and disconnect switches (unless otherwise noted).
 - b. Power wiring and conduit (unless otherwise noted).
 - c. Provision, installation and wiring of smoke detectors (unless otherwise noted).
 - d. Other equipment and wiring as specified in Division 26.

G. Agency and Code Approvals:

- 1. All products of the TCS and FMCS shall be provided with the following agency approvals. Verification that the approvals exist for all submitted products shall be provided with the submittal package. Systems or products not currently offering the following approvals are not acceptable.
 - a. UL-916; Energy Management Systems

- b. C-UL listed to Canadian Standards Association C22.2 No. 205-M1983 "Signal Equipment"
- c. CE
- d. FCC, Part 15, Subpart J, Class A Computing Devices

H. Software License Agreement:

- 1. The Owner shall agree to the manufacturer's standard software and firmware licensing agreement as a condition of this contract. Such license shall grant use of all programs and application software to Owner as defined by the manufacturer's license agreement, but shall protect manufacturer's rights to disclosure of trade secrets contained within such software.
 - 2. The Owner shall be the named license holder of all software associated with any and all incremental work on the project(s). In addition, the Owner shall receive ownership of all job specific configuration documentation, data files, and application-level software developed for the project. This shall include all custom, job specific software code and documentation for all configuration and programming that is generated for a given project and/or configured for use with the NAC, FMCS Server(s), and any related LAN / WAN / Intranet and Internet connected routers and devices. Any and all required IDs and passwords for access to any component or software program shall be provided to the Owner. The Owner shall be free to contract with any vendor or contractor for future service, expansion and/or modifications.
- I. Delivery, Storage and Handling:** Provide factory-shipping cartons for each piece of equipment and control device. Maintain cartons through shipping, storage, and handling as required to prevent equipment damage. Store equipment and materials inside and protected from weather.
- J. Job Conditions: Cooperation with Other Trades:** Coordinate the Work of this section with that of other sections to ensure that the Work will be carried out in an orderly fashion. It shall be this Contractor's responsibility to check the Contract Documents for possible conflicts between his Work and that of other crafts in equipment location, pipe, duct and conduit runs, electrical outlets and fixtures, air diffusers, and structural and architectural features.

K. Materials:

- 1. General:
 - a. The Temperature Control System (TCS) and Facility Management Control System (FMCS) shall be comprised of a network of interoperable, stand-alone digital controllers, Network Area Controllers (NAC) servers, printers, network devices, valves, dampers, sensors, and other devices as specified herein.
 - b. The installed system shall provide secure password access to all features, functions and data contained in the overall FMCS.
- 2. Open, Inoperable, Integrated Architectures:
 - a. The intent of this Specification is to provide a peer-to-peer networked, stand-alone, distributed control system with the capability to integrate ANSI/ASHRAE Standard 135-2001 BACnet, LonWorks technology, MODBUS, OPC, and other open and proprietary communication protocols in one open, interoperable system.
 - b. The supplied NAC and IDC/IBC shall employ object-oriented technology (OOT) for representation

of all data and control devices within the system. In addition, adherence to industry standards including ANSI / ASHRAE™ Standard 135-2001, BACnet and LonMark to assure interoperability between all system components is required. Devices that do not have LonMark certification are not acceptable. For each BACnet device, the device supplier must provide a PICS document showing the installed device's compliance level. Minimum compliance is Level 3; with the ability to support data read and write functionality. Physical connection of BACnet devices shall be via Ethernet (BACnet Ethernet/IP,) and/or RS-485 (BACnet MSTP) as specified.

- c. All components and controllers supplied under this Division shall be true "peer-to-peer" communicating devices. Components or controllers requiring "polling" by a host to pass data shall not be acceptable.
 - d. The supplied system must incorporate the ability to access all data using standard Web browser without requiring proprietary operator interface and configuration software or licenses. No installed software or license shall be required to view, modify or program the Niagara NAC OR the IDC/IBC field controllers. All engineering shall be performed by use of the embedded Niagara WorkBench tool utilizing only a web browser such as Microsoft's Windows Explorer or Mozilla's Fire-Fox web browser. Systems requiring proprietary database, interface programs and or configuration software shall not be acceptable.
 - e. A hierarchical topology is required to assure reasonable system response times and to manage the flow and sharing of data without unduly burdening the customer's internal Intranet network. Systems employing a "flat" single tiered architecture shall not be acceptable.
 - f. Maximum acceptable response time from any alarm occurrence (at the point of origin) to the point of annunciation shall not exceed 5 seconds for network connected user interfaces.
 - g. Maximum acceptable response time from any alarm occurrence (at the point of origin) to the point of annunciation shall not exceed 60 seconds for remote or dial-up connected user interfaces.
3. Networks:
- a. The Local Area Network (LAN) shall be a 100 Megabits/sec Ethernet network supporting BACnet, Java, XML, HTTP, and SOAP for maximum flexibility for integration of building data with enterprise information systems and providing support for multiple Network Area Controllers (NACs), user workstations and, if specified, a local server.
 - b. Local area network minimum physical and media access requirements:
 - 1) Ethernet; IEEE standard 802.3
 - 2) Cable; 100 Base-T, UTP-8 wire, category 5e
 - 3) Minimum throughput; 100 Mbps.
4. Network Access:
- a. Remote Access: For Local Area Network installations, provide access to the LAN from a remote location, via the Internet (if desired). The Owner shall provide a connection to the Internet to enable this access via high speed cable modem, asynchronous digital subscriber line (ADSL) modem, ISDN line, T1 Line or via the customer's Intranet to a corporate server providing access to an Internet Service Provider (ISP). Customer agrees to pay monthly access charges for connection and ISP (if required).
5. Network Area Controller (NAC):

- a. The Division 23 contractor shall supply one or more Network Area Controllers (NAC) as part of this contract. Number of area controllers required is dependent on the type and quantity of devices provided under Divisions 23 and 26. It is the responsibility of the Division 23 contractor to coordinate with the Division 23 and 26 contractors to determine the quantity and type of devices.
- b. The Network Area Controller (NAC) shall provide the interface between the LAN or WAN and the field control devices, and provide global supervisory control functions over the control devices connected to the NAC. It shall be capable of executing application control programs to provide:
 - 1) Calendar functions
 - 2) Scheduling
 - 3) Trending
 - 4) Alarm monitoring and routing
 - 5) Time synchronization
 - 6) Integration of LonWorks controller data and BACnet controller data
 - 7) Network Management functions for all LonWorks based devices
- c. The Network Area Controller must provide the following hardware features as a minimum:
 - 1) Two Ethernet Port – 10/100 Mbps
 - 2) One RS-232 port
 - 3) One LonWorks Interface Port – 78KB FTT-10A
 - 4) One RS-485 ports
 - 5) Battery Backup
 - 6) Flash memory for long term data backup (If battery backup or flash memory is not supplied, the controller must contain a hard disk with at least 1 gigabyte storage capacity)
 - 7) The NAC must be capable of operation over a temperature range of 32 to 122°F
 - 8) The NAC must be capable of withstanding storage temperatures of between 0 and 158°F
 - 9) The NAC must be capable of operation over a humidity range of 5 to 95% RH, non-condensing
- d. The NAC shall provide multiple user access to the system and support for ODBC or SQL (if specified). A database resident on the NAC shall be an ODBC-compliant database or must provide an ODBC data access mechanism to read trend history data stored within it.
- e. The NAC shall support standard Web browser access via the Intranet/Internet. It shall support a minimum of 32 simultaneous users.
- f. Event Alarm Notification and Actions:
 - 1) The NAC shall provide alarm recognition, storage; routing, management, and analysis to supplement distributed capabilities of equipment or application specific controllers.
 - 2) The NAC shall be able to route any alarm condition to any defined user location whether connected to a local network or wide-area network or via email.
 - 3) Alarm generation shall be selectable for annunciation type and acknowledgment requirements including but limited to:
 - a) To alarm

- b) Return to normal
 - c) To fault
 - 4) Provide for the creation of a minimum of eight of alarm classes for the purpose of routing types and or classes of alarms, i.e.: security, HVAC, Fire, etc.
 - 5) Provide timed (schedule) routing of alarms by class, object, group, or node.
 - 6) Provide capability for alarm generation from binary object “runtime” and /or event counts for equipment maintenance. The user shall be able to reset runtime or event count values with appropriate password control.
 - g. Control equipment and network failures shall be treated as alarms and annunciated.
 - h. Alarms shall be annunciated in any of the following manners as defined by the user:
 - 1) Screen message text
 - 2) Email of the complete alarm message to multiple recipients. Provide the ability to route and email alarms based on:
 - a) Day of week
 - b) Time of day
 - c) Recipient
 - d) Pagers via paging services that initiate a page on receipt of email message
 - e) Graphic with flashing alarm object(s)
 - f) Printed message, routed directly to a dedicated alarm printer
 - i. The following shall be recorded by the NAC for each alarm (at a minimum):
 - 1) Time and date
 - 2) Location (building, floor, zone, office number, etc.)
 - 3) Equipment (air handler #, accessway, etc.)
 - 4) Acknowledge time, date, and user who issued acknowledgement
 - 5) Number of occurrences since last acknowledgement
 - j. Alarm actions may be initiated by user defined programmable objects created for that purpose.
 - k. Defined users shall be given proper access to acknowledge any alarm, or specific types or classes of alarms defined by the user.
 - l. A log of all alarms shall be maintained by the NAC and/or a server (if configured in the system) and shall be available for review by the user.
 - m. Provide a “query” feature to allow review of specific alarms by user defined parameters.
 - n. A separate log for system alerts (controller failures, network failures, etc.) shall be provided and available for review by the user.
 - o. An Error Log to record invalid property changes or commands shall be provided and available for review by the user.
6. Data Collection and Storage:

- a. The NAC shall have the ability to collect data for any property of any object and store this data for future use.
 - b. The data collection shall be performed by trend history extensions, resident in the NAC that shall have, at a minimum, the following configurable properties:
 - 1) Designating the log as interval or deviation.
 - 2) For interval logs, the object shall be configured for time of day, day of week and the sample collection interval.
 - 3) For all logs, provide the ability to set the maximum number of data stores for the log and to set whether the log will stop collecting when full, or rollover the data on a first-in, first-out basis.
 - c. All log data shall be stored in a relational database in the NAC and the data shall be accessed from a server (if the system is so configured) or a standard Web browser or via a web Excel query.
 - d. All log data, when accessed from a server, shall be capable of being manipulated using standard BQL statements.
 - e. All log data shall be available to the user in the following data formats:
 - 1) Niagara table or chart viewer.
 - 2) OBIX
 - 3) XML
 - 4) PDF
 - 5) Excel Comma or tab separated values (CSV)
 - f. Systems that do not provide log data in a RDBMS and csv formats at a minimum shall not be acceptable.
 - g. The NAC shall have the ability to archive its log data either locally (to itself), or remotely to a server or other NAC on the network. Provide the ability to configure the following archiving properties, at a minimum:
 - 1) Archive on time of day.
 - 2) Auto archive when a Web-Supervisor archive is being reviewed by a user (Live History).
7. Audit Log:
- a. Provide and maintain an Audit Log that tracks all activities performed on the NAC. Provide the ability to specify a buffer size for the log and the ability to archive log based on time or when the log has reached its user-defined buffer size. Provide the ability to archive the log locally (to the NAC), to another NAC on the network, or to a server. For each log entry, provide the following data:
 - 1) Time and date
 - 2) User ID
 - 3) Change or activity: i.e., Change setpoint, add or delete objects, commands, etc.
8. Database Backup and Storage:
- a. The NAC shall have the ability to automatically backup its database. The database shall be backed up once a day at a minimum.

- b. Copies of the current database and, at the most recently saved database shall be stored in the NAC. The age of the most recently saved database is dependent on the user-defined database save interval.
 - c. The NAC database shall be archived to a Web-Supervisor (if present) on a monthly basis for extended system back-up, additionally an admin user shall be able to back-up the NAC database to his/her PC via a standard web browser.
9. Interoperable Digital Controller (IBC)
- a. Advanced Unitary Controller: The controller platform shall be designed specifically to control HVAC – ventilation, filtration, heating, cooling, humidification, and distribution. Equipment includes: constant volume air handlers, VAV air handlers, packaged RTU, heat pumps, unit vents, fan coils, natural convection units, and radiant panels. The controller platform shall provide options and advanced system functions, programmable and configurable using Niagara AX Framework™, that allow standard and customizable control solutions required in executing the “Sequence of Operation” as outlined in Section 4.
 - b. Minimum Requirements:
 - 1) The controller shall be capable of either integrating with other devices or stand-alone operation.
 - 2) The controller shall have two microprocessors. The Host processor contains on-chip FLASH program memory, FLASH information memory, and RAM to run the main HVAC application. The second processor for BACnet® network communications.
 - a) FLASH Memory Capacity: 372 Kilobytes with 8 Kilobytes for application program.
 - b) FLASH Memory settings retained for ten years.
 - c) RAM: 8 Kilobytes
 - 3) The controller shall have an internal time clock with the ability to automatically revert from a master time clock on failure.
 - a) Operating Range: 24 hour, 365 day, multi-year calendar including day of week and configuration for automatic day-light savings time adjustment to occur on configured start and stop dates.
 - b) Accuracy: ± 1 minute per month at 77° F (25° C).
 - c) Power Failure Backup: 24 hours at 32° to 100° F (0° to 38° C), 22 hours at 100° to 122° F (38° to 50° C).
 - 4) The controller shall include Sylk Bus, a two wire, polarity insensitive bus that provides both 18 Vdc power and communications between a Sylk-enabled device and a Sylk-enabled controller.
 - 5) The controller shall have an internal DC power supply to power external sensors.
 - a) Power Output: 20 VDC $\pm 10\%$ at 75 mA.
 - 6) The controller shall have a visual indication (LED) of the status of the device:
 - a) Controller operating normally.
 - b) Controller in process of download.
 - c) Controller is in reflash mode

- d) No power to controller, low voltage, or controller damage.
- e) Processor and/or controller are not operating.
- 7) The controller shall have a visual indication (LED) of the BACnet MS/TP communication status of the device:
 - a) Processor missing bootloader image.
 - b) Bootloader running and no MS/TP token present.
 - c) Bootloader running and there is MS/TP communication.
 - d) BACnet communications processor is not running
- 8) The minimum controller Environmental ratings
 - a) Operating Temperature Ambient Rating: -40° to 150° F (-40° to 65.5° C).
 - b) Storage Temperature Ambient Rating: -40° to 150° F (-40° to 65.5° C).
 - c) Relative Humidity: 5% to 95% non-condensing.
- 9) The controller shall have the additional approval requirements, listings, and approvals:
 - a) UL/cUL (E87741) listed under UL916 (Standard for Open Energy Management Equipment) with plenum rating.
 - b) BACnet Application Specific Controller (B-ASC)
 - c) CSA (LR95329-3) Listed
 - d) Meets FCC Part 15, Subpart B, Class B (radiated emissions) requirements.
 - e) Meets Canadian standard C108.8 (radiated emissions).
 - f) Conforms to the following requirements per European Consortium standards:
 - (1) EN 61000-6-1; 2001 (EU Immunity)
 - (2) EN 61000-6-3; 2001 (EU Emissions)
- 10) The controller housing shall be UL plenum rated mounting to either a panel or DIN rail (standard EN50022; 7.5mm x 35mm).
- 11) The controller shall have sufficient on-board inputs and outputs to support the application.
 - a) Analog outputs (AO) shall be capable of being configured to support 0-10 V, 2-10 V or 4-20 mA devices.
 - b) Triac outputs shall be capable of switching 30 Volts at 500 mA.
 - c) Input and Output wiring terminal strips shall be removable from the controller without disconnecting wiring. Input and Output wiring terminals shall be designated with color coded labels.
 - d) Universal inputs shall be capable of being configured as binary inputs, resistive inputs, voltage inputs (0-10 VDC), or current inputs (4-20 mA).
- 12) The controller shall provide “continuous” automated loop tuning with an Adaptive Integral Algorithm Control Loop.
- 13) The controller platform shall have standard HVAC application programs that are modifiable to

- support both the traditional and specialized “sequence of operations” as outlined in Section 4.
- a) Discharge air control and low limit
 - b) Pressure-dependent dual duct without flow mixing.
 - c) Variable air volume with return flow tracking.
 - d) Economizer with differential enthalpy.
 - e) Minimum air flow coordinated with CO2.
 - f) Unit ventilator cycle (1, 2, 3) 2-pipe.
 - g) Unit ventilator cycle (1, 2, 3) 2-pipe with face/bypass.
10. HVAC control shall be accomplished using BACnet based devices. The Division 23 contractor shall provide all programming, documentation and programming tools necessary to set up and configure the supplied devices per the specified sequences of operation.
11. The Division 23 contractor shall run the BACnet network trunk to the nearest Network Area Controller (NAC). Coordinate locations of the NAC to ensure that maximum network wiring distances, as specified by the BACnet wiring guidelines, are not exceeded. A maximum of 30 devices may occupy any one BACnet trunk and must be installed using the appropriate trunk termination device.
12. The Network Area Controller (NAC) will provide all scheduling, alarming, trending, and network management for the BACnet based devices.
13. The IBCs shall communicate with the NAC at a baud rate of not less than 38.4K baud. The IBC shall provide LED indication of communication and controller performance to the technician.
14. All IBCs shall be fully application programmable and shall at all times maintain their BACnet BTL certification. Controllers offering application selection only (non-programmable), require a 10% spare point capacity to be provided for all applications. All control sequences within or programmed into the IBC shall be stored in non-volatile memory, which is not dependent upon the presence of a battery, to be retained.
15. The Division 23 contractor supplying the IBC’s shall provide documentation for each device, with the following information at a minimum:
- a. Analog In
 - b. Analog Out
 - c. Analog Value
 - d. Binary
 - e. Binary In
 - f. Binary Out
 - g. Binary Value
 - h. Multi-State In
 - i. Multi-State Out
 - j. Multi-State Value

- k. Schedule object
 - l. Calendar object
16. It is the responsibility of the Division 23 contractor to ensure that the proper BACnet objects are provided in each IBC, as required by the project.
17. The supplier of any programmable IBC shall provide one copy of the manufacturer's programming tool, with documentation, to the Owner.

L. Graphical User Interface

1. Operating System:
- a. The GUI shall be a standard web browser such as Microsoft Internet Explorer, Google Chrome or Mozilla Fire-Fox.
 - b. The GUI shall employ browser-like functionality for ease of navigation. It shall include a tree view (similar to Windows Explorer) for quick viewing of, and access to, the hierarchical structure of the database. In addition, menu-pull downs, and toolbars shall employ buttons, commands and navigation to permit the operator to perform tasks with a minimum knowledge of the HVAC Control System and basic computing skills. These shall include, but are not limited to, forward/backward buttons, home button, and a context sensitive locator line (similar to a URL line), that displays the location and the selected object identification.
 - c. Real-Time Displays. The GUI, shall at a minimum, support the following graphical features and functions:
 - 1) Graphic screens shall be developed using any drawing package capable of generating a GIF, BMP, or JPG file format. Use of proprietary graphic file formats shall not be acceptable. In addition to, or in lieu of a graphic background, the GUI shall support the use of scanned pictures.
 - 2) Graphic screens shall have the capability to contain objects for text, real-time values, animation, color spectrum objects, logs, graphs, HTML or XML document links, schedule objects, hyperlinks to other URL's, and links to other graphic screens.
 - 3) Graphics shall support layering and each graphic object shall be configurable for assignment to a layer. A minimum of six layers shall be supported.
 - 4) Modifying common application objects, such as schedules, calendars, and set points shall be accomplished in a graphical manner.
 - a) Schedule times will be adjusted using a graphical slider, without requiring any keyboard entry from the operator.
 - b) Holidays shall be set by using a graphical calendar without requiring any keyboard entry from the operator.
 - 5) Commands to start and stop binary objects shall be done by right-clicking the selected object and selecting the appropriate command from the pop-up menu.
 - 6) Adjustments to analog objects, such as set points, shall be done by right-clicking the selected object and using an override value input box to adjust the value.
 - d. System Configuration. At a minimum, the GUI shall permit the operator to perform the following tasks, with proper password access:

- 1) Create, delete or modify control strategies.
 - 2) Add/delete objects to the system.
 - 3) Tune control loops through the adjustment of control loop parameters.
 - 4) Enable or disable control strategies.
 - 5) Generate hard copy records or control strategies on a printer.
 - 6) Enable/disable points to be alarmed and define the alarm name, state or value, time delays etc.
 - 7) Enable/disable points to be trended over a period of time and adjust trending parameters and names.
- e. Security. Each operator shall be required to log on to that system with a user name and password in order to view, edit, add, or delete data. System security shall be selectable for each operator. The system administrator shall have the ability to set passwords and security levels for all other operators. Each operator password shall be able to restrict the operators' access for viewing and/or changing each system application, full screen editor, and object. Each operator shall automatically be logged off of the system if no keyboard or mouse activity is detected. This auto log-off time shall be set per operator password. All system security data shall be stored in an encrypted format.
- f. System Diagnostics. The system shall automatically monitor the operation of all workstations, printers, modems, network connections, building management panels, and controllers. The failure of any device shall be annunciated to the operator.
- g. Alarm Console:
- 1) The system will be provided with a web browser based alarm window or console. This window will notify the operator of an alarm condition, and allow the operator to view details of the alarm and acknowledge the alarm.
 - 2) An optional Alarm Console Service can be used to provide continuous alarm notification and monitoring by means of an alarm window that will supersede all other windows on the desktop and shall not be capable of being minimized or closed by the operator. This window will notify the operator of new alarms and un-acknowledged alarms. Alarm notification windows or banners that can be minimized or closed by the operator shall not be acceptable. The Alarm Console Service is an option that can be installed on any PC for continuous alarm monitoring for a single site, or from multiple sites.
2. Web Browser Clients:
- a. The system shall be capable of supporting an unlimited number of clients using a standard Web browser such as Internet Explorer™, Google Chrome, or Mozilla Fire Fox™. Systems requiring additional software (to enable a standard Web browser) to be resident on the client machine, or manufacture-specific browsers shall not be acceptable.
 - b. The Web browser software shall run on any operating system and system configuration that is supported by the Web browser. Systems that require specific machine requirements in terms of processor speed, memory, etc., in order to allow the Web browser to function with the FMCS, shall not be acceptable.
 - c. The Web browser client shall support at a minimum, the following functions:
 - 1) User log-on identification and password shall be required. Security using Java authentication and encryption techniques to prevent unauthorized access shall be implemented.

- 2) HTML programming shall not be required to display system graphics or data on a Web page. HTML editing of the Web page shall be allowed if the user desires a specific look or format.
 - 3) Storage of the graphical screens shall be in the Network Area Controller (NAC), without requiring any graphics to be stored on the client machine. Systems that require graphics storage on each client are not acceptable.
 - 4) Real-time values displayed on a Web page shall update automatically without requiring a manual “refresh” of the Web page.
 - 5) Users shall have administrator-defined access privileges. Depending on the access privileges assigned, the user shall be able to perform the following:
 - a) Modify common application objects, such as schedules, calendars, and set points in a graphical manner.
 - (1) Schedule times will be adjusted using a graphical slider, without requiring any keyboard entry from the operator.
 - (2) Holidays shall be set by using a graphical calendar, without requiring any keyboard entry from the operator.
 - b) Commands to start and stop binary objects shall be done by right-clicking the selected object and selecting the appropriate command from the pop-up menu.
 - c) View logs and charts
 - d) View and acknowledge alarms
 - 6) The system shall provide the capability to specify a user’s (as determined by the log-on user identification) home page. Provide the ability to limit a specific user to just their defined home page. From the home page, links to other views, or pages in the system shall be possible, if allowed by the system administrator.
 - a) Graphic screens on the Web Browser client shall support hypertext links to other locations on the Internet or on Intranet sites, by specifying the Uniform Resource Locator (URL) for the desired link.
3. Web-Supervisor Server Functions and Hardware:
- a. A central server, located in the Maintenance Office, shall be provided. The server shall support all Network Area Controllers (NAC) connected to the customer’s network whether local or remote.
 - b. Local connections shall be via an Ethernet LAN. Remote connections can be via ISDN, ADSL, T1 or dial-up connection.
 - c. It shall be possible to provide access to all Network Area Controllers via a single connection to the server. In this configuration, each Network Area Controller can be accessed from a remote Graphical User Interface (GUI) or from a standard Web browser (WBI) by connecting to the server.
 - d. The server shall provide the following functions, at a minimum:
 - 1) Global Data Access: The server shall provide complete access to distributed data defined anywhere in the system.
 - 2) Distributed Control: The server shall provide the ability to execute global control strategies based on control and data objects in any NAC in the network, local or remote.

- 3) The server shall include a master clock service for its subsystems and provide time synchronization for all Network Area Controllers (NAC).
- 4) The server shall accept time synchronization messages from trusted precision Atomic Clock Internet sites and update its master clock based on this data.
- 5) The server shall provide master scheduling for all Network Area Controllers and their underlying field control devices.
- 6) The server shall provide demand limiting that operates across all Network Area Controllers. The server must be capable of multiple demand programs for sites with multiple meters and or multiple sources of energy. Each demand program shall be capable of supporting separate demand shed lists for effective demand control.
- 7) The server shall implement priority array command prioritization scheme (16 levels) for safe and effective contention resolution of all commands issued to Network Area Controllers. Systems not employing this prioritization shall not be accepted.
- 8) Each Network Area Controller supported by the server shall have the ability to archive its log data, alarm data and database to the server, automatically. Archiving options shall be user-defined including archive time and archive frequency.
- 9) The server shall provide central alarm management for all Network Area Controllers supported by the server. Alarm management shall include:
 - a) Routing of alarms to display, printer, email and pagers
 - b) View and acknowledge alarms
 - c) Query alarm logs based on user-defined parameters
- 10) The server shall provide central management of log data for all Network Area Controllers supported by the server. Log data shall include process logs, runtime and event counter logs, audit logs and error logs. Log data management shall include:
 - a) Viewing and printing log data
 - b) Exporting log data to other software applications
 - c) Query log data based on user-defined parameters
- 11) Server Hardware Requirements: The server hardware platform shall have the following requirements:
 - a) The computer shall provide a small footprint tower format.
 - b) The computer shall be an Intel Pentium i7 based computer (minimum processing speed of 3.0 GHz with 4 GB 800 MHz RAM and a 1 terabyte minimum hard drive), 2-USB ports, and DVD writer.
 - c) A minimum 17" flat panel color monitor, 1280 x 1024 optimal preset resolution, 25 ms response time shall also be included.
 - d) The server operating system shall be Microsoft Windows 10.
 - e) Connection to the FMCS network shall be via an Ethernet network interface card, 100 Mbps.

4. System Programming:

- a. The Graphical User Interface software (GUI) shall provide the ability to perform system programming and graphic display engineering as part of a complete software package. Access to the programming functions and features of the GUI shall be through password access as assigned by the system administrator.
 - b. A library of control, application, and graphic objects shall be provided to enable the creation of all applications and user interface screens. Applications are to be created by selecting the desired control objects from the library, dragging or pasting them on the screen, and linking them together using a built in graphical connection tool. Completed applications may be stored in the library for future use. Graphical User Interface screens shall be created in the same fashion. Data for the user displays is obtained by graphically linking the user display objects to the application objects to provide “real-time” data updates. Any real-time data value or object property may be connected to display its current value on a user display. Systems requiring separate software tools or processes to create applications and user interface displays shall not be acceptable.
 - c. Programming Methods:
 - 1) Provide the capability to copy objects from the supplied libraries, or from a user-defined library to the user’s application. Objects shall be linked by a graphical linking scheme by dragging a link from one object to another. Object links will support one-to-one, many-to-one, or one-to-many relationships. Linked objects shall maintain their connections to other objects regardless of where they are positioned on the page and shall show link identification for links to objects on other pages for easy identification. Links will vary in color depending on the type of link; i.e., internal, external, hardware, etc.
 - 2) Configuration of each object will be done through the object’s property sheet using fill-in the blank fields, list boxes, and selection buttons. Use of custom programming, scripting language, or a manufacturer-specific procedural language for configuration will not be accepted.
 - 3) The software shall provide the ability to view the logic in a monitor mode. When on-line, the monitor mode shall provide the ability to view the logic in real time for easy diagnosis of the logic execution. When off-line (debug), the monitor mode shall allow the user to set values to inputs and monitor the logic for diagnosing execution before it is applied to the system.
 - 4) The system shall support object duplication within a customer’s database. An application, once configured, can be copied and pasted for easy re-use and duplication. All links, other than to the hardware, shall be maintained during duplication.
5. LonWorks Network Management:
- a. The Graphical User Interface software (GUI) shall provide a complete set of integrated LonWorks network management tools for working with LonWorks networks. These tools shall manage a database for all LonWorks devices by type and revision, and shall provide a software mechanism for identifying each device on the network. These tools shall also be capable of defining network data connections between LonWorks devices, known as “binding”. Systems requiring the use of third party LonWorks network management tools shall not be accepted.
 - b. Network management shall include the following services: device identification, device installation, device configuration, device diagnostics, device maintenance and network variable binding.
 - c. The network configuration tool shall also provide diagnostics to identify devices on the network, to reset devices, and to view health and status counters within devices.
 - d. These tools shall provide the ability to “learn” an existing LonWorks network, regardless of what

network management tool(s) were used to install the existing network, so that existing LonWorks devices and newly added devices are part of a single network management database.

- e. The network management database shall be resident in the Network Area Controller (NAC), ensuring that anyone with proper authorization has access to the network management database at all times. Systems employing network management databases that are not resident, at all times, within the control system, shall not be accepted.

6. Object Libraries:

- a. A standard library of objects shall be included for development and setup of application logic, user interface displays, system services, and communication networks.
- b. The objects in this library shall be capable of being copied and pasted into the user's database and shall be organized according to their function. In addition, the user shall have the capability to group objects created in their application and store the new instances of these objects in a user-defined library.
- c. In addition to the standard libraries specified here, the supplier of the system shall maintain an on-line accessible (over the Internet) library, available to all registered users to provide new or updated objects and applications as they are developed.
- d. All control objects shall conform to the control objects specified in the BACnet Specification.
- e. The library shall include applications or objects for the following functions, at a minimum:
 - 1) Scheduling Object. The schedule must conform to the schedule object as defined in the BACnet Specification, providing 7-day plus holiday & temporary scheduling features and a minimum of 10 on/off events per day. Data entry to be by graphical sliders to speed creation and selection of on-off events.
 - 2) Calendar Object. . The calendar must conform to the calendar object as defined in the BACnet Specification, providing 12-month calendar features to allow for holiday or special event data entry. Data entry to be by graphical "point-and-click" selection. This object must be "linkable" to any or all scheduling objects for effective event control.
 - 3) Duty Cycling Object. Provide a universal duty cycle object to allow repetitive on/off time control of equipment as an energy conserving measure. Any number of these objects may be created to control equipment at varying intervals
 - 4) Temperature Override Object. Provide a temperature override object that is capable of overriding equipment turned off by other energy saving programs (scheduling, duty cycling etc.) to maintain occupant comfort or for equipment freeze protection.
 - 5) Start-Stop Time Optimization Object. Provide a start-stop time optimization object to provide the capability of starting equipment just early enough to bring space conditions to desired conditions by the scheduled occupancy time. Also, allow equipment to be stopped before the scheduled un-occupancy time just far enough ahead to take advantage of the building's "flywheel" effect for energy savings. Provide automatic tuning of all start / stop time object properties based on the previous day's performance.
 - 6) Demand Limiting Object. Provide a comprehensive demand-limiting object that is capable of controlling demand for any selected energy utility (electric, oil, and gas). The object shall provide the capability of monitoring a demand value and predicting (by use of a sliding window prediction algorithm) the demand at the end of the user defined interval period (1-60 minutes). This object shall also accommodate a utility meter time sync pulse for fixed interval

demand control. Upon a prediction that will exceed the user defined demand limit (supply a minimum of 6 per day), the demand limiting object shall issue shed commands to either turn off user specified loads or modify equipment set points to effect the desired energy reduction. If the list of sheddable equipment is not enough to reduce the demand to below the set point, a message shall be displayed on the users screen (as an alarm) instructing the user to take manual actions to maintain the desired demand. The shed lists are specified by the user and shall be selectable to be shed in either a fixed or rotating order to control which equipment is shed the most often. Upon suitable reductions in demand, the demand-limiting object shall restore the equipment that was shed in the reverse order in which it was shed. Each sheddable object shall have a minimum and maximum shed time property to effect both equipment protection and occupant comfort.

- f. The library shall include control objects for the following functions. All control objects shall conform to the objects as specified in the BACnet Specification.
- 1) Analog Input Object - Minimum requirement is to comply with the BACnet standard for data sharing. Allow high, low and failure limits to be assigned for alarming. Also, provide a time delay filter property to prevent nuisance alarms caused by temporary excursions above or below the user defined alarm limits.
 - 2) Analog Output Object - Minimum requirement is to comply with the BACnet standard for data sharing.
 - 3) Binary Input Object - Minimum requirement is to comply with the BACnet standard for data sharing. The user must be able to specify either input condition for alarming. This object must also include the capability to record equipment run-time by counting the amount of time the hardware input is in an "on" condition. The user must be able to specify either input condition as the "on" condition.
 - 4) Binary Output Object - Minimum requirement is to comply with the BACnet standard for data sharing. Properties to enable minimum on and off times for equipment protection as well as interstart delay must be provided. The BACnet Command Prioritization priority scheme shall be incorporated to allow multiple control applications to execute commands on this object with the highest priority command being invoked. Provide sixteen levels of priority as a minimum. Systems not employing the BACnet method of contention resolution shall not be acceptable.
 - 5) PID Control Loop Object - Minimum requirement is to comply with the BACnet standard for data sharing. Each individual property must be adjustable as well as to be disabled to allow proportional control only, or proportional with integral control, as well as proportional, integral and derivative control.
 - 6) Comparison Object - Allow a minimum of two analog objects to be compared to select either the highest, lowest, or equality between the two linked inputs. Also, allow limits to be applied to the output value for alarm generation.
 - 7) Math Object - Allow a minimum of four analog objects to be tested for the minimum or maximum, or the sum, difference, or average of linked objects. Also, allow limits to be applied to the output value for alarm generation.
 - 8) Interlock Object - Provide an interlock object that provides a means of coordination of objects within a piece of equipment such as an Air Handler or other similar types of equipment. An example is to link the return fan to the supply fan such that when the supply fan is started, the return fan object is also started automatically without the user having to issue separate commands or to link each object to a schedule object. In addition, the control loops, damper

- objects, and alarm monitoring (such as return air, supply air, and mixed air temperature objects) will be inhibited from alarming during a user-defined period after startup to allow for stabilization. When the air handler is stopped, the interlocked return fan is also stopped, the outside air damper is closed, and other related objects within the air handler unit are inhibited from alarming thereby eliminating nuisance alarms during the off period.
- 9) Temperature Override Object - Provide an object whose purpose is to provide the capability of overriding a binary output to an "On" state in the event a user specified high or low limit value is exceeded. This object is to be linked to the desired binary output object as well as to an analog object for temperature monitoring, to cause the override to be enabled. This object will execute a Start command at the Temperature Override level of start/stop command priority unless changed by the user.
- g. The object library shall include objects to support the integration of devices connected to the Network Area Controller (NAC). At a minimum, provide the following as part of the standard library included with the programming software:
- 1) LonMark/LonWorks devices. These devices shall include, but not be limited to, devices for control of HVAC, lighting, access, and metering. Provide LonMark manufacturer-specific objects to facilitate simple integration of these devices. All network variables defined in the LonMark profile shall be supported. Information (type and function) regarding network variables not defined in the LonMark profile shall be provided by the device manufacturer.
 - 2) For devices not conforming to the LonMark standard, provide a dynamic object that can be assigned to the device based on network variable information provided by the device manufacturer. Device manufacturer shall provide an XIF file, resource file and documentation for the device to facilitate device integration.
 - 3) For BACnet devices, provide the following objects at a minimum:
 - a) Analog In
 - b) Analog Out
 - c) Analog Value
 - d) Binary
 - e) Binary In
 - f) Binary Out
 - g) Binary Value
 - h) Multi-State In
 - i) Multi-State Out
 - j) Multi-State Value
 - k) Schedule Export
 - l) Calendar Export
 - m) Trend Export
 - n) Device
 - 4) For each BACnet object, provide the ability to assign the object a BACnet device and object instance number.

- 5) For BACnet devices, provide the following support at a minimum
 - a) Segmentation
 - b) Segmented Request
 - c) Segmented Response
 - d) Application Services
 - e) Read Property
 - f) Read Property Multiple
 - g) Write Property
 - h) Write Property Multiple
 - i) Confirmed Event Notification
 - j) Unconfirmed Event Notification
 - k) Acknowledge Alarm
 - l) Get Alarm Summary
 - m) Who-has
 - n) I-have
 - o) Who-is
 - p) I-am
 - q) Subscribe COV
 - r) Confirmed COV notification
 - s) Unconfirmed COV notification
 - t) Media Types
 - u) Ethernet
 - v) BACnet IP Annex J
 - w) MSTP
 - x) BACnet Broadcast Management Device (BBMD) function
 - y) Routing

7. DDE Device Integration:

- a. The Network Area Controller shall support the integration of device data via Dynamic Data Exchange (DDE), over the Ethernet Network. The Network Area Controller shall act as a DDE client to another software application that functions as a DDE server.
- b. Provide the required objects in the library, included with the Graphical User Interface programming software, to support the integration of these devices into the FMCS. Objects provided shall include at a minimum:
 - 1) DDE Generic AI Object
 - 2) DDE Generic AO Object

- 3) DDE Generic BO Object
 - 4) DDE Generic BI Object
8. MODBUS System Integration:
- a. The Network Area Controller shall support the integration of device data from Modbus RTU, Ascii, or TCP control system devices. The connection to the Modbus system shall be via an RS-232, RS485, or Ethernet IP as required by the device.
 - b. Provide the required objects in the library, included with the Graphical User Interface programming software, to support the integration of the Modbus system data into the FPMS. Objects provided shall include at a minimum:
 - 1) Read/Write Modbus AI Registers
 - 2) Read/Write Modbus AO Registers
 - 3) Read/Write Modbus BI Registers
 - 4) Read/Write Modbus BO Registers
 - c. All scheduling, alarming, logging and global supervisory control functions, of the Modbus system devices, shall be performed by the Network Area Controller.
 - d. The FMCS supplier shall provide a Modbus system communications driver. The equipment system vendor that provided the equipment utilizing Modbus shall provide documentation of the system's Modbus interface and shall provide factory support at no charge during system commissioning
9. OPC System Integration:
- a. The Network Area Controller shall act as an OPC client and shall support the integration of device data from OPC servers. The connection to the OPC server shall be Ethernet IP as required by the device. The OPC client shall support third party OPC servers compatible with the Data Access 1.0 and 2.0 Specifications.
 - b. Provide the required objects in the library, included with the Graphical User Interface programming software, to support the integration of the OPC system data into the BAS. Objects provided shall include at a minimum:
 - 1) Read/Write OPC AI Object
 - 2) Read/Write OPC AO Object
 - 3) Read/Write OPC BI Object
 - 4) Read/Write OPC BO Object
 - 5) Read/Write OPC Date/Time Input Object
 - 6) Read/Write OPC Date/Time Output Object
 - 7) Read/Write OPC String Input Object
 - 8) Read/Write OPC String Output Object
 - c. All scheduling, alarming, logging and global supervisory control functions, of the OPC system devices, shall be performed by the Network Area Controller.
 - d. The FMCS supplier shall provide an OPC client communications driver. The equipment system

vendor that provided the equipment utilizing OPC shall provide documentation of the system's OPC server interface and shall provide factory support at no charge during system commissioning.

10. Other Control System Hardware:

- a. Space Temperature Wall Module. Wall Module shall be Honeywell or equivalent.
 - 1) Wall module shall have a 20K Ohm NTC thermistor temperature sensor with operating range of 45 to 99 F under a locking cover/enclosure with UL 916 listing designed for mounting on a standard electrical switch box.
 - 2) Space temperature sensors shall be accurate to plus or minus one F degree.
 - 3) Where specified, space temperature sensors shall have a setpoint knob calibrated for warmer-cooler adjustments (option: calibrated to allow plus or minus adjustments to a software setpoint).
 - 4) Where specified, wall module shall also have an after-hours override pushbutton and LED override indicator.
 - 5) Where specified, the wall module shall have a fan coil unit fan control switch for (auto-off-on) (auto-off-low-med-hi) fan control. The wall module function is further specified in SECTION III Sequence of Operation.
- b. Duct Mount, Pipe Mount and Outside Air Temperature Sensors: Temperature sensors with an accuracy of $+ 0.3^{\circ}$ F. Temperature sensors shall be Honeywell or equivalent.
 - 1) Outside air sensors shall include an integral sun shield.
 - 2) Duct sensors shall have sensor approximately in center of the duct, and shall have selectable lengths of 6, 12, and 18 inches.
 - 3) Multipoint averaging element sensors shall be provided where specified and shall have a minimum of one foot of sensor length for each square foot of duct area (provide multiple sensors if necessary).
 - 4) Pipe mount sensors shall have copper, or stainless steel separable wells.
- c. Current Sensitive Switches: Solid state, split core current switch that operates when the current level (sensed by the internal current transformer) exceeds the adjustable trip point shall be provided where specified. Current switches shall include an integral LED for indication of trip condition and a current level below trip set point.
- d. Low Temperature Limit Switches. Limit switches shall be Honeywell or equivalent. Safety low limit shall be manual reset twenty foot limited fill type responsive to the coolest section of its length.
- e. High Temperature Limit Switches. Limit and Safety switches shall be Honeywell or equivalent. Safety high limit (firestats) shall be manual reset type.
- f. Humidity Sensors. Humidity sensors shall be Honeywell or equivalent.
 - 1) Duct and room sensors shall have a sensing range of 5% to 95%.
 - 2) Duct sensors shall be provided with a sampling chamber.
 - 3) Outdoor air humidity sensors shall have a sensing range of 20% to 95% RH. They shall have a compensated ambient temperature range of 40° F to 170° F.
- g. Enthalpy Sensors. Enthalpy sensors shall be Honeywell or equivalent. Duct mounted enthalpy

sensor shall include a temperature sensor and a humidity sensor constructed to close an electrical contact upon a drop in enthalpy (total heat) to enable economizer modes of operation where specified.

- 1) (OPTION - C7400 – Select one) Where specified provide duct mounted sensor including solid state temperature and humidity sensors with electronics which shall output a 4-20 ma signal input to the controller upon a varying enthalpy (total heat) to enable economizer modes of operation when outside air enthalpy is suitable for free cooling .
- h. Annular Pitot Tube Flow Meter. Annular pitot tube shall be averaging type differential pressure sensors with four total head pressure ports and one static port made of austenitic stainless steel.
 - 1) Sensor shall have an accuracy of $\pm .25\%$ of full flow and a repeatability of $\pm .05\%$ of measured value.
 - 2) Transmitter shall be electronic and shall produce a linear output of 4 to 20 mAdc corresponding to the required flow span.
 - 3) The transmitter shall include non-interacting zero and span adjustments.
 - 4) Acceptable Manufacturers: Pitot Tube: Dieterich Annubar, Transmitter: Setra or Dieterich
- i. Fast Acting Two Position Fire & Smoke Actuators (ML4115, ML8115). Actuators shall be Honeywell or equivalent. Fire/smoke damper actuators shall be direct connected (no linkages) two-position spring return types with stroke for 90 degree nominal rotation applications and designed for 60,000 full stroke cycles and normal operation between 0 and 130 F.
 - 1) Actuators control shall be compatible with SPST control switch and with torque ratings of 30 lb-in.
 - 2) Actuator timing shall be 25 seconds maximum in powered instances and shall spring-return in 15 seconds.
 - 3) Actuators shall be UL listed with UL873 plenum rating with die-cast aluminum housing with integral junction box and conduit knockouts, and designed to operate reliably in smoke control systems requiring UL555S ratings up to 350F.
 - 4) The actuator shall be designed to operate for 30 minutes during a one-time excursion to 350F.
 - 5) Actuator shall require no special cycling during long-term holding, and shall “hold” with no audible noise at a power consumption of approximately half of the driving power.
 - 6) Actuators shall be 24 volt (ML8115) or 120 volt (ML4115) with models for clockwise (add a B suffix) and counter-clockwise (add an A suffix) spring return.
- j. Temperature Control Panels: Furnish temperature control panels of code gauge steel with locking doors for mounting all devices as shown. Control panels shall meet all requirements of Title 24, California Administrative Code. All electrical devices within a control panel shall be factory wired. All external wiring shall be connected to terminal strips mounted within the panel. Provide printed PVC nameplates identifying all devices mounted on the face of control panels. A complete set of ‘as-built’ control drawings (relating to the controls within that panel) shall be furnished within each control panel.

11. Installation:

- a. All work described in this section shall be performed by system integrators or contractors that have a successful history in the design and installation of integrated control systems. The installing office shall have a minimum of five years of integration experience and shall provide

documentation in the submittal package verifying the company's experience.

- b. Install system and materials in accordance with manufacturer's instructions, and as detailed on the project drawing set.
- c. Drawings of the TCS and FMCS network are diagrammatic only and any apparatus not shown, but required to make the system operative to the complete satisfaction of the Architect shall be furnished and installed without additional cost.
- d. Line and low voltage electrical connections to control equipment shown specified or shown on the control diagrams shall be furnished and installed by this contractor in accordance with these Specifications.
- e. Equipment furnished by the HVAC Contractor that is normally wired before installation shall be furnished completely wired. Control wiring normally performed in the field will be furnished and installed by this contractor.

12. Wiring:

- a. All electrical control wiring and power wiring to the control panels, NAC, computers and network components shall be the responsibility of the this contractor.
- b. The electrical contractor (Division 26) shall furnish all power wiring to electrical starters and motors.
- c. All wiring shall be in accordance with the Project Electrical Specifications (Division 26), the National Electrical Code and any applicable local codes. All FMCS wiring shall be installed in the conduit types specified in the Project Electrical Specifications (Division 26) unless otherwise allowed by the National Electrical Code or applicable local codes. Where FMCS plenum rated cable wiring is allowed it shall be run parallel to or at right angles to the structure, properly supported and installed in a neat and workmanlike manner.
- d. All wiring that must be exposed in finished areas shall be run in electrical raceways:
 - 1) Raceways, fittings and junction boxes for all wiring shall be Legrand Wiremold 500/700 series, in a color selectable by the Architect.

13. Warranty:

- a. Equipment, materials and workmanship incorporated into the work shall be warranted for a period of one year from the time of system acceptance.
- b. Within this period, upon notice by the Owner, any defects in the work provided under this section due to faulty materials, methods of installation or workmanship shall be promptly (within 48 hours after receipt of notice) repaired or replaced by this contractor at no expense to the Owner

14. Warranty Access:

- a. The Owner shall grant to this contractor, reasonable access to the TCS and FMCS during the warranty period.
- b. The Owner shall allow the contractor to access the TCS and FMCS from a remote location for the purpose of diagnostics and troubleshooting, via the Internet, during the warranty period.

15. Software License:

- a. The Owner shall be the named license holder of all software associated with any and all

incremental work on the project(s).

- b. The Owner, or his appointed agent, shall receive ownership of all job specific software configuration documentation, data files, and application-level software developed for the project. This shall include all custom, job specific software code and documentation for all configuration and programming that is generated for a given project and /or configured for use within Niagara Framework (Niagara) based controllers and/or servers and any related LAN / WAN / Intranet and Internet connected routers and devices. Any and all required Ids and passwords for access to any component or software program shall be provided to the Owner.

16. Acceptance Testing:

- a. Upon completion of the installation, this contractor shall load all system software and start-up the system. This contractor shall perform all necessary calibration, testing and de-bugging and perform all required operational checks to insure that the system is functioning in full accordance with these Specifications.
- b. This contractor shall perform tests to verify proper performance of components, routines, and points. Repeat tests until proper performance results. This testing shall include a point-by-point log to validate 100% of the input and output points of the DDC system operation.
- c. Upon completion of the performance tests described above, repeat these tests, point by point as described in the validation log above in presence of Owner's Representative, as required. Properly schedule these tests so testing is complete at a time directed by the Owner's Representative. Do not delay tests so as to prevent delay of occupancy permits or building occupancy.
- d. System Acceptance: Satisfactory completion is when this contractor and the Division 26 contractor have performed successfully all the required testing to show performance compliance with the requirements of the Contract Documents to the satisfaction of the Owner's Representative. System acceptance shall be contingent upon completion and review of all corrected deficiencies.

17. Operator Instruction, Training:

- a. During system commissioning and at such time acceptable performance of the TCS and FMCS hardware and software has been established this contractor shall provide on-site or remote operator instruction to the Owner's operating personnel. Operator instruction shall be done during normal working hours and shall be performed by a competent representative, familiar with the system hardware, software and accessories.
- b. This contractor shall provide 12 hours of instruction to the Owner's designated personnel on the operation of the TCS and FMCS and describe its intended use with respect to the programmed functions specified. Operator orientation of the systems shall include, but not be limited to; the overall operation program, equipment functions (both individually and as part of the total integrated system), commands, systems generation, advisories, and appropriate operator intervention required in responding to the System's operation.
- c. The training shall be in three sessions as follows:
 - 1) Initial Training: One (4 hours) session after system is started up and at least one week before first acceptance test. Manual shall have been submitted at least two weeks prior to training so that the Owners' personnel can start to familiarize themselves with the system before classroom instruction begins.
 - 2) First Follow-Up Training: One (4 hours) session approximately two weeks after initial training, and before Formal Acceptance. These sessions will deal with more advanced topics and

answer questions.

- 3) Warranty Follow Up: One (4 hours) session to be scheduled at the request of the Owner during the one year warranty period. These sessions shall cover topics as requested by the Owner such as; how to add additional points, create and gather data for trends, graphic screen generation or modification of control routines.

2.23 SEQUENCE OF OPERATIONS

A. General:

1. The terms Building Management System (BMS) and Facility Network & Control System (FMCS) will be used synonymously herein.
2. All mechanical systems shall be automatically controlled where no description of operation is indicated for a particular system or device. The Contractor shall select appropriate control scenarios and review them with the Engineer prior to proceeding. All controls shall be arranged and designed for maximum energy conservation.
3. All equipment shall be tied to the building automation system central controller for scheduling and owner's hours of operation.
4. Provide control points required to perform Sequence of Operation and to monitor and control equipment. Provide set-point and space temperatures for each space and equipment.
5. Provide all control panels, accessory modules and wiring, in full cooperation with the Mechanical Contractor, necessary to accomplish the sequence of operations indicated herein.
6. All sequences shall be capable of being executed by the BMS unless noted as being controlled locally or specifically noted as controlled by others.
7. All temperatures listed are in degrees Fahrenheit.
8. All equipment controlled by the Building Management System shall be capable of manual operation through HOA switches and starters.
9. For hydronic systems with sensors, refer to the flow diagrams for sensor locations. Coordinate to ensure proper upstream and downstream pipe diameters for all sensors.
10. For duct systems with sensors, provide sensors at locations dictated herein or as scheduled. Space sensors shall be placed where they are shown on plans or described herein.
11. Motor and compressor failures for all HVAC equipment (fans, pumps, drive, heat pumps, etc.) shall be monitored through the BMS utilizing current sensors or system manufacturer's integral sensor technology.
12. Appropriate delays shall be included in the programming to avoid nuisance and start-up alarm conditions; such delays are not included herein.
13. All inputs for controlling variable frequency drives shall be inputs to the BMS; inputs shall not be

connected to the VFD directly. Inputs to VFD's shall be from the BMS. VFD fault contacts shall be connected to the BMS, and upon a fault condition of the VFD, there shall be an alarm.

B. Control Devices:

1. Devices and sensors shall be adjustable. The BMS shall display setpoints and actual conditions of all control devices and the position of all actuators at the front end.
2. Global limits shall be maintained through the BMS and be adjustable at the front end. The range of setpoint adjustment available shall be +/- 5°F at each user adjustable temperature controller. Global setpoints shall be as follows (and shall be adjustable at the front end).
 - a. Occupied heating = 70°F
 - b. Unoccupied heating = 62°F
 - c. Occupied cooling = 75°F
 - d. Unoccupied cooling = 82°F.
3. All user/occupant adjustable space/zone controllers:
 - a. Enabled user features include:
 - 1) Temperature adjustment within the global range.
 - b. Disabled features include:
 - 1) Mode (heat/cool auto).
 - 2) Fan speed control.
 - 3) Turning air system off completely.
 - 4) All other normally allowed local functions unless explicitly listed as "enabled" above.

C. Dedicated Outdoor Air System (DOAS) units:

1. General:
 - a. Each unit shall include a BACnet interface card for connection to the BMS sub-network such that the full functionality of the unit can be monitored and controlled from the BMS.
 - b. The operating mode of the unit shall be considered "Occupied" or "Unoccupied" in conjunction with the building programming schedule to be coordinated with the Owner's Project Manager.
 - c. Whenever a unit is off per the BMS, for any reason, all devices shall go to their fail-safe positions as follows:
 - 1) Supply and exhaust fans are de-energized.
 - 2) Outside air and exhaust dampers are fully closed.
 - 3) Compressors are de-energized.
 - 4) Furnace is locked out.
2. Fans:
 - a. Supply Fan:

- 1) Occupied: On.
 - 2) Unoccupied: Off, except on call for unoccupied heating.
 - b. Exhaust Fan:
 - 1) Occupied: On.
 - 2) Unoccupied: Off.
3. Outdoor air and exhaust air dampers
 - a. Occupied: Open
 - b. Unoccupied: Closed, except on a call for unoccupied heating.
4. Energy recovery wheel:
 - a. The energy recovery wheel shall be enabled to run whenever the DOAS unit is indexed on by the BMS.
 - b. The ERV wheel shall modulate speed by variable frequency drive to maximize the energy transfer efficiency between air streams for heating and cooling functions.
 - c. The ERV wheel shall be commanded to modulate for frost control based on internal algorithms, cycling the supply fan off and outdoor air damper closed, only providing exhaust air as required to prevent frost accumulation on the wheel. The unit defrost cycle time shall be minimized.
 - d. The ERV wheel shall be stopped when the unit is indexed to economizer cycle based on outdoor air enthalpy conditions comparative to return/exhaust air conditions.
5. Discharge air temperature (DAT) control:
 - a. The discharge air temperature and humidity shall be controlled based on a duct mounted combination temperature/humidity sensor and a daisy-chain of averaging space combination temperature/humidity sensors (refer to drawings).
 - 1) The unit controller shall index the economizer dampers, energy recovery wheel, cooling stages, and gas heating furnace as required to meet the DAT setpoints indicated below.
 - 2) Normal or Heating mode: DAT = 70°F.
 - 3) Cooling mode: DAT = 55°F.
 - 4) Dehumidification mode: DAT = 70°F.
6. Heating:
 - a. The unit shall utilize a modulating control strategy to stage furnace burner firing rate in conjunction with ERV wheel modulation as required to maintain the discharge air temperature. The unit controller shall index the unit to heating mode whenever the averaging space sensors indicate heating is required (average space temperature is <70°F).
 - b. Staging:
 - 1) The first stage of heating shall be the ERV wheel. The unit controller shall modulate the ERV wheel to maximize energy transfer to maintain the DAT setpoint.
 - 2) If the ERV wheel is at max. speed and the DAT continues to fall, the unit shall automatically stage the furnace on and modulate the firing rate to maintain the DAT setpoint.

7. Cooling:

- a. The unit shall utilize a staged cooling strategy by integrating all compressor cooling, economizer cooling, and ERV wheel energy transfer. The unit controller shall index the unit to cooling mode whenever the averaging space sensors indicate cooling is required (average space temperature is $>75^{\circ}\text{F}$).
- b. Mechanical cooling (direct expansion compressor cooling) shall be locked out if the unit is in heating mode (furnace is energized).
- c. When indexed to cooling mode by averaging space temperature sensors, the unit shall be commanded to cooling and shall reset the discharge air temperature to 55°F .
- d. Staging:
 - 1) The first stage of cooling shall be economizer cooling. Based on enthalpy conditions. If outdoor air enthalpy is less than return/exhaust air enthalpy, the unit shall bypass the ERV wheel to deliver outdoor air directly without subsequent staging as long as the DAT can be satisfied.
 - 2) The second stage of cooling shall be economizer cooling integrated with the ERV wheel. If outdoor air enthalpy increases to the return air enthalpy reading, the ERV wheel shall energize and the system shall monitor the unit discharge air enthalpy to maintain the DAT setpoint.
 - 3) The third stage of cooling shall be ERV wheel at 100% speed integrated with mechanical (direct expansion compressor) cooling. The unit shall stage on compressors as required to maintain the DAT setpoint.
- e. Hot Gas Reheat Coil – Dehumidification Mode:
 - 1) The unit controller shall modulate hot gas to the reheat coil from the refrigeration circuit as required to keep neutral DAT of 70°F under the following conditions:
 - a) Whenever the system averaging space temperatures are in disagreement as to the need for cooling (e.g. one sensor is $>75^{\circ}\text{F}$ and the other is less).
 - b) Whenever any of the space RH sensors registers a level $>60\%$ RH.

8. Alarms:

- a. Fan failure (supply & exhaust).
- b. ERV wheel motor failure.
- c. Damper failure (intake & exhaust).
- d. Low unit DAT ($>5^{\circ}\text{F}$ below setpoint).
- e. High unit DAT ($<5^{\circ}\text{F}$ above setpoint).
- f. Dirty filter (supply & exhaust).
- g. Duct mounted smoke detector activated (supply & exhaust fans shall automatically de-energize).

D. Packaged Rooftop HVAC (RTU) Units:

1. General:

- a. Each unit shall include a BACnet interface card for connection to the BMS sub-network such that the full functionality of the unit can be monitored and controlled from the BMS.

- b. Units serving spaces with transient occupancy that could be considered “densely occupied” such as libraries, gymnasiums, etc. shall be furnished with demand controlled ventilation (DCV) sensors and controls. DCV sensing shall be return air mounted CO2 detection.
 - c. The operating mode of the unit shall be considered “Occupied” or “Unoccupied” in conjunction with the building programming schedule to be coordinated with the Owner’s Project Manager.
 - d. Whenever a unit is off per the BMS, for any reason, all devices shall go to their fail-safe positions as follows:
 - 1) Supply fan is de-energized.
 - 2) Outside air damper is fully closed.
 - 3) Compressor(s) are de-energized.
 - 4) Furnace is locked out.
2. Supply Fan:
- a. Occupied: On.
 - b. Unoccupied: Off, except on call for unoccupied heating or cooling.
3. Outdoor air damper:
- a. Occupied: Open to minimum position except when in economizer mode.
 - b. Unoccupied: Closed, except on a call for economizer cooling or DCV sensor reads > 500 parts per million (PPM) of CO2.
 - c. DCV: Open, starting at minimum position and increasing toward full open based on dynamic feedback from return air CO2 sensor.
 - 1) For CO2 measured < 750 PPM, damper shall stay at minimum position.
 - 2) If CO2 measured increases above 750 PPM, damper shall modulate toward full open and shall close toward minimum position if CO2 drops closer to 750 PPM.
4. Heating:
- a. The unit controller shall index the unit to heating mode whenever the space sensor indicates heating is required (space temperature is <70°F).
 - b. Staging:
 - 1) The unit shall command the furnace on and modulate (or stage/step) from low to high fire based on space temperature drift below setpoint.
 - 2) The furnace shall modulate (or stage/step) from high to low fire as the space temperature approaches setpoint and then be off once setpoint is met.
5. Cooling:
- a. The unit shall utilize a staged cooling strategy by integrating all compressor cooling with economizer cooling. The unit controller shall index the unit to cooling mode whenever the space sensor indicates cooling is required (space temperature is >75°F).
 - b. Mechanical cooling (direct expansion compressor cooling) shall be locked out if the unit is in heating mode (furnace is energized).

- c. On a call for cooling the unit shall stage as needed to provide 55°F discharge air.
 - 1) The first stage of cooling shall be economizer cooling. Based on enthalpy conditions. If outdoor air enthalpy is less than return air enthalpy, the unit shall deliver outdoor air directly without subsequent staging as long as the DAT can be satisfied.
 - 2) The second (and third, if applicable) stage of cooling shall be mechanical (direct expansion compressor) cooling. The unit shall stage on compressors as required to maintain the DAT setpoint.
- 6. Alarms:
 - a. Fan failure.
 - b. Damper failure.
 - c. Low space temp (>5°F below setpoint).
 - d. High space temp (>5°F above setpoint).
 - e. Dirty filter.
 - f. Duct mounted smoke detector activated (supply fan shall automatically de-energize).
 - g. DCV high limit (CO₂ > 1000 PPM).

E. Heating Water Boiler Plant:

- 1. The boiler plant shall be enabled and disabled through the BMS based on ambient OAT:
 - a. OAT above 60°F: Off.
 - b. OAT below 50°F: On, and remain on until OAT rises above 60°F.
- 2. System supply water temperature:
 - a. The boiler supply water temperature delivery for the system shall be reset based on an outdoor air temperature strategy:
 - 1) When ambient OAT <20°F, SWT shall be 160°F.
 - 2) When ambient OAT >50°F, SWT shall be 120°F.
 - 3) When ambient OAT is 21°F to 49°F, SWT shall reset inversely proportional from 160°F down to 120°F.
- 3. Each boiler has an primary boiler pump. Pumps shall be operated automatically from the boiler controller to provide supply water temperature to the secondary loop via system sensors. Supply water temperature shall be on a reset schedule as noted above.
- 4. Boiler staging:
 - a. Boilers shall be setup in a lead and standby configuration and the lead boiler shall automatically switch weekly.
 - b. When commanded to fire, the lead boilers shall stage on first and modulate up to 100% firing rate as required to maintain the system supply water temperature.
 - c. If after 100% fire is reached on the lead boiler, the SWT cannot be met, the standby boiler shall fire

and modulate up as required to achieve the SWT.

d. When SWT is met, the reverse staging and modulation shall occur.

5. Secondary system pumps:

a. Shall be enabled/disabled with the boiler plant On/Off setpoints listed above.

b. Lead/lag operation:

1) Pumps shall be automatically switched between lead and lag pump status through the BMS daily at 2 am.

2) If lead pump fails to start, an alarm shall be generated and the BMS shall automatically index the lag pump to lead status.

c. Speed Control:

1) Pumps shall be self-sensing variable frequency drive technology and automatically vary system flow based on system differential pressure.

2) Speed settings shall be set initially during test and balance procedure for “full flow” and “minimum flow” conditions:

a) Full flow = all equipment calling for full heat demand, valves full open (HW coils, CUH, UH, FT).

b) Minimum flow = “system bypass” flow through CUH and UH coils only.

6. Points:

a. Boiler(s) status.

b. Boiler pump status.

c. Secondary (system) pump status.

d. Secondary (system) supply water temperature setpoint.

e. Secondary (system) supply water temperature active.

f. Secondary (system) return water temperature active.

g. Secondary (system) pump differential pressure active.

7. Alarms:

a. Boiler(s): lockout condition.

b. Boiler pump fail to start.

c. Secondary (system) pump fail to start.

d. Low secondary system supply water temperature ($>10^{\circ}\text{F}$ below setpoint).

e. High secondary system supply water temperature ($<10^{\circ}\text{F}$ above setpoint).

F. Hot Water Coils (DOAS System – duct mounted coils):

1. Provide a space mounted adjustable temperature sensor meeting the constraints of “control devices” listed above.

2. Setpoints: shall be globally adjustable at the BMS, including global range adjustment for local user control and shall be individually adjustable at each sensor within the global range.
3. All HWC's on a respective system (DOAS) shall have their control valves mapped to the DOAS unit control logic. Whenever the respective DOAS unit is in cooling or dehumidification mode, all associated HWC control valves shall be held closed (no reheat allowed).
4. On a call for heat at the space sensor, the HW coil control valve shall modulate towards full open based on active space temperature deviation below setpoint.
5. As space temperature approaches the sensor setpoint, the control valve shall modulate closed until setpoint is met.

G. Cabinet Unit Heaters:

1. Provide a space mounted temperature sensor. The temperature sensor shall cycle the fan On/Off as well as actuate the 2-position control valve open/closed based on heating demand.
2. Setpoints: shall be globally adjustable at the BMS only (no user adjustability at the space level).
 - a. Occupied: 70°F
 - b. Unoccupied: 60°F
3. Points:
 - a. Fan status.
 - b. Control valve status (open/closed).
 - c. Space temperature setpoint.
 - d. Space temperature active.
4. Alarms:
 - a. Low space temp. (>5°F below sensor setpoint)

H. Unit Heater:

1. Provide a space mounted temperature sensor. The temperature sensor shall cycle the fan On/Off based on heating demand.
2. Setpoints: shall be globally adjustable at the BMS only (no user adjustability at the space level).
 - a. Permanent: 50°F
3. Points:
 - a. Fan status.
 - b. Space temperature setpoint.
 - c. Space temperature active.
4. Alarms:

- a. Low space temp. (>5°F below sensor setpoint)

PART 3 – EXECUTION

3.1 COMMISSIONING OF EQUIPMENT AND SYSTEMS

- A. Coordinate with the Owner's Commissioning Agent (CxA) for the commissioning of the work of this specification section. The Contractor(s) providing the work of this specification section shall be available before construction, during construction, and at the end of construction to assist the CxA in the commissioning process. Assistance shall include demonstrating proper operation, calibration, and adjustment of the work of this specification section, as necessary for the CxA to verify that the equipment and systems are working properly and in accordance to the Construction Documents.
- B. Where the commissioning process reveals, as determined by the CxA, equipment and/or systems that are not operating properly or are not in accordance to the Construction Documents, such equipment and systems shall be repaired and/or adjusted until they are operating properly and are in accordance to the Construction Documents.
- C. Prior to final commissioning, submit documentation indicating that the Contractor(s) providing work of this section have verified the following:
 - 1. That equipment and systems of this specification section have been started up and tested in accordance to the manufacturer's installation manuals. Where either the manufacturer's installation manuals or the equipment submittals include manufacturer's start-up sheets, such documentation shall be completed, signed, and dated by the Contractor(s) performing the start-up.
 - 2. That equipment and systems of this specification section have been tested and balanced by the testing and balancing agency.

3.2 SPECIAL RESPONSIBILITIES

- A. Coordination: Cooperate and coordinate with work of other Sections in executing work of this Section.
 - 1. Perform work such that progress of entire project including work of other Sections shall not be interfered with or delayed.
 - 2. Provide information as requested on items furnished under this Section which shall be installed under other Sections.
 - 3. Obtain detailed installation information from manufacturers of equipment provided under this Section.
 - 4. Obtain final roughing dimensions or other information as needed for complete installation of items furnished under other Sections or by Owner.
 - 5. Keep fully informed as to shape, size and position of openings required for material or equipment to be provided under this and other Sections. Give full information so that openings required by work of this Section may be coordinated with other work and other openings and may be provided for in advance. In case of failure to provide sufficient information in proper time, provide cutting and patching or have same done, at own expense and to full satisfaction of Architect.

6. Provide information as requested as to sizes, number and locations of concrete housekeeping pads necessary for floor-mounted vibrating and rotating equipment provided under this Section.
7. Notify Architect of location and extent of existing piping, ductwork and equipment that interferes with new construction. In coordination with and with approval of Architect, relocate piping, ductwork and equipment to permit new work to be provided as required by Contract Documents. Remove non-functioning and abandoned piping, ductwork and equipment as directed by Architect. Dispose of or store items as requested by Architect.

B. Installation Only Items:

1. Where this Contractor is required to install items which it does not purchase, it shall coordinate their delivery and be responsible for this unloading from delivery vehicles and for their safe handling and field storage up to the time of installation. This trade shall be responsible for:
 - a. Any necessary field assembly and internal connections, as well as mounting in place of the items, including the purchase and installation of all dunnage supporting members and fastenings necessary to adapt them to architectural and structural conditions.
 - b. Their connection to building systems including the purchase and installation of all terminating fittings necessary to adapt and connect them to the building system.
2. This Contractor shall carefully examine such items upon delivery. Claims that any of these items have been received in such condition that their installation will require procedures beyond the reasonable scope of work of this Contractor will be considered only if presented in writing within one (1) week of their date of delivery. Unless such claims have been submitted this Contractor shall be fully responsible for the complete reconditioning or replacement of the damaged items.

C. Maintenance of equipment and Systems: Maintain HVAC equipment and systems until Final Acceptance. Ensure adequate protection of equipment and material during delivery, storage, installation and shutdown delays pending final test of systems and equipment because of seasonal conditions. Do not use boilers before providing water treatment where required; this includes use of boilers for temporary heat or for testing.

D. Use of Premises: Use of premises shall be restricted as directed by Architect and as required below:

1. Remove and dispose of dirt and debris, and keep premises reasonably clean. Upon completion of work, remove equipment and unused material. Put building and premises in neat and clean condition and do cleaning and washing required to provide acceptable appearance and operation of equipment, to satisfaction of Architect and as specified under CLEANING paragraph.
2. It shall be this trade's responsibility to store his material in a manner that will maintain an orderly clean appearance. If stored on-site in open or unprotected areas, all equipment and material shall be kept off the ground by means of pallets or racks, and covered with tarpaulins.
3. Do not interfere with functions of existing sewers and gas mains. Extreme care shall be observed to prevent debris from entering ductwork. Confer with Architect as to disruption of heating services or other utilities due to testing or connection of new work to existing. Interruption of heating services shall be performed at time of day or night deemed by Architect to provide minimum interference with normal operation. Obtain Architect's approval of the method proposed for minimizing service interruption.

E. Surveys and Measurements:

1. Base measurements, both horizontal and vertical, on reference points established by Contractor and be responsible for correct laying out of work.
2. In event of discrepancy between actual measurements and those indicated, notify Architect in writing and do not proceed with work until written instructions have been issued by Architect.

F. Fireproofing:

1. Clips, hangers, clamps, supports and other attachments to surfaces to be fireproofed shall be installed, insofar as possible prior to start of spray fiber work.
2. Ducts, piping and other items, which would interfere with proper application of fireproofing, shall be installed after completion of spray fiber work.
3. Patching and repairing of spray fireproofing due to cutting or damaging to fireproofing during course of work specified under this Section shall be performed by installer of fireproofing and paid for by trade responsible for damage and shall not constitute grounds for an extra to Owner.

3.3 MATERIALS AND WORKMANSHIP

- A. Work shall be neat and rectilinear. Ductwork and piping shall run concealed except in mechanical rooms and areas where no hung ceiling exists. Install material and equipment as required by manufacturers. Installation shall operate safely and without leakage, undue wear, noise, vibration, corrosion or water hammer. Work shall be properly and effectively protected, and pipe and duct openings shall be temporarily closed to prevent obstruction and damage before completion.
1. Except as specified otherwise, material and equipment shall be new. Provide supplies, appliances and connections necessary for complete and operational installation. Provide components required or recommended by OSHA and applicable NFPA documents.
 2. References to manufacturers and to catalog designation are intended to establish standards of quality for materials and performance but imply no further limitation of competitive bidding.
 3. Finish of materials, components and equipment shall be as approved by Architect and shall be resistant to corrosion and weather as necessary.
 4. Owner will not be responsible for material and equipment before testing and acceptance.

3.4 CONTINUITY OF SERVICES

- A. Do not interrupt existing service without Owner's approval.
- B. Schedule interruptions in advance, according to Owner's instructions. Submit, in writing, with request for interruption, methods proposed to minimize length of interruption.
- C. Interruptions shall be scheduled at such times of day and work so that they have minimal impact on Owner's operations.

3.5 TAGS

- A. Upon completion of work, attach engraved laminated tags to all valves (listed in the valve directory called for in the "Bulletins, Manuals and Instructions" paragraph of these Specifications) and all pieces of HVAC equipment (including but not limited to pumps, fans, air handlers, coils and all other equipment listed in the HVAC Schedules). Valve tags shall have black characters on white face, consecutively numbered and prefixed by letter "V". Equipment tags shall have black characters on white face with labels corresponding to drawing schedule numbers.
- B. Embossed or engraved aluminum or brass tags may be substituted if desired. Tags shall be at least 1/8" thick.
- C. Valve tags shall be at least 1" in diameter with numerals at least 3/8" high and attached by "S" hooks or chains. Equipment tags shall be at least 2" diameter securely attached to apparatus.
- D. Provide manufacturers equipment nameplates, catalog numbers and rating identification securely attached to electrical and mechanical equipment with screws or rivets. Adhesives or cements will not be permitted.

3.6 PIPE AND DUCT IDENTIFICATION

- A. Ductwork shall be stenciled at each junction or branch takeoff, at least once in each room, and at intervals not longer than 20 feet. Stencil shall clearly identify duct service ("S" for supply air; "R" for return air, "O" for outdoor air, "E" for exhaust air), area served by branch, and arrow indicating direction of flow.
- B. Provide color-coded pipe identification markers on piping installed under this Section. Pipe markers shall be snap-on laminated plastic protected by clear acrylic coating. Pipe markers shall be applied after architectural painting where such is required.
- C. Provide arrow marker with each pipe content marker to indicate direction of flow. If flow can be in either direction, use double-headed arrow marker.
- D. Mains shall be labeled at points of entrance and exit from mechanical room, adjacent to each valve, on each riser, at each tee fitting, at points of entrance and exit from building, at least once in each room and at intervals no longer than 20 feet.
- E. Size of legend letters on markers and length of color field shall be per the latest edition of ANSI A13.1.
- F. Markers shall be "Setmark" by Seton Name Plate Corp., or approved equal.

- G. Following color-coding shall be used with names in black letters on background and while letters on green background:

Service	Legend	Background Color
Suction Gas Refrigerant	SGR	Green
Discharge Gas Refrigerant	DGR	Green
Liquid Refrigerant	LR	Green
Condensate	CON	Yellow

- H. Color banding shall meet latest edition of ANSI A13.1 and OSHA.

3.7 ACCESS AND ACCESS PANELS

- A. Provide proper access to materials and equipment that require inspection, replacement, repair or service and coordinate their delivery with the installing Trade. If proper access cannot be provided, confer with Architect as to best method of approach for minimizing effect of reduced access which may result.
- B. Coordinate and prepare a location, size and function schedule of access panels required to fully service equipment and deliver to a representative of the installing Trade. Furnish and install distinctively colored buttons (color as selected by Architect) in finished ceiling to identify all access panels.
- C. Furnish access panels for installation under other Sections where fire dampers, volume dampers, controls, shut-off valves, control valves, check valves or other items installed under this Section require access and are concealed in floor, wall, furred space or above ceiling. Access panels shall be by Milcor, Knapp, Nystrom or Inland Steel; coordinate selection with other Sections supplying similar access panels.
- D. Ceilings consisting of lay-in or removable splined tiles do not require access panels and dampers, splitters or test hole openings above ceiling shall have location marked with thumb tack on finished ceiling panel. Location shall be noted on record Drawings.
- E. Access panels shall have same fire-rating classification as surface penetrated.
- F. Panels shall be at least 12" x 12"; access panels at equipment shall be 18" x 18".

3.8 PENETRATIONS AND SLEEVES

A. General:

- 1. Provide pipe and duct sleeves and packing materials as specified and as shown on Drawings at penetrations of foundations, walls, slabs (except on-grade), partitions and floors. Sleeves shall meet NFPA-101 requirements and materials requirements of PART 2 or this Section.

2. Coordinate work carefully with architectural and structural work. Set sleeves in forms before concrete is poured. Provide core drilling as necessary if walls are poured, or otherwise constructed, without sleeves and a wall penetration is required. Provide core drilling as required for penetrations of existing construction. Do not penetrate structural members without Architect's approval.
3. Sleeves for insulated pipe and duct in non-fire rated construction shall accommodate continuous insulation without compression. Sleeves and/or penetrations in fire-rated construction shall be packed with fire-rated material which shall maintain the fire rating of the wall. Seal ends of penetrations to provide continuous vapor barrier where insulation is interrupted. See "PART 2" of these Specifications for requirements for packing materials.
4. Sleeves through floor shall be water-tight and shall extend 2" above floor surface.

B. Pipe Sleeves:

1. Annular space between pipe and sleeve shall be at least 1/4".
2. Sleeves are not required for slabs-on-grade unless specified otherwise.
3. Sleeves and packing materials, through rated fire walls and smoke partitions shall maintain fire rating of construction penetrated.
4. Do not support piping risers on sleeves.

C. Duct Sleeves and Prepared Openings:

1. Provide duct sleeves for round ducts 15" and smaller; provide prepared, framed openings for round ducts larger than 15" and for square, rectangular and flat oval ducts, except as specified otherwise. Sleeves shall meet SMACNA requirements.
2. Provide sleeves for ducts through 1, 2, or 3-hour fire-rated construction and smoke partitions, regardless of size and shape of ducts. Sleeves shall maintain fire rating of construction penetrated. Sleeve and seal materials, construction and clearances shall meet requirements of SMACNA Fire Damper and Heat Stop Guide for Air Handling Systems.
3. Prepared openings shall be framed to provide 1" clearance between framing and duct or duct insulation.

D. Installation Testing, Listings and Approvals:

1. Installation shall meet material manufacturer's recommendations exactly, particularly as regarding safety, ventilation, removal of foreign materials and other details of installation. Dam openings as recommended. Remove flammable materials used for damming and forming seals in fire-rated construction.
2. Sleeve penetration methods shall be water and gas-tight and shall meet requirements of ASTM E-119 Standard Methods of Fire Tests of Building Construction and Materials.
3. Fire-stop penetration seal methods and materials shall be FM-approved and UL-listed as applicable.
4. Inspect foamed sealants to ensure manufacturer's optimum cell structure and color ranges.

3.9 ANCHORS AND INSERTS

- A. Inserts shall be iron or steel of type to receive machine bolt head or nut after installation. Inserts shall permit adjustment of bolt in one (1) horizontal direction and shall develop strength of bolt when installed in properly cured concrete.
- B. Provide anchors as necessary for attachment of equipment supports and hangers.

3.10 INSTALLATION OF EQUIPMENT

- A. Avoid interference with structure and with work of other trades, preserving adequate headroom and clearing doors and passageways to satisfaction of Architect and in accordance with code requirements. Installation shall permit clearance for access to equipment for repair, servicing and replacement.
- B. Install equipment so as to properly distribute equipment loads on building structural members provided for equipment support under other Sections. Roof-mounted equipment shall be installed and supported on structural steel provided under other Sections.
- C. Provide suspended platforms, strap hangers, brackets, shelves, stands or legs as necessary for floor, wall or ceiling mounting of equipment provided under this Section (e.g. heating and ventilating units, fans, ducts and piping) as indicated on Drawings and in Specifications.
- D. Provide steel supports and hardware for proper installation of hangers, anchors, guides, etc.
- E. Provide cuts, weight and other pertinent data required for proper coordination of equipment support provisions and installation.
- F. Structural steel and hardware shall conform to Standard Specifications of ASTM; use of steel and hardware shall conform to requirements of Section 5 of Code of Practice of American Institute of Steel Construction.
- G. Verify site conditions and dimensions of equipment to ensure access for proper installation of equipment without disassembly which will void warrantee. Report in writing to Architect, prior to purchase or shipment of equipment involved, on conditions which may prevent proper installation.

3.11 INSTALLATION OF BOILERS

- A. General:
 - 1. Installation shall be performed by the contractor in accordance with the requirements of the applicable codes. Contractor shall review the boiler and installation for compliance with requirements and/or issues that may affect boiler performance. Installation should not proceed until unsatisfactory conditions have been corrected.
 - 2. The contractor shall mount the equipment as described below:
 - a. Install boilers on cast-in-place concrete equipment base in compliance with the requirements for equipment bases and foundation specified in Section 03 30 00 "Cast-in-Place Concrete."
 - b. If required by the local code, install vibration isolation devices in compliance with Section 23 05 48 "Vibration and Seismic Controls for HVAC Piping and Equipment."

3. The contractor shall install gas-fired boilers in accordance with NFPA 54/ANSI Z223.1 (United States), or CAN/CSA B/149.1 (Canada).
4. The contractor shall install gas-fired boilers in accordance with NBIC – Part 1 (Installation), or another installation code having local jurisdiction.
5. The contractor shall assemble and install any external boiler safety/trim devices.
6. The contractor shall install any electrical devices furnished with the boiler, but not specified to be factory-mounted.
7. The contractor shall install control wiring to field mounted electrical devices in accordance with the requirements of NFPA 70.
8. The contractor shall install electrical (power) wiring to the boiler in accordance with the requirements of NFPA 70.

B. Connections:

1. Gas Piping:

- a. Each boiler shall be provided with all necessary gas connections. Refer to the boiler's specification sheet or manual for connection sizes.
- b. Install gas piping in accordance with NFPA 54/ANSI Z223.1 (United States), or CAN/CSA B/149.1 (Canada).
- c. For boilers configured for Natural Gas or Dual Fuel, refer to the requirements of Section 23 11 23 "Facility Natural-Gas Piping".
- d. For boilers configured for Propane Gas or Dual Fuel, refer to the requirements of Section 23 11 26 "Facility Liquefied-Petroleum Gas Piping".

2. Hydronic Piping:

- a. Each boiler shall be provided with all necessary inlet (supply) and outlet (return) connections. Refer to the boiler's specification sheet or manual for connection sizes.
- b. Check manufacturer's installation manual for clearance dimensions and install piping that will allow for service and ease of maintenance.
- c. Install piping from equipment drain connection to nearest floor drain. Piping shall be at least full size of connection and adhere to proper codes for neutralization.
- d. The hydronic piping and related components shall comply with the requirements of 23 21 00 "Hydronic Piping and Pumps".
- e. All meters and gages in the hydronic piping shall comply with the requirements of Section 23 05 19 "Meters and Gages for HVAC Piping".
- f. All instrumentation and controls in the hydronic piping shall comply with the requirements of Section 23 09 13 "Instrumentation and Control Devices for HVAC".
- g. All valves in the hydronic piping shall comply with the requirements of Section 23 05 23 "General-Duty Valves for HVAC Piping".

- h. All expansion fittings shall comply with the requirements of Section 23 05 16 "Expansion Fittings and Loops for HVAC Piping".
 - i. Any pipe hangers or supports shall comply with the requirements of Section 23 05 29 "Hangers and Supports for HVAC Piping and Equipment".
 - j. Any vibration isolation devices on the hydronic piping shall comply with the requirements of Section 23 05 48 "Vibration and Seismic Controls for HVAC Piping and Equipment."
 - k. The feedwater piping shall comply with the requirements of Section 23 53 00 "Heating Boiler Feedwater Equipment".
 - l. The hydronic piping shall be insulated in accordance with the requirements of Section 23 07 19 "HVAC Piping Insulation".
 - m. After insulation, all hydronic piping shall be identified in accordance with the requirements of Section 23 05 53 "Identification for HVAC Piping and Equipment".
 - n. Any water treatment of the hydronic system shall be in accordance with the boiler manufacturer's requirements and/or Section 23 25 13 "Water Treatment for Closed-Loop Hydronic Systems".
3. Exhaust Venting:
- a. The boilers shall be dual certified as Category II or IV appliances and are capable of operating with slightly negative to slightly positive exhaust vent pressure, and the vent gas temperature is likely to cause condensate production in the vent.
 - b. Install the exhaust/flue venting system in accordance with NFPA 54/ANSI Z223.1 (United States), or CAN/CSA B/149.1 (Canada) and per the manufacturer's recommendations in the installation manual.
 - c. All exhaust venting components shall comply with the requirements of Section 23 51 00 "Breechings, Chimneys and Stacks."
4. Air Inlet:
- a. The boilers shall be certified for Direct Vent / Sealed Combustion installations where the combustion air is supplied directly to the boiler through ductwork.
 - b. Install the air inlet system in accordance with NFPA 54/ANSI Z223.1 (United States), or CAN/CSA B/149.1 (Canada) and per the manufacturer's recommendations in the installation manual.
 - c. All air inlet components shall comply with the requirements of Section 23 37 00 "Air Outlets and Inlets".
5. Electrical:
- a. Install an external disconnect and overload protection for each boiler in accordance with the requirements of NFPA 70.
 - b. The voltage requirements for each boiler model is described below:
 - c. The boilers shall be configured for 110-120VAC, Single Phase (w/ Neutral), 60 Hz.
 - d. The amperage requirements for each boiler shall be as scheduled.

3.12 PAINTING

- A. Equipment installed under this Section shall have shop coat of non-lead gray paint. Hangers and supports shall have one (1) coat of non-lead red primer. Machinery such as pumps, fans, etc., shall be stenciled with equipment name. Stencil shall be at least 6" high for large equipment, 2" high for small equipment. Finish painting, including painting of various piping and duct systems, shall be done under other Sections.
- B. Note requirements for Architect's approval invoked under paragraph 3.03 MATERIALS AND WORKMANSHIP regarding finish of material and equipment which are visible or subject to corrosive or atmospheric conditions.

3.13 CLEANING

- A. Ductwork:
 - 1. New ductwork shall be shipped from the shop to the job site with the ends of the ducts sealed tight with heavy duty plastic to prevent dirt, water or other elements from entering the ducts while in transport to the job site.
 - 2. At the end of each working day all open ends of ducts that have been hung in place shall be re-covered with the plastic material to prevent the entry of foreign objects, dirt or debris into the ducts.
 - 3. All ducts shall be cleaned of dirt and any other foreign matter if it should accumulate on or in the ducts prior to start-up and testing of the new HVAC systems. If the ducts do need to be blown clean, cheesecloth shall be placed over the outlet air openings, and the rooftop unit(s) serving the ducts shall be provided with temporary filters.

3.14 STARTUP, TESTING, ADJUSTING AND BALANCING FOR HVAC

- A. General:
 - 1. 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, Ventilating, 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.
 - 2. Qualifications:
 - a. Agency: Company specializing in the testing, adjusting, and balancing of systems specified in this section with minimum three years documented experience certified by AABC.
 - b. Perform work under supervision of AABC Certified Test and Balance Engineer or NEBB Certified Testing, Balancing and Adjusting Supervisor.
- B. Examination:

1. Verify that systems are complete and operable before commencing work. Ensure the following conditions:
 - a. Systems are started and operating in a safe and normal condition.
 - b. Control systems are installed complete and operable.
 - c. Proper thermal overload protection is in place for electrical equipment.
 - d. Ductwork systems:
 - 1) Final filters are clean and in place. If required, install temporary media in addition to final filters.
 - 2) Duct systems are clean of debris.
 - 3) Fans are rotating correctly.
 - 4) Dampers are in place and open.
 - 5) Air coil fins are cleaned and combed.
 - 6) Access doors are closed and duct end caps are in place.
 - 7) Air inlets and outlets are installed and connected.
 - 8) Duct system leakage is minimized.
2. Submit field reports. Report defects and deficiencies noted during performance of services which prevent system balance.
3. Beginning of work means acceptance of existing conditions.

C. Preparation:

1. Provide instruments required for testing, adjusting, and balancing operations. Make instruments available to Owner to facilitate spot checks during testing.
2. Provide additional balancing devices as required.

D. Installation Tolerances:

1. HVAC Systems: Adjust to within plus or minus 10 percent of design for supply and return systems and plus or minus 10 percent of design for exhaust systems.
2. Air Outlets and Inlets: Adjust outlets and inlets in space to within plus or minus 10 percent of design.

E. Adjusting:

1. Ensure recorded data represents actual measured or observed conditions.
2. Permanently mark settings of balancing devices allowing settings to be restored. Set and lock memory stops.
3. After adjustment, take measurements to verify balance has not been disrupted or that such disruption has been rectified.

4. Leave systems in proper working order, replacing belt guards, closing access doors, closing doors to electrical switch boxes, and restoring thermostats to specified settings.

F. Sequencing:

1. All systems providing both heating and cooling shall be balanced in both modes of operation.
2. For all systems provide initial balancing to tolerances indicated in this section. After initial balancing readjust systems as directed by engineer and owner as necessary to achieve uniform space temperatures free from objectionable drafts and noises.

G. Air System Procedure:

1. Adjust equipment and distribution systems to provide required or design air quantities.
2. Make air quantity measurements in ducts by Pitot tube traverse of entire cross sectional area of duct.
3. Measure and record air quantities at air inlets and outlets.
4. Use volume control devices to regulate air quantities only to extent that adjustments do not create objectionable air motion or sound levels. Adjust air volume by adjusting duct internal devices such as dampers and splatters. Do not utilize opposed blade dampers at air inlets and outlets.
5. Vary total system air quantities by adjusting sheave position or replacing fixed sheaves with larger or smaller diameter sheaves at each fan. Provide replacement fixed ratio sheaves and belts after final balancing selected to achieve design airflows. Vary branch air quantities by damper regulation.
6. Measure and record static air pressure conditions at air supply and exhaust units, including filter and coil pressure drops, and total pressure across the fan. Make allowances for 50 percent loading of filters.
7. Adjust settings and minimum setpoints for motorized and backdraft dampers to design conditions.
8. Measure and record temperature conditions across dampers to check leakage.
9. Where modulating dampers are provided, take measurements and balance at extreme conditions.
10. Measure and record building static pressure and adjust supply, return, and exhaust air systems to provide required relationship between each to maintain approximately 0.05 inches (12.5 Pa) positive static pressure near the building entries.
11. Measure and record inlet and outlet temperatures at each air supply unit at full cooling and heating capacity.
12. Prepare system pressure profiles: On schematic fan system diagrams, show STATIC pressure readings taken at following points.
 - a. Fan discharge
 - b. Fan discharge plenum or main duct in fan room
 - c. Fan inlet plenum

- d. Inlet and outlet plenum space on each side of each heating coil, cooling coil and filter
- e. Return air/outside air mixing plenum
- f. Duct or plenum immediately behind outside air louver
- g. Return/exhaust fan inlet
- h. Return/exhaust fan outlet
- i. Each main branch duct takeoff at each floor
- j. Within 3 feet of last supply air outlet connection in most remote duct.

H. Schedules:

- 1. Equipment requiring Testing, Adjusting, and Balancing including but not limited to:
 - a. Pumps
 - b. Unit Air Conditioners
 - c. Air Coils
 - d. Air Handling Units
 - e. Fans
 - f. Generators
 - g. Electric Heaters
 - h. Gas Detection System
 - i. Intake Ventilators
 - j. Exhaust Fans
 - k. Energy Recovery Unit
 - l. Variable Refrigerant Flow System

I. Report Forms:

- 1. Forms shall include the following:
 - a. Title Page:
 - 1) Name of Testing, Adjusting, and Balancing Agency
 - 2) Address of Testing, Adjusting, and Balancing Agency
 - 3) Telephone number of Testing, Adjusting, and Balancing Agency
 - 4) Project name
 - 5) Project location
 - 6) Project Architect
 - 7) Project Engineer
 - 8) Project Contractor
 - 9) Project altitude

- 10) Report date
- b. All equipment shall include:
 - 1) Manufacturer
 - 2) Model/Size
 - 3) Identification/Number
 - 4) Serial Number
- c. Summary Comments:
 - 1) Design versus final performance
 - 2) Notable characteristics of system
 - 3) Description of systems operation sequence
 - 4) Summary of outdoor and exhaust flows to indicated amount of building pressurization
 - 5) Nomenclature used throughout report
 - 6) Test conditions
- d. Instrument List:
 - 1) Instrument
 - 2) Manufacturer
 - 3) Model number
 - 4) Serial number
 - 5) Range
 - 6) Calibration date
- e. Electric Motors: (data for single and multispeed motors)
 - 1) Manufacturer
 - 2) Model/Frame
 - 3) HP/BHP/efficiency
 - 4) Phase, voltage, amperage; nameplate, actual, no load
 - 5) RPM
 - 6) Service factor
 - 7) Starter size, rating, heater elements
 - 8) Sheave Make/Size/Bore
- f. V-Belt Drive:
 - 1) Identification/location
 - 2) Required driven RPM
 - 3) Driven sheave, diameter and RPM
 - 4) Belt, size and quantity

- 5) Motor sheave diameter and RPM
- 6) Center to center distance, maximum, minimum, and actual
- g. Pump Data:
 - 1) Impeller
 - 2) Service
 - 3) Design flow rate, pressure drop, BHP
 - 4) Actual flow rate, pressure drop, BHP
 - 5) Discharge pressure
 - 6) Suction pressure
 - 7) Total operating head pressure
 - 8) Shut off, discharge and suction pressures
 - 9) Shut off, total head pressure
- h. Combustion Test:
 - 1) Manufacturer
 - 2) Model number
 - 3) Firing rate
 - 4) Over-fire draft
 - 5) Gas meter timing dial size
 - 6) Gas meter time per revolution
 - 7) Gas pressure at meter outlet
 - 8) Gas flow rate
 - 9) Heat input
 - 10) Oil flow rate
 - 11) Burner manifold gas pressure
 - 12) Percent carbon monoxide (CO)
 - 13) Percent carbon dioxide (CO₂)
 - 14) Percent oxygen (O₂)
 - 15) Percent excess air
 - 16) Flue gas temperature at outlet
 - 17) Ambient temperature
 - 18) Net stack temperature
 - 19) Percent stack loss
 - 20) Percent combustion efficiency
 - 21) Heat output

- i. Air Cooled Condensing Unit:
 - 1) Location
 - 2) Serial number
 - 3) Entering DB air temperature, design and actual
 - 4) Leaving DB air temperature, design and actual
 - 5) Number of compressors
- j. Coil Data:
 - 1) Location
 - 2) Service
 - 3) Air flow, design and actual
 - 4) Entering air DB temperature, design and actual
 - 5) Entering air WB temperature, design and actual
 - 6) Leaving air DB temperature, design and actual
 - 7) Leaving air WB temperature, design and actual
 - 8) Water flow, design and actual
 - 9) Water pressure drop, design and actual
 - 10) Entering water temperature, design and actual
 - 11) Leaving water temperature, design and actual
 - 12) Saturated suction temperature, design and actual
 - 13) Air pressure drop, design and actual
- k. Air Handling Units/ Rooftop Units:
 - 1) Location
 - 2) Arrangement/Class/Discharge
 - 3) Air flow, specified and actual
 - 4) Return air flow, specified and actual
 - 5) Outside air flow, specified and actual
 - 6) Total static pressure (total external), specified and actual
 - 7) Inlet pressure
 - 8) Discharge pressure
 - 9) Sheave Make/Size/Bore
 - 10) Number of Belts/Make/Size
 - 11) Fan RPM
- l. Return Air/Outside Air Data:
 - 1) Identification/location

- 2) Design air flow
 - 3) Actual air flow
 - 4) Design return air flow
 - 5) Actual return air flow
 - 6) Design outside air flow
 - 7) Actual outside air flow
 - 8) Return air temperature
 - 9) Outside air temperature
 - 10) Required mixed air temperature
 - 11) Actual mixed air temperature
 - 12) Design outside/return air ratio
 - 13) Actual outside/return air ratio
- m. Exhaust/Supply Fan Data:
- 1) Location
 - 2) Air flow, specified and actual
 - 3) External static pressure, specified and actual
 - 4) Inlet pressure
 - 5) Discharge pressure
 - 6) Fan RPM
- n. Duct Traverse:
- 1) System zone/branch
 - 2) Duct size
 - 3) Area
 - 4) Design velocity
 - 5) Design air flow
 - 6) Test velocity
 - 7) Test air flow
 - 8) Duct static pressure
 - 9) Air temperature
 - 10) Air correction factor
- o. Duct Leak Test:
- 1) Description of ductwork under test
 - 2) Duct design operating pressure
 - 3) Duct design test static pressure

- 4) Duct capacity, air flow
- 5) Maximum allowable leakage duct capacity times leak factor
- 6) Test apparatus
 - a) Blower
 - b) Orifice, tube size
 - c) Orifice size
 - d) Calibrated
- 7) Test static pressure
- 8) Test orifice differential pressure
- 9) Leakage
- p. Terminal Unit Data:
 - 1) Type, constant, variable, single, dual duct
 - 2) Location
 - 3) Size
 - 4) Minimum static pressure
 - 5) Minimum design air flow
 - 6) Maximum design air flow

END OF SECTION

SECTION 26 00 00

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SECTION 26 00 00

ELECTRICAL

PART 1 – GENERAL

1.1 GENERAL REQUIREMENTS AND REFERENCES

- A. Include “General Requirements” and applicable parts of Division 1 as part of this section.
- B. Examine all other sections of the Specifications for requirements which affect work under this Section whether or not such work is specifically mentioned in this section. Where paragraphs of this section conflict with similar paragraphs of Division 1, requirements of this section shall prevail.
- C. Coordinate work with that of all other trades affecting, or affected by work of this section. Cooperate with such trades to assure the steady progress of all work under the Contract.
- D. The Subcontractor shall be responsible for filing all documents, payment of all fees, and securing of all inspections and approvals necessary for the work of this section.
- E. The Electrical Subcontractor shall carry in the Bid Price all Utility Company and Municipal back charges for all materials furnished and work performed by them in conjunction with this Contract and pay same to the respective agency upon demand. The Electrical Subcontractor shall not be entitled to additional compensation after the submittal of his bid price should he fail, for any reason, to obtain the total back charge costs to be incurred by the Local Utility Companies or Municipal Agencies.

1.2 DEFINITIONS

- A. As used in this section, “provide” means “furnish and install”, and “POS” means “Provided Under Other Sections”.
- B. As used in the Contract Drawings and Specifications for Electrical work, certain non-technical words shall be understood to have specific meanings as follows, regardless of indications to the contrary in the General Conditions of other documents governing the Electrical work.
 - 1. “Furnish” means: Purchase and deliver to the project site complete with every necessary appurtenance and support, all as part of the Electrical work. Purchasing shall include payment of all sales taxes and other surcharges as may be required to assure that purchased item(s) are free of all liens, claims, or encumbrances.
 - 2. “Install” means: 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, all as part of the Electrical work.
 - 3. “Provide” means: “Furnish” and “Install”.
 - 4. “New” means: Manufactured within the past two (2) years and never before used.
- C. Except where modified by a specific notation to the contrary, it shall be understood that the indication

and/or description of any electrical item in the Contract Drawings or Specifications for Electrical work carries with it the instruction to furnish, install and connect the item as part of the Electrical work, regardless of whether or not this instruction is explicitly stated.

- D. It shall be understood that the Specifications and Drawings for Electrical work are complimentary and are to be taken together for a complete interpretation of the Electrical work except that indications on the Contract Drawings, which refer to an individual element of work, take precedence over the Specifications where they conflict.

1.3 SCOPE

- A. Perform work and provide material and equipment as shown on Drawings and as specified or indicated in this Section of the Specifications. Completely coordinate work of this Section with work of other trades and provide a complete and fully functional installation.
1. Primary electric service duct bank.
 2. Secondary electric service including underground conduit bank and secondary service entrance feeders, from the utility company pad mounted transformer, building grounding electrode and main service disconnect.
 3. Interior secondary distribution systems including distribution panelboards, motor controls, magnetic starters, overcurrent and switching devices, panelboards, raceways, cables, wiring, junction and pull boxes, wireways, and all other components required for complete electrical distribution system.
 4. All lighting systems (indoor and outdoor, normal, night, emergency and exit) including all fixtures, lamps, mounting accessories, switches, controls, outlets, wiring, raceways, and all other components and fittings required for a complete lighting system.
 5. Grounding and bonding of all electrical systems and equipment.
 6. Wiring devices (switches and receptacles) complete with associated wallplates.
 7. Power wiring to HVAC equipment.
 8. Testing of all electrical systems.
 9. Fire alarm system modifications.
 10. Coordination between electrical and other trades.
 11. All other systems hereinafter specified or indicated on the Contract Drawings, complete, leaving ready an electrical system in perfect operating condition.
 12. All required staging and scaffolding of any height.
- B. Drawings and Specifications form complimentary requirements; provide work specified and not shown, and work shown and not specified as though explicitly required by both. Although work is not specifically shown or specified, provide supplementary or miscellaneous items, appurtenances, devices and materials obviously necessary for a sound, secure and complete installation.

- C. Give notices, file plans, obtain permits and licenses, pay fees and back charges, and obtain necessary approvals from Authorities Having Jurisdiction as required to perform work in accordance with all legal requirements and with Specifications, Drawings, Addenda and Change Orders, all of which are part of Contract Documents.
- D. Before submitting bid, visit and carefully examine site to identify existing conditions and difficulties that will affect work of this Section. No extra payment will be allowed for additional work caused by unfamiliarity with site conditions that are visible or readily construed by an experienced observer. Site visit is particularly important because this is renovation work.
- E. Before starting work in a particular area of the project, visit site and examine conditions under which work must be performed including preparatory work done under other Sections or Contracts or by Owner. Report conditions that might affect work adversely in writing through Contractor to Architect. Do not proceed with work until defects have been corrected and conditions are satisfactory. Commencement of work shall be construed as complete acceptance of existing and preparatory work.

1.4 RELATED WORK UNDER OTHER SECTIONS

- A. The following items are not included in this section and will be performed under the designated sections.
 - 1. Temporary Facilities.
 - 2. Earthwork: Excavation and backfill.
 - 3. Concrete:
 - a. Equipment foundations.
 - b. Housekeeping pads.
 - c. Concrete encasement for conduit banks.
 - d. Rebar for items "a. & b." above.
 - 4. Masonry: All openings in masonry walls.
 - 5. Waterproofing, Dampproofing and Caulking.
 - 6. Roofing and Flashing.
 - 7. Painting: All painting except as specified herein.
 - 8. Finish Carpentry and Millwork.
 - 9. Steel Doors and Frames.
 - 10. Finish Hardware.
 - 11. Plumbing.
 - 12. HVAC.

1.5 REGULATORY REQUIREMENTS

- A. Comply with all applicable Federal and State laws, and all Local Codes, By-laws and Ordinances.
- B. Where provisions of the Contract Documents conflict with any codes, rules or regulations, the latter shall govern. Where the contract requirements are in excess of applicable codes, rules or regulations, the contract provisions shall govern unless the Architect rules otherwise.
- C. Request inspections from Authorities Having Jurisdiction, obtain all permits and pay for all fees and inspection certificates as applicable and/or required. All permits and certificates shall be turned over to the Owners at the completion of the work. Copies of permits shall be given to the resident engineer prior to the start of work.
- D. Unless otherwise specified or indicated, materials and workmanship and equipment performance shall conform with the latest edition of the following standards, codes, Specifications, requirements and regulations:
 - 1. State Building Code.
 - 2. State Electrical Code.
 - 3. State Fire Code.
 - 4. National Fire Protection Association (NFPA).
 - 5. Local Town Regulations and By-Laws.
 - 6. Underwriter's Laboratories, Inc. (UL).
 - 7. National Electrical Manufacturer's Association (NEMA).
 - 8. American National Standards Institute (ANSI).
- E. All Electrical work shall meet or exceed any other state and local codes and/or Authorities Having Jurisdiction including all other standards indicated herein.

1.6 SUBMITTALS

- A. This paragraph shall supplement Division 1.
- B. Definitions:
 - 1. Shop Drawings: Information prepared by the Contractor to illustrate portions of the work in more detail than shown in the Contract Documents.
 - 2. Coordination Drawings: Detailed, large-scale layout Shop Drawings showing HVAC, Electrical, Plumbing and Fire Protection work superimposed to identify conflicts and ensure inter-coordination of Mechanical, Electrical, Architectural, Structural and other work.
 - 3. Manufacturer's Product Data: Information prepared by the manufacturer which depicts standard equipment.
- C. Submittals, Procedures and Format:

1. Review submittal packages for compliance with Contract Documents and then submit to Architect for review. Submit transparency and two (2) blue or black-line reproductions of each Shop Drawing larger than 8-1/2" x 11". Submit eight (8) sets of each smaller shop drawing. After review, transparency original of each large Shop Drawing and six (6) sets of each small shop drawing will be returned with reviewer's marks. Electronically submitted shop drawings are acceptable.
2. Each Shop Drawing shall indicate in title block, and each Product Data package shall indicate on cover sheet, the following information:
 - a. Title.
 - b. Name and location of project.
 - c. Names of Architect, Engineer, Contractor and Subcontractor(s).
 - d. Names of Manufacturer, Supplier, Vendor, etc.
 - e. Date of submittal.
 - f. Whether original submittal or resubmitted.
3. Shop Drawings and/or Manufacturer's Product Data shall contain detailed dimensional Drawings, accurate and complete description of materials of construction, manufacturer's published performance characteristics and capacity ratings (performance data alone is not acceptable), electrical requirements and wiring diagrams. Drawings shall clearly indicate location (terminal block or wire number), voltage and function for all field terminations, and other information necessary to demonstrate compliance with all requirements of Contract Documents.

D. Acceptable Manufacturers:

1. The Architect's Mechanical/Electrical design for each project is based on the single manufacturer listed in the schedule or shown on the Contract Drawings. In Division 26 of these Specifications certain "Alternate Manufacturers" are listed as being acceptable. These are acceptable only if, as a minimum, they:
 - a. Meet all performance criteria listed in the schedules and outlined in the Specifications.
 - b. Have identical operating characteristics to those called for in the Specifications.
 - c. Fit within the available space it was designed for, including space for maintenance and component removal, with no modifications to either the space or the product. Clearances to walls, ceilings and other equipment will be at least equal to those shown on the Contract Documents. The fact that a manufacturer's name appears as acceptable shall not be taken to mean the Architect has determined that the Manufacturer's products will fit within the available space. This determination is solely the responsibility of the Contractor.
 - d. For equipment mounted in areas where structural matters are a consideration, the products must have a weight no greater than the product listed in the schedules or Specifications.
 - e. Products must adhere to all architectural considerations including, but not limited to, being the same size and of the same physical appearance as scheduled or specified products.

E. Substitutions: Substitution of products by manufacturers other than those listed shall only be done in accordance with subparagraph "F" "Substitutions and Deviations".

F. Substitutions and Deviations:

1. Deviations from the Contract Documents and the substitution of materials or equipment relative to the "Acceptable Manufacturers" referred to above shall be requested individually in writing whether deviations result from field conditions, standard shop practice, or other cause. Submit letter with transmittal of Shop Drawings which flags the substitution or deviation to the attention of the Architect. The letter shall describe changes in the system shown and physical characteristics (connections to adjacent materials, electrical services, service access requirements, and other characteristics), and differences in operating characteristics or cycles.
2. Without letters flagging the substitution or deviation to the Architect, it is possible that the Architect may not notice such substitution or deviation or may not realize its ramifications. Therefore, if such letters are not submitted to the Architect, the Contractor shall hold the Architect and his consultants harmless for any and all adverse consequences resulting from the deviations being implemented. Adverse consequences shall include, but not be limited to, excessive noise, excessive maintenance, shortened longevity, spatial coordination problems, and inadequate performance versus scheduled design. This shall apply regardless of whether the Architect has reviewed or approved Shop Drawings containing the deviation, and will be strictly enforced.
3. Do not request substitute materials or equipment unless identical material or equipment has been operated successfully for at least three (3) consecutive years. Such materials and equipment shall be a regular cataloged item shown in the current catalog of the manufacturer. When deviation or substitution is permitted, coordinate fully with related changes to Architectural, Structural, Plumbing, Fire Protection, Mechanical, and other work. Ensure that related changes necessary for coordination of substituted items are made within the Contract Price. Assume full responsibility for safety, operation and performance of the altered system. Any extra costs incurred to the project based on the use of alternate manufacturers shall be borne by the Contractor who has requested the substitution.
4. Substitutions of equipment, systems, etc. requiring approval of local Authorities must comply with such regulations and be filed by the Contractor (should filing be necessary).
5. Consideration will not be given to claims that the substituted item meets the performance requirements with lesser construction. Performance, as delineated in schedules and in the Specifications, shall be interpreted as minimum performance.
6. Approval of proposed deviations or substitutions, if any, will be made at discretion of Architect.
7. If equipment is proposed for substitution that is not tested and rated according to industry-wide standards, the Architect shall have the right to have performance tests completed, at the Contractor's expense, to confirm the manufacturer's performance claims.

G. Submittal Notations: Submittals will be returned from the Architect marked as illustrated below:

☐ NO EXCEPTION TAKEN	☐ ACCEPTED AS NOTED
☐ NOT ACCEPTED	☐ REVISE AND RESUBMIT

1. Checking is only for general conformance with the design concept of the project and general compliance with the information given in the Contract Documents. Any action shown is subject to the requirements of the Contract Drawings and Specifications. Contractor is responsible for dimensions which shall be confirmed and correlated at the job site; fabrication process and techniques of construction; coordination of his work with that of all other trades; and the satisfactory performance of

his work.

- H. Schedule: Incorporate the Shop Drawing review period into the construction schedule so that work is not delayed. Contractor shall assume full responsibility for delays caused by not incorporating the following Shop Drawing review time requirements into his project schedule. Allow at least ten (10) working days, exclusive of transmittal time, for review each time Shop Drawing is submitted or resubmitted with the exception that fifteen (15) working days, exclusive of transmittal time, are required for the following:
1. Motor control wiring diagram submittals.
 2. Coordination Drawings, if required by this Specification.
 3. If more than five (5) Shop Drawings of this trade are received in one (1) calendar week.
- I. List of Proposed Equipment and Materials: Within four (4) weeks after Award of Contract and before ordering materials or equipment, submit a complete list of proposed materials and equipment and indicate manufacturer's names and addresses. No consideration will be given to partial lists submitted out of sequence.
- J. Responsibility:
1. The intent of submittal review is to check for capacity, rating, and certain construction features. Contractor shall ensure that work meets requirements of the Contract Documents regarding information that pertains to fabrication processes or means, methods, techniques, sequences and procedures of construction; and for coordination of work of this and other Sections. Work shall comply with submittals marked "REVIEWED" to extent that they agree with the Contract Documents. Submittal review shall not diminish responsibility under this Contract for dimensional coordination, quantities, installation, wiring, supports and access for service, nor the shop drawing errors or deviations from requirements of the Contract Documents. The Architect's noting of some errors while overlooking others will not excuse the Contractor for proceeding in error. Contract Document requirements are not limited, waived, nor superseded in any way by review.
 2. Inform Subcontractors, Manufacturers, Suppliers, etc., of scope and limited nature of review process and enforce compliance with the Contract Documents.
- K. Material and equipment requiring Shop Drawing and/or Manufacturer's Data Submittals shall include but not be limited to:
1. Light fixtures.
 2. Panelboards.
 3. Overcurrent and switching devices.
 4. Wiring devices and wall plates.
 5. Fire alarm devices.
 6. Wiring and cables.

7. Conduit.
8. Boxes and fittings.
9. Safety switches.
10. Lighting control system.

1.7 SURVEYS AND MEASUREMENTS

- A. Base all required measurements, both horizontal and vertical, on reference points established by the General Contractor and be responsible for the correct laying out of the Electrical work. In the event of a discrepancy between actual measurements and those indicated, notify the General Contractor in writing. Do not proceed with the work required until written instructions have been issued by the General Contractor.

1.8 COORDINATION

- A. HVAC, Plumbing, Fire Protection, and Electrical Drawings are diagrammatic. They indicate general arrangements of Mechanical and Electrical systems and other work. They do not show all offsets required for coordination nor do they show the exact routings and locations needed to coordinate with Structural and other trades and to meet Architectural requirements.
- B. Work shall be performed in cooperation with other trades on the project and so scheduled as to allow speedy and efficient completion of the work.
- C. Furnish to other trades advance information on locations and sizes of all frames, boxes, sleeves and openings needed for their work. Furnish information and Shop Drawings necessary to allow trades affected by the work to install their work properly and without delay.
- D. In all spaces, prior to installation of visible material and equipment, including access panels, review Architectural Drawings for exact locations and where not definitely indicated, request information from Architect. Where the Electrical work shall interfere with the work of other trades, assist in coordinating the space conditions to make satisfactory adjustments before installation. Without extra cost to the Owners, make reasonable modifications to the work as required by normal Structural interferences. Pay the General Contractor for additional openings, or relocating and/or enlarging existing openings through concrete floors, walls, beams and roof required for any work which was not properly coordinated. Maintain maximum headroom at all locations. All piping, duct, conduit, and associated components to be as tight to underside of structure as possible.
- E. If any Electrical work has been installed before coordination with other trades so as to cause interference with the work of such trades, all necessary adjustments and corrections shall be made by the trades involved without extra cost to the Owners.
- F. Where conflicts or potential conflicts exist and engineering guidance is desired, submit sketch of proposed resolution to Architect for review and approval.
- G. Protect all materials and work of other trades from damage which may be caused by the Electrical work, and repair all damages without extra cost to the Owners.

1.9 MECHANICAL AND ELECTRICAL COORDINATION

- A. The HVAC Subcontractor shall furnish and install various electrical items relating to the heating and ventilating equipment and control apparatus. The Electrical Subcontractor shall be required to connect power wiring to this equipment unless noted otherwise.
- B. The HVAC and Electrical Subcontractors shall coordinate their respective portions of the work, as well as the electrical characteristics of the heating, ventilating and air conditioning equipment.
- C. All power wiring and local disconnect switches will be provided by the Electrical Subcontractor for the line voltage power. All control and interlocking wiring shall be the responsibility of the HVAC Subcontractor.
- D. 120V and above power wiring sources extended and connected to HVAC control panels, transformers and switches shall be the responsibility of the Electrical Subcontractor. All low voltage thermostat, and any switch wiring shall be the responsibility of the HVAC Subcontractor.
- E. Temperature control and equipment wiring shall be installed by the Heating and Ventilating Subcontractor.
- F. The Electrical Subcontractor will provide all magnetic starters except those furnished as an integral part of packaged equipment.

1.10 COORDINATION DRAWINGS

- A. Coordination Drawings:
 - 1. The Sheetmetal Subcontractor shall prepare a complete set of 3D model electronic Drawings at a scale not less than 3/8" equals 1'-0", showing structure and other information as needed for coordination. He shall show sheetmetal layout thereon. These will be the Coordination Drawings.
 - 2. The main paths of egress and for equipment removal, from main Mechanical, Electrical, Plumbing and Fire Protection rooms must be clearly shown on the Coordination Drawings. All fire and smoke partitions must be highlighted on the Coordination Drawings for appropriate coordination.
 - 3. Each of the below specialty trades shall add its work to these background Drawings with appropriate elevations and grid dimensions. Specialty trade information is required for fan rooms and mechanical rooms, horizontal exits from duct shafts, crossovers, and for spaces in and above ceilings where congestion of work may occur such as corridors, and even entire floors. Drawings shall indicate horizontal and vertical dimensions, to avoid interference with structural framing, ceilings, partitions, and other services.
 - a. Specialty Trades:
 - 1) Plumbing System.
 - 2) HVAC Piping and Associated Control System.
 - 3) Electrical.
 - 4) Sheet Metal Work.

Each specialty trade shall sign and date each electronic Coordination Drawing. Return Drawings to the Sheetmetal Subcontractor, who shall route them sequentially to all specialty trades.

4. Where conflicts occur with placement of materials of various trades, the Sheetmetal Subcontractor will be responsible to coordinate the available space to accommodate all trades. Any resulting adjustments shall be initialed and dated by the specialty trade. The Sheetmetal Subcontractor shall then final date and sign each Coordination Drawing. If he cannot resolve conflicts, the decision of the General Contractor shall be final, subject to the approval of the Architect.
5. A Subcontractor who fails to promptly review and incorporate his work on the Coordination Drawings shall assume full responsibility of any installation conflicts affecting his work and of any schedule ramifications.
6. The Sheetmetal Subcontractor shall make electronic copies of all Coordination Drawings. Fabrication shall not start until such electronic Drawings are received by the Architect/Engineer and have been reviewed.
7. Review of Coordination Drawings shall not diminish responsibility under this Contract for final coordination of installation and maintenance clearances of all systems and equipment with Architectural, Structural, Mechanical, Electrical, Plumbing and Fire Protection Contractors.

1.11 INSTALLATION REQUIREMENTS

- A. The arrangement of all Electrical work shown on the Contract Drawings is diagrammatic only and indicates the minimum requirements of the work. Conditions at the building including actual measurements shall determine the details of the installation. All work shall be laid out and installed so as to require the least amount of cutting and patching.
- B. Review the Architectural Drawings and Specifications before ordering any material and equipment. Any discrepancies shall be brought to the attention of the Architect for his determination prior to proceeding with the work.

1.12 TYPICAL DETAILS

- A. Typical details where shown on the Contract Drawings shall apply to each and every item of the project where such items are applicable. They are not repeated in full on the Contract Drawings, which in many cases are diagrammatic only, but with the intention that such details shall be incorporated in full. Any alternate method proposed for use by the Contractor shall have the prior approval of the Architect.

1.13 SLEEVES, INSERTS

- A. Furnish and install all sleeves, inserts, anchor bolts and similar items to be set into masonry or concrete, as required for Mechanical and Electrical work. Internal diameter of sleeve shall be 1/2" larger than the outside diameter of the pipe or insulation covered line passing through it.

1.14 CORING, DRILLING

- A. Core, cut and/or drill all small holes 4.5" diameter or less in walls, floors and ceiling required for the installation of sleeves, supports, and conduit for the Electrical work.

1.15 FIRESTOPPING, SMOKEPROOFING AND WATERPROOFING

- A. All penetrations made through fire rated assemblies (structures or partitions) shall be completely and

properly fire sealed with the appropriate firestop systems installed in accordance with the Manufacturer's recommendations. The firestop material UL listed fire rating shall match or exceed the fire rated assemblies. Verify with Architect if project is utilizing a specified product. If not, provide product manufactured by Hilti, Nelson or STI.

- B. Provide waterproofing of all materials which penetrate a floor, exterior wall, slab or roof. All sleeves shall extend a minimum of 3 inches above floor or roof. All penetrations thru building foundation walls shall utilize Link-Seal products or approved equal.
- C. All device, outlet and junction boxes installed within fire rated walls or ceilings shall be provided with a fire rated moldable putty pad. The putty pad shall be a one component, ready to use, intumescent elastomer capable of expanding a minimum of 3 times at 1000°F and the material shall be suitable for overhead, vertical and horizontal fire stops. The putty shall be listed by an independent testing agency such as U.L. or FM and shall meet or exceed the requirements of the applicable sections of the IBC, NFPA 5000, NEC & NFPA 101. Provide 3M fire barrier moldable putty pads MPP+ approved equal.

1.16 COMMISSIONING OF SYSTEMS

- A. Provide the services of a factory authorized technician to instruct and direct the Owner in the operation and maintenance of indicated systems and/or equipment. Cost of such instruction shall be for a minimum of five (5) days for Electrical Contractor to assist in operation and troubleshooting of system. Technicians for each system shall be available for a minimum of four (4) hours. The Electrical Subcontractor shall be available throughout the entire Commissioning Phase to operate the systems/equipment. Systems and/or equipment that shall be commissioned include the following:

- 1. Panelboards.
- 2. Circuit breaker.
- 3. Disconnect switches.
- 4. Toggle switches.
- 5. Occupancy/Vacancy sensors.
- 6. Fire Alarm systems.
- 7. Surge protection devices.

- B. Upon completion of all tests, the Electrical Subcontractor shall repair and/or replace any defective equipment. Once replaced and/or repaired, all Commissioning shall be performed.

- C. Refer to Section 26 00 00 paragraph 3.2 for additional requirements.

1.17 ACCESSIBILITY

- A. Install all work such that parts requiring periodic inspection, operation, maintenance and repair are readily accessible.
- B. Furnish all access panels appropriate to particular conditions, to be installed by trades having responsibility

for the construction of actual walls, floors or ceilings at required locations.

1.18 SUPPLEMENTARY SUPPORTING STEEL

- A. Provide all supplementary (non-structural) steelwork required for mounting or supporting equipment and materials.
- B. Steelwork shall be firmly connected to building construction as required. Locations and methods of attachment shall be approved by the Architect.
- C. Steelwork shall be of sufficient strength to allow only minimum deflection in conformity with manufacturer's published requirements.
- D. All supplementary steelwork shall be installed in a neat and workmanlike manner parallel to floor, wall and ceiling construction: all turns shall be made at forty-five and ninety degrees, and/or as dictated by construction and installation conditions.
- E. All manufactured steel parts and fittings shall be galvanized.

1.19 TOOLS AND EQUIPMENT

- A. Provide all tools and equipment required for the fabrication and installation of the Mechanical and Electrical equipment at the site.

1.20 PORTABLE AND DETACHABLE PARTS

- A. Contractors shall retain in their possession all portable and/or detachable parts and portions of materials, devices, equipment, etc. necessary for the proper operation and maintenance of the Mechanical and Electrical systems until final completion of the work, at which time they shall be handed over to the Owners.

1.21 RECORD DRAWINGS, PROJECT CLOSEOUT

- A. As work progresses and for the duration of Contract, maintain a complete and separate set of prints of Contract Drawings at job site at all times. Record work completed and all changes from original Contract Drawings clearly and accurately including work installed as a modification or addition to the original design. Work shall be updated on a weekly basis and shall be made available for review by Architect. Failure to perform this work shall be reason for withholding requisition payments. In addition, take photographs of all concealed equipment in gypsum board ceilings, shafts, and other concealed, inaccessible work. At completion of work, make copies of photographs with written explanation on back. These shall become part of Record Documents.
- B. At completion of work prepare a complete set of Record Drawings utilizing AutoCAD produced drawings showing all systems as actually installed, including all fire alarm and electrical circuitry. Submit three (3) sets of prints to Architect for comments as to compliance with this section.
- C. The Architect will not certify the accuracy of the Record Drawings. This is the sole responsibility of the Electrical Contractor.
- D. This trade shall submit the Record Drawings for approval by the Fire and Building Departments in a form acceptable to the departments, when required by the jurisdiction.

- E. Record Drawings shall show record condition of details, sections, riser diagrams, control changes and corrections to schedules. Schedules shall show actual manufacturer, make and model numbers of final equipment installation.

1.22 GUARANTEE/WARRANTY

A. Guarantee and 24 Hour Service:

1. Guarantee Work of this Section in writing for not less than one (1) year following the date of acceptance by the Owner. If the equipment is used for temporary power etc, prior to acceptance by the Owner, the bid price shall include an extended period of warranty covering the one (1) year of occupancy, starting from the date of acceptance by the Owner. The guarantee shall repair or replace defective materials, equipment, workmanship and installation that develop within this period, promptly and to the Architect's satisfaction and correct damage caused in making necessary repairs and replacements under guarantee within Contract Price.
2. In addition to guarantee requirements of Division 1 and of Subparagraph A above, obtain written equipment and material warranties offered in manufacturer's published data without exclusion or limitation, in Owner's name.
3. Upon receipt of notice from the Owner of failure of any part of the systems or equipment during the warranty period, the affected part or parts shall be replaced by this Contractor without any reimbursement.
4. Replace material and equipment that require excessive service during guarantee period as defined and as directed by Architect.
5. Provide 24 hour service beginning on the date the project is accepted by the Owner, whether or not fully occupied, and lasting until the termination of the guarantee period. Service shall be at no cost to the Owner. Service can be provided by this Contractor or a separate service organization. Choice of service organization shall be subject to Architect and Owner approval. Submit name and a phone number that will be answered on a 24 hour basis each day of the week, for the duration of the service.
6. Submit copies of equipment and material warranties to Architect before final payment.
7. At end of guarantee period, transfer manufacturer's equipment and material warranties still in force to Owner.
8. This paragraph shall not be interpreted to limit Owner's rights under applicable codes and laws and under this Contract.
9. PART 2 paragraphs of this Specification may specify warranty requirements that exceed those of this paragraph. Those paragraphs shall govern.
10. Use of systems provided under this Section for temporary services and facilities shall not constitute Final Acceptance of Work by Owner, and shall not initiate the guarantee period.
11. Provide manufacturer's engineering and technical staff at site to analyze and rectify problems that develop during guarantee period immediately. If problems cannot be rectified immediately to Owner's satisfaction, advise the Architect in writing, describe efforts to rectify situation, and provide analysis of

cause of problem. The Architect and/or Engineer will direct course of action.

1.23 OPERATING, INSTRUCTION AND MAINTENANCE MANUALS

- A. Refer to Section 017000 – CONTRACT CLOSEOUT for submittal procedures pertaining to operating and maintenance manuals.
- B. Each copy of the approved operating and maintenance manual shall contain copies of approved Shop Drawings, equipment literature, cuts, bulletins, details, equipment and engineering data sheets and typewritten instructions relative to the care and maintenance for the operation of the equipment, all properly indexed. Each manual shall have the following minimum contents:
 - 1. Table of Contents.
 - 2. Introduction:
 - a. Explanation of manual and its purpose and use.
 - b. Description of the electrical systems.
 - c. Safety precautions necessary for equipment.
 - d. Illustrations, schematics and diagrams.
 - e. Installation drawing.
 - 3. Maintenance:
 - a. Maintenance and lubricating instructions.
 - b. Replacement charts.
 - c. Trouble-shooting charts for equipment components.
 - d. Testing instructions for each typical component.
 - e. Two (2) typed sets of instructions for ordering spare parts. Each set shall include name, price, telephone number and address of where they may be obtained.
 - 4. Manufacturer's Literature:
 - a. The equipment for which Shop Drawings have been submitted and approved.

1.24 SERVICE CHARACTERISTICS

- A. Building Voltage: 120/208.
- B. All equipment and wiring shall be suitable for the applied voltage.

1.25 QUALITY ASSURANCE

- A. The requirements of the State Building Code and Local regulations establish the minimum acceptable quality of workmanship and materials, and all work shall conform thereto unless more stringent requirements are indicated or specified herein.
- B. All work shall comply with the latest editions of the codes as referenced herein.

- C. Follow manufacturer's directions for articles furnished, in addition to directions shown on Drawings or specified herein.
- D. Protect all work, materials, and equipment from damage during process of work. Replace all damaged or defective work, materials and equipment without additional cost to the Owner.
- E. All equipment and materials for permanent installation shall be the products of recognized manufacturers and shall be new.
- F. Equipment and materials shall:
 - 1. Where normally subject to Underwriters Laboratory Inc. listing or labeling services, be so listed and labeled.
 - 2. Be without blemish or defect.
 - 3. Not be used for temporary light and power purposes.
 - 4. Be in accordance with the latest applicable NEMA standards.
 - 5. Buy products which will meet with the acceptance of all Authorities Having Jurisdiction over the work. Where such acceptance is contingent upon having the products examined, tested and certified by Underwriters or other recognized testing laboratory, the product shall be so examined, tested and certified.
- G. Except for conduit, conduit fittings, outlet boxes, wire and cable, all items of equipment or material of one generic type shall be the product of one manufacturer throughout.
- H. For items which are to be installed but not purchased as part of the Electrical work, the Electrical work shall include:
 - 1. The coordination of their delivery.
 - 2. Their unloading from delivery trucks driven into any point on the property line at grade level.
 - 3. Their safe handling and field storage until the time of permanent placement in the project.
 - 4. The correction of any damage, defacement or corrosion to which they may have been subjected. Replacement, if necessary, shall be coordinated with the Contractor who originally purchased the item.
 - 5. Field erection and internal wiring as necessary for their proper operation.
 - 6. Mounting in place, including the purchase and installation of all dunnage, supporting members, and fastenings, necessary to adapt them to architectural and structural conditions.
- I. Items which are to be installed but not purchased as part of the electric work shall be carefully examined upon delivery to the project. Claims that any of these items have been received in such condition that their installation will require procedures beyond the reasonable scope of the electric work will be considered only if presented in writing within one (1) week of the date of delivery to the project of the items in question. The electric work includes all procedures, regardless of how extensive, necessary to put into

satisfactory operation, all items for which no claims have been submitted as outlined above.

1.26 DELIVERY, STORAGE AND HANDLING

- A. All materials for the work of this section shall be delivered, stored and handled so as to preclude damage of any nature. Manufactured materials shall be delivered and stored in their original containers, plainly marked with the products' and manufacturer's name. Materials in broken containers or in packages showing watermarks or other evidence of damage, shall not be used and shall be removed from the site.

1.27 TEMPORARY POWER AND LIGHTING

- A. The Electrical Subcontractor shall furnish and install feeders of sufficient size from the Utility Company's power lines for the electric light and power requirements for the building while under construction and until the permanent feeders and related equipment have been installed and are in operation. Temporary lighting shall be based on a minimum of one watt per square foot covering each and every square foot of floor area in the building. Sufficient wiring, lamps, and outlets shall be installed to insure proper lighting in all rooms, space, stairwells, and corridors. Minimum sized lamp used shall be 100 watt. Where higher lighting intensities are required by Federal or State Standards of Laws or otherwise specified, the above specified wattage shall be increased to provide these increased intensities.
- B. All necessary transformers, meters, cables, panelboards, switches, temporary lamp replacements and accessories required for the temporary light and power installation shall be provided by the Electrical Subcontractor.
- C. Permanent convenience receptacles may be utilized during construction.
- D. The Electrical Subcontractor shall install and maintain the wiring and accessories for the offices of the General Contractor as specified in the contract form.
- E. All temporary Electrical work shall meet the requirements of the National Electrical Code Article 590 Temporary Wiring, the Local Utility Company, and all Federal Standards and Laws.
- F. All temporary wiring and accessories thereto installed by the Electrical Subcontractor shall be removed after their purposes have been served.
- G. The Owner will pay for the cost of electric energy consumed by the General Contractor and by all of the Subcontractors.
- H. All lamps installed in permanent lighting fixtures and used for lighting during construction shall be replaced by the Electrical Subcontractor just prior to date of Use and Occupancy or Final Acceptance.
- I. Provide all temporary lighting and power required above during the normal working hours of the project or a total of ten (10) hours per normal working day; Saturdays, Sundays and legal holidays are excluded. The ten hours per day shall include manning the temporary power and lighting 1/2 hour before and 1/2 hour after a normal eight (8) hour working day. In addition to the above, provide and maintain, to the satisfaction of the local Authorities Having Jurisdiction, all temporary lighting and power that may be required for safety purposes. The Electrical Subcontractor will be compensated by the General Contractor for any additional standby time, materials or equipment required by the General Contractor or other Subcontractors beyond the normal working hours, as defined above.

1.28 STAGING AND SCAFFOLDING

- A. Provide staging and scaffolding for all the work of this section complying with Division 1 requirements.

1.29 EXTRA MATERIALS

- A. Furnish extra materials as indicated below that match products installed, are packaged with protective covering for storage, and are identified with labels clearly describing contents.

1. 10% of each total circuit breakers installed.
2. 10% of each total fuses installed.
3. Ten (10) quadplex receptacles and associated wall plates.
4. Refer to Fire Alarm section for extra material requirements.
5. Two (2) of each ceiling mounted occupancy or vacancy sensor installed.
6. Two (2) of each wall mounted occupancy sensor or vacancy sensor switch installed.

1.30 SEISMIC REQUIREMENTS

- A. Equipment and work shall meet the restraint requirements for the designated Seismic Design category. This shall include all installation and connections of material and equipment to the building structure. Refer to Structural Drawings for Seismic Design category and ASCE7 for electrical requirements.

1.31 PHASING, DEMOLITION AND MAINTAINING EXISTING SERVICES

- A. During the execution of the work, required relocation, etc., of existing equipment and systems in the existing building areas where new work is to be installed or new connections are scheduled to be made, shall be performed by the Electrical Subcontractor, as required by job conditions and as determined by the Architect in the field, to facilitate the installation of the new system, while demolition, relocation work or new tie ins will be performed. Outages required for construction purposes shall be scheduled for the shortest practical period of time, in coordination with the Owner's designated representative, for specified, mutually agreeable periods of time, after each of which the interruption shall cease and the service shall be restored. This procedure shall be repeated to suit the Owner's working schedule, as many times as required until all work is completed. Any outages of service shall be approved by the Owner, prior to commencing the work. No outages or shutdowns of service shall occur without the written authorization of the Owner prior to commencing the work. Give notice of any scheduled shutdowns, a minimum of two (2) weeks in advance. Owner shall make their best efforts to meet this request without adversely affecting the electric service to the existing building.
- B. Prior to any deactivation and relocation or demolition work, consult the Contract Drawings and arrange a conference with the Architect and Owner's Representative in the field to inspect each of the items to be deactivated, removed or relocated. Care shall be taken to protect all equipment designated to be relocated and reused or to remain in operation and be integrated with the new systems.
- C. All deactivation, relocation and temporary tie-ins of electrical systems and equipment shall be provided by the Electrical Subcontractor. All demolition and removal of electrical systems and equipment designed to

be demolished shall be provided by the Electrical Subcontractor. Place all demolished electrical materials except hazardous materials (PCB lighting ballasts, fluorescent lamps, etc.) as determined by the Authorities Having Jurisdiction in General Contractor's dumpster. All hazardous electrical materials shall be legally disposed of by the Electrical Subcontractor.

- D. The Owner reserves the right to inspect the material scheduled for removal and salvage any items he deems usable as spare parts.
- E. Phasing:
 - 1. The Electrical Subcontractor shall construct the subject project in phases as directed by the Architect to suit the project progress schedule, as well as the completion date of the project.
 - 2. For additional information related to phasing, review the General Conditions and Supplementary Conditions and the Architectural Drawings.

PART 2 – PRODUCTS

2.1 GENERAL

- A. Product Specifications are written in such a manner so as to specify what materials may be used in a particular location or application and therefore do not indicate what is not acceptable or suitable for a particular location or application. As an example: Non-metallic sheathed cable is not specified; therefore it is not acceptable.
- B. For purpose of establishing a standard of quality and not for purposes of limiting completion, the basis of this Specification is upon specified models and types of equipment and materials, as manufactured by specified manufacturers.
- C. In all cases, standard cataloged materials and systems have been selected. Materials such as lighting fixtures specially manufactured for this particular project, and not part of a manufacturer's standard product line, will not be acceptable. In the case of systems, the system components shall be from a single source regularly engaged in supplying such systems. A proposed system made up of a collection of various manufacturers products will be unacceptable.
- D. Where Specifications list manufacturers names and/or "as approved" or "equal approved by Designer", other manufacturers equipment will be considered if equipment meets Specification requirements and has all features of the specified items as are considered essential by the Architect.
- E. All materials shall be new and shall be UL listed.

2.2 POWER SYSTEM STUDIES

- A. Short Circuit Studies, Protective Device Evaluation Studies, Protective Device Coordination Studies and arc flash analysis shall be provided by this Electrical Subcontractor. The studies shall be submitted to the Engineer prior to receiving final approval of the distribution equipment Shop Drawings and/or prior to release of equipment for manufacture. If formal completion of the studies may cause delay in equipment manufacture, approval may be obtained for a preliminary submittal of sufficient study data to ensure that the selection of device ratings and characteristics will be satisfactory.

- B. The studies shall include all portions of the electrical distribution system from the normal power source. Normal system connections and those which result in maximum fault conditions shall be adequately covered in the study.
- C. The short circuit study shall be in accordance with ANSI/IEEE guidelines, NFPA 70B and ANSI C2.
- D. The study input data shall include the power company's short circuit contribution, resistance and reactance components of the branch impedances, the X/R ratios, base quantities selected, and other source impedances.
- E. Short circuit momentary duty values and interrupting duty values shall be calculated on the basis of assumed three-phase bolted short circuits at each power center bus, distribution panelboards, pertinent branch circuit panel and other significant locations through the system. The short circuit tabulations shall include symmetrical fault currents, and X/R ratios. For each fault location, the total duty on the bus, as well as the individual contribution from each connected branch, shall be listed with its respective X/R ratio.
- F. A protective device evaluation study shall be performed to determine the adequacy of overcurrent and switching devices and automatic transfer switches, by tabulating and comparing the short circuit ratings of these devices with the calculated fault currents. Appropriate multiplying factors based on system X/R ratios and protective device rating standards shall be applied.
- G. A protective device coordination study shall be performed to provide the necessary calculations and logic decisions required to select or to check the selection of power fuse ratings, protective relay characteristics and settings, ratios and characteristics of associated current transformers, and low voltage breaker trip characteristics and settings. The objective of the study is to obtain optimum protective and coordination performance from these devices.
- H. The coordination study shall include all low voltage classes of equipment from the utility's incoming line protective device down to and including the devices in the 120/208 volt panelboards. The phase and ground overcurrent protection shall be included as well as settings of all other adjustable protective devices.
- I. The time-current characteristics of the specified protective devices shall be drawn on Keuffel and Esser log-log paper. The plots shall include complete titles, representative one-line diagram and legends, associated power company's relays or fuse characteristics, significant motor starting characteristics, complete parameters of transformer withstand limits and significant symmetrical and asymmetrical fault currents. All restrictions of the National Electrical Code shall be adhered to and proper coordination intervals and separation of characteristic curves shall be maintained. The coordination plots for phase and ground protective devices shall be provided on a system basis. A sufficient number of separate curves shall be used to clearly indicate the coordination achieved.
- J. The selection and settings of the protective devices shall be provided separately in a tabulated form listing circuit identification, IEEE device number, current transformer ratios and recommended power fuse selection shall be provided for the medium voltage fuses where applied in the system. Any discrepancies, problem areas, or inadequacies shall be promptly brought to the Architect's attention.
- K. The results of the power system study shall be summarized in a submittal.
- L. Report shall include the following selections:
 - 1. Description, purpose, basis and scope of the study and a single diagram of that portion of the power

system which is included within the scope of the study.

2. Tabulations of circuit breaker, fuse and other protective device ratings versus calculated short circuit duties, and commentary regarding same.
 3. Protective device time versus current coordination curves, tabulations of relay and circuit breaker trip settings, fuse selection, and commentary regarding same.
 4. Fault current calculations including a definition of terms and guide for interpretation of computer printout.
 5. The Electrical Subcontractor shall test, calibrate, and adjust circuit breaker trip devices as recommended in the power system study.
- M. The arc flash analysis shall be performed in accordance with IEEE 1584. Based on results of this study, the Electrical Contractor shall provide labeling at all equipment outlined in NFPA 70E. Labeling shall indicate at a minimum, the required level of PPE, nominal system voltage and arc flash boundary.

2.3 RACEWAYS AND FITTINGS

A. Raceways – General:

1. No raceway shall be used smaller than 3/4" diameter. No conduit shall have more than three (3) 90° bends in any one run, and where necessary, pull boxes shall be provided.
2. Rigid metal conduit (RMC) conforming to, and installed in accordance with, Article 344 of NFPA 70 shall be heavy wall zinc coated steel conforming to American Standard Specifications C80-1 and may be used for service work, exterior work, slab work, and below grade level slab, wet locations, and in mechanical rooms and where raceway may be subjected to mechanical damage, i.e., loading docks, workshops, etc.
3. Intermediate metal conduit (IMC) conforming to, and installed in accordance with Article 342 of NFPA 70 shall be zinc coated steel and may be used in all areas similar to RMC.
4. Thin wall conduit (EMT), conforming to, and installed in accordance with, Article 358 of NFPA 70 shall be zinc coated steel, conforming to industry standards, may be used in masonry block walls, stud partitions, above furred ceilings where exposed but not subject to mechanical damage, and shall be used for fire alarm work.
5. Flexible metal conduit (FMC) conforming to, and installed in accordance with Article 348 of NFPA 70 shall be used for connections to recessed light fixtures, vibrating equipment and motors. All FMC shall be secured and supported in accordance with Article 348 of NFPA 70.
6. Liquidtight flexible metal conduit (LFMC) conforming to, and installed in accordance with Article 350 of NFPA 70 shall be used for connections to light fixtures, vibrating equipment and motors. All LFMC shall be secured and supported in accordance with Article 350 of NFPA 70. If used on roof applications, all LFMC shall be supported by sleepers approved by the Architect prior to installation.
7. Rigid non-metallic conduit may be used at the Contractor's option for underground electric and telephone services outside the foundation wall and shall be polyvinyl chloride (PVC) schedule 40 or

80, 90° C. If option of rigid non-metallic conduit is exercised, underground runs outside the foundation wall shall be concrete encased at Contractor's expense. Schedule 40/80 conduit shall be installed in conformance with Article 352 of NFPA 70. Use of type EB or A PVC conduit is not allowed.

8. PVC Schedule 40 may also be used for below grade slab circuits within building confines. Below slab rigid non-metallic conduits do not require concrete encasement. Rigid non-metallic conduits shall not be used in slabs. Rigid steel elbows or stubs shall be used for penetrations from below slab or through exterior walls into building. PVC shall not be installed within building. Raceways and fittings shall be produced by same manufacturer. All PVC conduit shall comply with ANSI/UL 651.
9. Where indicated on the project drawings provide color coded EMT as follows:
 - a. Red – Fire Systems.
10. Acceptable Manufacturers:
 - a. Wheatland Tube Company
 - b. Allied Tube
 - c. Western Tube & Conduit
 - d. Carlon
11. Fittings:
 - a. Provide insulated bushings on all raceways that house conductors #4 AWG or larger at all threaded fittings no matter what the size of the conductor.
 - b. Manufacturer's standard fittings shall be used for raceway supports.
 - c. Expansion Fittings: Expansion fittings shall be used where structural and concrete expansion joints occur and shall include a ground strap.
 - d. Couplings for rigid metal conduit and IMC shall be threaded type. Provide insulated bushings.
 - e. All fittings for EMT conduit shall be steel. No die-cast fittings are allowed. Set screw and compression connectors are allowed.
 - f. Threadless fittings for EMT shall be watertight compression type. All fittings shall be concrete tight.
 - g. Cable supports in vertical raceways shall be of the split wedge type. Armored cable supports for vertical runs to be of wire mesh basket design.
 - h. Wall entrance seals shall be equal to O.Z. Gedney type "WSK" or Link-Seal.
 - i. Couplings, elbows and other fittings used with rigid nonmetallic raceways shall be of the solvent cemented type to secure a waterproof installation.
 - j. Acceptable manufacturers:
 - 1) O.Z. Gedney
 - 2) Crouse Hinds
 - 3) American Fittings
 - 4) Hubbell

5) Thomas & Betts

2.4 WIRING MATERIALS

- A. Building Wire and Cable shall be copper with 600V insulation, THWN for branch circuitry and XHHW for feeders.
- B. Conductors shall be of soft drawn 98% minimum conductivity properly refined copper, solid construction where No. 10 AWG and smaller, stranded construction where No. 8 AWG and larger.
- C. Exterior of wires shall bear repetitive markings along their entire length indicating conductor size, insulation type and voltage rating.
- D. Exterior of wires shall be color coded, so as to indicate a clear differentiation between each phase and between each phase and neutral. In all cases, grounded neutral wires and cables shall be identified by the colors "white" or "gray". In sizes and insulation types where factory applied colors are not available, wires and cables shall be color coded by the application of colored plastic tapes in overlapping turns at all terminal points, and in all boxes in which splices are made. Colored tape shall be applied for a distance of 6 inches along the wires and cables, or along their entire extensions beyond raceway ends, whichever is less.
- E. Final connections to motors shall be made with 18" of neoprene sheathed flexible conduit.
- F. Minimum branch circuit conductor size shall be No. 12 AWG installed in conduit. Motor control circuit wiring shall be minimum No. 14 AWG installed in conduit.
- G. Fire alarm wiring shall be per manufacturer's recommendations.
- H. Other wires and cables required for the various systems described elsewhere in this section of the Specifications shall be as specified herein, as shown on the Contract Drawings, or as recommended by the manufacturer of the specific equipment for which they are used, all installed in conduit.
- I. Metal clad sheathed cable NFPA 70, type MC may be used for branch circuitry where run concealed, and not subject to physical damage. All type MC cable used shall contain a full size insulated ground conductor. All conductors shall be copper. All type MC cable insulation used shall have voltage rating of 600 volts, shall have a temperature rating of 75° C, and shall be thermoplastic material. Armor material shall be steel and armor design shall be interlocked metal tape. Fire alarm rated MC cable may be used for fire alarm work where concealed and acceptable to the Local Authorities Having Jurisdiction.
- J. Wiring materials shall be manufactured by Southwire, Prysmian, General Cable, or equal.

2.5 OUTLET, JUNCTION, PULL BOXES AND WIRING TROUGHS FOR ALL SYSTEMS

- A. Outlets:
 - 1. Each outlet in wiring or raceway systems shall be provided with an outlet box to suit conditions encountered. Boxes installed in normally wet locations shall be of cast-metal type having hubs. Concealed boxes shall be cadmium plated or zinc coated sheet metal type. Old work boxes with Madison clamps are not allowed in new construction.

2. Each box shall have sufficient volume to accommodate number of conductors in accordance with requirements of NFPA 70. Boxes shall not be less than 1-1/2" deep unless shallower boxes are required by structural conditions and are specifically approved by Architect. Ceiling and bracket outlet boxes shall not be less than 4" octagonal except that smaller boxes may be used where required by particular fixture to be installed. Flush or recessed fixtures shall be provided with separate junction boxes when required by fixture terminal temperature requirements. Switch and receptacle boxes shall be 4" square or of comparable volume.
3. Acceptable Manufacturers:
 - a. Appleton
 - b. Crouse Hinds
 - c. Steel City
 - d. RACO

- B. Pull and Junction Boxes: Where necessary to terminate, tap off, or redirect multiple raceway runs or to facilitate conductor installation, furnish and install appropriately designed boxes. Boxes shall be fabricated from code gauge steel assembled with corrosion resistant machine screws. Box size shall be as required by Code. Where intermediate cable supports are necessary because of box dimensions, provide insulated removable core brackets to support conductors. Junction boxes are to be equipped with barriers to separate circuits. Where splices are to be made, boxes shall be large enough to provide ample work space. All conductors in boxes are to be clearly tagged to indicate characteristics. Boxes shall be supported independently of raceways. Junction boxes in moist or wet areas shall be galvanized type. Boxes larger than 4 inches square shall have hinged covers. Boxes larger than 12 inches in one dimension will be allowed to have screw fastened covers, if a hinged cover would not be capable of being opened a full 90 degrees due to installation location.
- C. Non-metallic outlet boxes shall be molded of high-impact thermo plastic and shall consist of single, two, three, four gang and 4" square boxes equipped with integral non-metallic cable retainers. Non-metallic outlet boxes shall also be equipped with captive nails or screws or metallic fastening brackets as appropriate for the respective installation (i.e.: wood/metal study framing, etc.). Non-metallic outlet boxes shall be installed only within dwelling units and where non-metallic sheathed cable ("NM") is utilized.

2.6 WIRING DEVICES

- A. Provide wiring device type plates for all wall-mounted devices. All wall plates shall be smooth high impact nylon for all areas, color as directed by the Architect. Provide galvanized steel for all Utility, Electric and Mechanical Rooms.
- B. Wiring devices standard for the project (i.e., with no specific type indicated) shall conform to the following:
1. Visible part colors of wiring devices shall be as directed by the Architect for all areas. Provide brown devices for all Utility, Electrical and Mechanical rooms.
 2. Exclude compact or "despard" type devices.
- C. Wiring device switches shall be toggle type, A.C. quiet design, specification grade, 20 amps on 120 volt circuits. Switches shall be mounted 48" to center line above finished floor unless noted otherwise.

1. Single pole switch shall be equal to Hubbell No. 1221.
 2. Double pole switch shall be equal to Hubbell No. 1222.
 3. Three-way switch shall be equal to Hubbell No. 1223.
 4. Four-way switch shall be equal to Hubbell No. 1224.
 5. Single pole pilot light switch shall be equal to Hubbell No. HBL 1221PL.
 6. Equivalent 277 volt 20 amp switches shall be used where required.
- D. Standard duplex convenience receptacles shall be 125 volt, 20 amps, three wire (two circuit wires plus ground), "U-bar" ground NEMA slot configuration 5-20R specification grade. Receptacles shall be mounted 18" to center line above finished floor unless noted otherwise.
1. Equal to Hubbell No. 5362.
 2. Where indicated on plans provide receptacles with ground fault current interrupters, UL Class A; 20A, 125V to be equal to Hubbell No. GF5362. All GFI receptacles shall be self-testing type in compliance with UL 943.
 3. Where indicated on plans, provide receptacles with integral USB charging ports; compliant with USB BC 1.2 rated 3A, 5VCD, 20A, 125V tamper resistant equal to Hubbell No. USB20X2W.
- E. Non-standard convenience receptacles and special purpose power supply receptacles shall be as listed on plans.
- F. Devices and device plates for flush wall devices which are not integrally equipped with same, shall be as directed by the Architect.
- G. For unfinished spaces, plates for surface-mounted wall devices which are not integrally equipped with same, shall be galvanized sheet steel, formed raised type which does not overlap box. Where for switches, such plates shall have toggle guards.
- H. Where more than one wiring device is indicated in the same location, the devices shall be mounted in gang under a common wall plate.
- I. Mount duplex convenience and power receptacles vertically with grounding posts at top of device unless otherwise indicated. Locate grounding post to left when horizontal mounting is indicated.
- J. Wiring devices and associated hardware shall be manufactured by Leviton, Hubbell or Pass and Seymour.

2.7 GROUNDING REQUIREMENTS

- A. Ground all systems and equipment in accordance with best industry practice, the requirements of NFPA 70, Article 250 and the following:
1. The ground bus of the main disconnect shall be connected to the main grounding electrode specified below by means of insulated conductors run in conduit.

- a. Metal underground water pipes.
 - b. Metal frame of building.
 - c. Concrete encased electrode.
 - d. Rod and pipe electrodes.
2. Provide grounding bonds between all metallic conduits of the light and power system which enter and leave cable chambers or other non-metallic cable pulling and splicing boxes. Accomplish this by equipping the conduits with bushings of the grounding type individually cross connected.
 3. Bond metallic conduits containing grounding electrode conductors and main bonding conductors to the ground bus service enclosure and/or grounding electrode at both ends of each run utilizing grounding bushings and jumpers.
 4. Provide grounding bonds for all metallic conduits of the light and power system which terminate in pits below equipment for which a ground bus is specified. Accomplish this by equipping the conduits with bushings of the grounding type connected individually to the ground bus.
 5. Provide supplementary ground bonding where metallic conduits terminate at metal clad equipment (or at the metal pull box of equipment) for which a ground bus is specified. Accomplish this by equipping the conduits with bushings of the grounding type connected individually by means of jumpers to the ground bus. Exclude the jumpers where directed. This exclusion will be required where an isolated ground for electronic equipment is to be maintained.
 6. Each grounding type bushing shall have the maximum ground wire accommodation available in standard manufacture for the particular conduit size. Connection to bushing shall be with wire of this maximum size.
 7. Bonding conductors on the load side of the service device and equipment grounding conductors shall be sized in relation to the fuses or trip size of the overcurrent device supplying the circuit.

2.8 PHASING AND COLOR CODING

- A. The insulation or covering of each wire or cable shall be color coded so as to provide for circuit identification as specified below:

120/208 V Circuits	Phase Circuits
Black	A
Red	B
Blue	C
White	Neutral
Green	Equipment Ground

- B. Color coding shall be achieved by one of the following methods:

1. The insulation or covering shall be coded during manufacture by use of one of the following methods:
 - a. Colored compounds.
 - b. Colored coatings.

2. In sizes and insulation types where factory applied colors are not available, wires and cables shall be color coded by the application of colored plastic tapes in overlapping turns at all terminal points, and in all boxes in which splices are made.

C. The same colored cable shall be connected to the same phase throughout the project.

D. In general, building load centers and panelboards shall be phased "A", "B", "C", left to right. The neutral, although it may be in different locations for different equipment, shall be identified.

2.9 ENCLOSURES FOR INDIVIDUALLY MOUNTED OVERCURRENT AND SWITCHING DEVICES

A. Construction shall be NEMA Class I, where installed indoors.

B. Construction shall be NEMA Class IIIIR, where installed outdoors, in mechanical rooms, in locations defined as damp or wet by NFPA 70 or where indicated as weatherproof.

C. Operating handles shall be front or side type to accommodate hand access space and flush or surface mounting requirements.

D. Each shall be equipped with padlock for locking operating handle in the open position.

2.10 PANELBOARDS

A. Panelboards shall consist of factory completed dead front assemblies of back pans, main busses, overcurrent and switching units, sheet metal cabinets and trims. They shall be so designed that switching and overcurrent devices can be replaced without disturbing adjacent units and without removing the main bus connectors, so that circuits may be changed without machine drilling or tapping.

B. Where indicated as power or distribution panels, they shall be as manufactured by Square D, Siemens, Eaton, or General Electric.

C. Bus bars for their mains shall be of copper having current capacities as indicated and sized for such capacities in accordance with Underwriter Laboratory standards. Provide double size neutral bus bars and lugs for all 120/208 volt panelboards where fed from "K" rated transformers. Bus bar taps for panels with single pole branches shall be arranged for sequence phasing of the branch circuit devices. Bussing shall be braced throughout to conform to industry standard practice governing short circuit stresses in panelboards. Phase bussing shall be full height without reduction.

D. A ground bus shall be provided for each panel. Each ground bus shall be of the same material as the phase and neutral buses.

E. Cabinets shall be fabricated from industry standard gauge galvanized sheet steel with corners lapped and riveted, or fastened by approved methods.

F. The inside and outside of the trims shall be factory painted with one (1) rust proofing primer coat and one (1) finish coat. The finish paint shall be of a type to which field applied paint will bond. All trims shall be hinged.

G. Cabinets and trims shall be suitable for the required mounting. Trims shall be fastened to cabinets and shall be of a type that is self-supporting on cabinets. Trims for flush panels shall overlap cabinets by at least

3/4" all around. Where two section panels are required, cabinets shall be of equal height including those cases where there is one main for both sections.

- H. Cabinets and trims for lighting and appliance panels shall accommodate and conform to the following limited dimensions:
 - 1. Minimum wiring gutter width on each side: 5-3/4".
 - 2. Maximum overall width: 24".
 - 3. Maximum overall depth: 6".
- I. Where wires or cables are used within panelboards to make up internal connections (factory installed or otherwise) such wire or cable shall have copper conductors only.
- J. Any cabinet for a power or distribution panel shall (regardless of the actual devices required to be in it) have a width, depth and bussing adequate for a 3-pole branch device equal in rating to the panel mains. In no case shall the cabinet be wider than 42" or deeper than 18".
- K. Hinged doors covering all switching device handles shall be included in all panel trims.
- L. Doors in panelboard trims shall conform to the following:
 - 1. In making switching device handles accessible, doors shall not uncover any live parts.
 - 2. Doors shall have flush type paracentric cylinder locks and catches. Two (2) keys shall be supplied for each lock and each key shall open all panelboards. Locks and keys shall conform to a "standard keying policy" as directed.
- M. Where "spaces only" for overcurrent protection and switching devices are called for in a panel, its main bus, and backpan, as well as its cabinet and trim, shall be extended to accommodate these spaces and shall include all necessary hardware including bus connectors to add future devices.
- N. Panelboards shall comply with the following industry standards:
 - 1. UL Standards:
 - a. Panelboards – UL67.
 - b. Cabinet & Boxes – UL50.
 - 2. NEMA Standard – PB1.
- O. Panelboards shall be labeled with UL short-circuit rating adequate for the available short-circuit and based on the lowest panel mounted circuit breaker available UL listed interrupting current rating, but in no case less than 100 ka for 240 volt panelboards.
- P. Provide "lock on" clips for the toggle handles of certain branches serving the Fire Alarm System, security, etc.
- Q. Panelboards shall be manufactured by Eaton, Siemens, Square D, or General Electric.

2.11 MOLDED CASE CIRCUIT BREAKERS

- A. Molded case type circuit breakers shall consist of manually operated quick-make quick-break mechanically trip free operating mechanisms for simultaneous operation of all poles, with contacts, arc interrupters and trip elements for each pole, all enclosed in molded phenolic plastic cases.
1. Their tripping units shall be of the “thermal magnetic” type having bimetallic elements for time delay overload protection and magnetic elements for short-circuit protection.
 2. They shall be manually operable by means of toggle type operating handles having “tripped” position midway between the “on-off” positions.
 3. They shall each be contained in an individual case enclosing only the number of poles required for the particular breaker.
 4. All panels and individually mounted circuit breakers shall have short circuit ratings exceeding the available short-circuit of the values indicated as follows:
 - a. 240V class panels/breakers: 100 kAIC.
 5. They shall be of the “bolted-in” type.
 - a. Where necessary, to accommodate other requirements, their frame sizes shall be increased to conform to such requirements, frame sizes being indicated only as a reference to the minimum acceptable interrupting ratings noted above.
 - b. Where single pole in trip sizes 20 amps or less, they shall be rated for switching duty.
 - c. They shall be equipped with 5 milliamp sensitivity ground fault interrupting features where so indicated.
 - d. All circuit breakers connected to lighting branch circuits shall be high magnetic type breakers.
 - e. Main circuit breaker in panel “DP” shall be current limiting type breaker.
 6. They shall be manufactured by Square D, Siemens, Eaton, or General Electric.

2.12 CARTRIDGE FUSES

- A. Cartridge fuses shall be as follows:
1. Provide a complete set of fuses for each item of fusible type equipment. Fusible equipment furnished by other Contractors will be complete with fuses.
 2. Secondary system fuses, rated at 600 volts or less, shall be UL listed and constructed in conformance with the applicable standards set forth by NEMA and ANSI. All fuses of a particular class shall be of same manufacturer.
 3. Regardless of actual fault current, they shall, at full recovery voltage, be capable of safely interrupting fault currents of 200,000 amperes RMS symmetrical or 340,000 amperes RMS asymmetrical, deliverable at the line side of the fuse.
 4. Circuits 0-600 amperes shall be protected by the equal of Bussman “Low Peak” current limiting fuses,

LPN-RK (250 volts), LPS-RK (600 volts), UL class RK-1.

5. Fuses shall be suitable for application to fuse gaps which reject other types of fusing.
6. Supply 10% spare fuses of each size and type 60 amps and less. Supply three (3) spare fuses for each size and type over 60 amps.

B. Cartridge fuses shall be manufactured by Bussman, Gould or EFCO.

2.13 MOTOR CONTROLS

A. Motor Controls – Manual and Magnetic:

1. Individually-mounted magnetic starters shall be across-the-line type with thermal overload on each phase, single-speed, two-speed, or reduced voltage start as indicated. Check exact type of two-speed or part-winding motors to be furnished by other Contractors, and provide proper starter.
2. Starters shall be of the replaceable contact double break type, of size and type required for particular motor horsepower and voltage. Minimum size starter to be size 1.
 - a. Starters shall have OL reset button, green pilot light to indicate “ON”, and “HAND-OFF-AUTO” switch in cover. Pilot lights shall be push-to-test type.
 - b. Starters to have 120 volt control transformers with fused output being provided for those units operating on 277/480 volt system.
 - c. Provide proper rating of thermal overloads. Replace any overloads found to be of an incorrect rating. Provide a spare set of three (3) thermal overloads for each starter.
 - d. Provide four (4) sets of auxiliary contacts of convertible type N.O. to N.C. for each starter.
 - e. Motor starters installed in dry locations shall have NEMA I enclosures. Those in wet locations shall have NEMA IV enclosures.
 - f. Acceptable Manufacturers:
 - 1) Siemens
 - 2) Eaton
 - 3) Square D
 - 4) General Electric
3. Manual motor starters shall have pilot lights and shall be furnished with thermal overloads on each phase.

B. Motors: Each motor shall have disconnect switch and starter provided under this section. Starters which are a part of “factory assembled” control panel will be provided under section supplying equipment to be controlled but connected under this section.

C. Disconnect Switches:

1. Disconnect (safety) switches shall conform to industrial standards of NEMA, be UL listed and shall be heavy-duty type, quick-make, quick-break type with interlocking cover mechanism and provisions for

padlocking switch handle in "OFF" position. Three (3) pole toggle switches are not acceptable as substitute for disconnect switches. Where utilized for service entrance, switches shall be rated for service entrance.

2. Disconnect switches shall be of fused or un-fused type as indicated with number of disconnecting poles indicated. The grounded conductor shall not be switched. Switches shall be for use with current limiting fuses with rejection type fuse clips and those shall be horsepower rated.
3. Enclosures shall be of proper NEMA type for the intended location and shall be phosphate coated or equivalent code gauge galvanized sheet steel with gray baked enamel finish.
4. Acceptable Manufacturers:
 - a. Eaton
 - b. Siemens
 - c. Square D
 - d. General Electric

D. Combination Starter: Provide combination starters where indicated on the plans.

E. Motor Control Circuitry:

1. Except as noted below, select materials exactly as specified for feeders. Utilize No. 12 A.W.G. THWN conductors throughout minimum.
2. Motor control circuit wires may be run in the same conduit as the wires of motor power circuits; however, exclude motor control wires from enclosures (other than motor starter enclosures) which contain power circuit overcurrent protection and switching devices; also from pull boxes and junction boxes containing the wires of main and sub main feeders. Utilize auxiliary pull boxes to separate motor control wires from motor power circuit wires before the power circuit wires enter the items from which motor control wires are excluded.
3. Prior to installing any motor control circuitry for a particular motor, notify the Architect of any deviations between the control circuitry requirements of the trade supplying the motor and the indicated electric work.

2.14 LIGHTING FIXTURES

A. All lighting fixtures shall be in accordance with identifications on the Contract Drawings and the following:

1. Finishes shall be as selected by the Architect or as indicated on the plans.
2. Any additional appurtenances required for installation and operation, where same are not covered by the identification used on the Contract Drawings, shall be included.
3. Recessed fixtures shall be coordinated with ceiling construction.
4. Exact location of all fixtures shall be confirmed with Architect prior to rough-in.

5. Recessed fixtures throughout shall have their components, wiring and external connections coordinated for use in ceilings utilized as air handling plenums.
6. Fixtures for use outdoors or in areas designated as damp locations, shall be suitably gasketed and UL listed for such applications.
7. All fixtures shall be UL approved with labels attesting thereto.
8. The Contractor shall obtain all information relative to the exact type of hung ceilings and suspension systems to be installed before ordering any recessed fixtures. This Contractor shall furnish the proper type fixtures applicable to the ceiling framing system. If, other than the type of fixtures specified are required for installation, due to the type of ceiling construction, this Contractor shall furnish and install the proper type fixtures and mounting appurtenances required at no extra charge.
9. The Contractor shall coordinate the exact locations of all lighting fixtures with the ceiling pattern during the construction period and before installation of the fixtures. Interferences between lighting fixtures, and other equipment, shall be brought to the attention of the General Contractor.
10. Include the aiming and/or adjustments of all lighting fixtures requiring same in accordance with instructions issued by the Architect in the field.
11. All lamp sockets in lighting fixtures shall be suitable for the indicated lamps and shall be set so that the lamps are positioned in optically correct relation to all lighting fixture components.
12. Lighting fixtures shall be supported from building structure only, not from hung or suspended ceiling, by means of chains, threaded rods or #14 gauge tie wire.
13. All fixtures shall include seismic clips and shall be supported to comply with seismic regulations.
14. Lamps shall be manufactured by Eaton, Phillips. OSRAM, or Sylvania.

B. LED Lamps and Luminaires:

1. Solid State Lighting/Light Emitting Diode (LED) Lamps and Luminaries:
 - a. Luminaire manufacturer shall have a minimum of five (5) years' experience in the manufacture and design of LED products and systems and no less than one hundred (100) North American installations.
 - b. Unless otherwise specified, all LED luminaires and power/data supplies shall be provided by a single manufacturer to ensure compatibility.
 - c. All components, peripheral devices and control software are to be provided by and shall be the responsibility of a single entity. All components shall perform successfully as a complete system.
 - d. Include all components necessary for a complete installation. Provide all power supplies, synchronizers, data cables, and data terminators for a complete working system.
 - e. All LED sources used in the LED luminaire shall be of proven quality from established and reputable LED manufacturers and shall have been fabricated after 2007.
2. Replacement and Spares:

- a. Manufacturer will keep record of original bin for each LED module and have replacement modules from the same bin available for three (3) years after date of installation.
 - b. Manufacturer will keep an inventory of replacement parts (source assembly, power and control components).
 - c. Manufacturer's LED system will not become obsolete for ten (10) years.
 - d. Manufacturer will provide exact replacement parts, or provide upgraded parts that are designed to fit into the original luminaire and provide equivalent distribution and lumen output to the original, without any negative consequences.
 - e. Manufacturer has in place a written recycling and re-use program, and will accept returned product and/or components for recycling or re-use.
 - f. Manufacturer will properly dispose of non-recyclable components that are deemed harmful to the environment.
 - g. System shall carry a full warranty for five (5) years.
3. Products and Components – Performance:
- a. LED luminaires and components shall be UL listed or UL classified.
 - b. LED luminaires and components shall be CE certified.
 - c. LED luminaires and components shall be PSE marked.
 - d. All LED luminaires shall be subjected to the following JEDEC Reliability Tests for Lead-free Semiconductors: HTOL, RTOL, LTOL, PTMCL, TMSK, Mechanical Shock, Variable Vibration Frequency, SHR, Autoclave.
 - e. To ensure luminaire quality, luminaire shall have been tested under accelerated life test conditions including an operating temperature span of 360 degrees F, and cyclic loading up to 60G.
 - f. All products included in system shall use Mil-Std 810F, Random Vibration 7.698G as a minimum standard. In installations subject to vibration, luminaire shall be installed with vibration isolation hardware to sufficiently dampen vibrations.
 - g. All LED components shall be mercury and lead-free.
 - h. All manufacturing processes and materials shall conform to the requirements of the European Union's Restriction on the Use of Hazardous Substances in Electrical and Electronics Equipment (RoHS) Directive, 2002/95/EC.
 - i. LEDs shall comply with ANSI/NEMA/ANSI C78.377-2008 – Specifications for the Chromaticity of Solid State Lighting Products. Color shall remain stable throughout the life of the lamp. Color shall match approved sample.
 - j. LEDs shall comply with IESNA LM-80 – Standards for Lumen Maintenance of LED Lighting Products.
 - k. White LEDs shall have a rated source life of 50,000 hours under normal operation conditions. RGB LEDs shall have a rated source life of 100,000 hours. LED "rated source life" is defined as the time when a minimum of 70% of initial lumen output remains.
 - l. Luminaire assembly shall include a method of dissipating heating so as to not degrade life of source, electronic equipment, or lenses. LED luminaire housing shall be designed to transfer heat from the LED board to the outside environment. Luminaire housing shall have no negative impact

on life of components.

- m. Manufacturer shall supply in writing a range of permissible operating temperatures in which system will perform optimally.
- n. High power LED luminaires shall be thermally protected using one or more of the following thermal management techniques: metal core board, gap pad, and/or internal monitoring firmware.
- o. LEDs shall be adequately protected from moisture or dust in interior applications.
- p. For wet and damp use, LED-based luminaires itself shall be sealed, rated, and tested for appropriate environmental conditions, not accomplished by using an additional housing or enclosure. Such protection shall have no negative impact on rated life of source or components, or if so, such reductions shall be explicitly brought to the attention of the Designer.
- q. All hardwired connections to LED luminaires shall be reverse polarity protected and provide high voltage protection in the event connections are reversed or shorted during the installation process.
- r. The LED luminaire shall be operated at constant and carefully regulated current levels. LEDs shall not be overdriven beyond their specified nominal voltage and current.
- s. RGB LED luminaires shall utilize an equal combination of high brightness red, blue and green LEDs, unless otherwise noted, to provide up to 16.78 million additive RGB colors and shall be capable of at least 8-bit control.
- t. Manufacturer shall be able to provide supporting documentation of the product meeting third party regulatory compliance.
- u. Manufacturer shall ensure that products undergo and successfully meet appropriate design and manufacturability testing including Design FMEA, Process FMEA, Environmental Engineering Considerations and Laboratory Tests, IEC standards and UL/CE testing.
- v. All LED luminaires (100% of each lot) shall undergo a minimum twenty-four (24) hour burn-in during manufacturing, prior to shipping.
- w. Manufacturer shall provide Luminaire Efficacy (lm/W), total luminous flux (lumens), luminous intensity (candelas) chromaticity coordinates, CCT and CRI optical performance, polar diagrams, and relevant luminance and illuminance photometric data. Provide data in IES file format in accordance with IES LM-79-2008, based on test results from an independent Nationally Recognized Testing Laboratory.
- x. Power/Data supply shall have the following:
 - 1) Supply outputs shall have current limiting protection.
 - 2) Supply shall provide miswiring protection.
 - 3) Supply shall have power factor correction.
 - 4) Supply shall provide connections that are conduit-ready or clamp-style connections in the case of low-voltage wiring.
 - 5) Supply shall come with a housing that meets a minimum IP20 rating for dry location installation unless located in a damp or wet location.
 - 6) Supply shall be UL listed for Class 1 or Class 2 wiring.

2.15 LIGHTING CONTROL DEVICES

- A. Scope: The Electrical Subcontractor, as part of the work of this section, shall furnish and install low voltage lighting control devices as indicated on the project documents and described herein.
- B. Submittals:
 - 1. Submit shop drawings and relevant product information as listed below:
 - a. Composite wiring and/or schematic diagram of each control circuit as proposed to be installed.
 - b. Catalog sheets, specifications and installation instructions for each device.
- C. Quality Assurance: The low voltage lighting control device manufacturer shall have a minimum of ten (10) years of experience in the manufacture of lighting control devices.
- D. Warranty: Provide a five (5) year manufacturer's warranty on all low voltage lighting control devices.
- E. Manufacturers:
 - 1. This specification is based on products as manufactured by WattStopper.
 - 2. Acceptable Manufacturers: Subject to the compliance with the requirements of the Contract Documents, acceptable manufacturers are listed below:
 - a. WattStopper
 - b. Sensor Switch
 - c. Cooper Wiring Devices
- F. Installation:
 - 1. The Electrical Subcontractor shall install all devices and wiring in a professional workmanlike manner per the manufacturer's installation instructions.
 - 2. The Electrical Subcontractor shall test all devices before start-up to ensure proper and correct installation.
- G. The Electrical Subcontractor shall calibrate all sensor time delays and sensitivity settings to ensure proper detection of occupants and energy savings.

- 1. Adjust as directed by the owner's representative.

2.16 FIRE ALARM SYSTEM

- A. Scope:
 - 1. Provide complete networked analog/addressable fire detection devices and appliances as indicated on project drawings.
 - 2. Each initiating device shall have full analog detection capabilities; identify its' exact location, and shall operate as described elsewhere in these specifications.
 - 3. Work in this section, as shown or specified, shall be in accordance with related Contract Documents.

4. Final connections, testing, and adjusting of system shall be done under direct supervision of system supplier.
 - a. System design and installation shall conform to following standards:
 - 1) Equipment shall be UL listed for its intended purpose, including UL 864 (UOJZ, UOXX, UOQY and UUKL), 1480 and 1971.
 - b. NFPA standards 70, 72, 90A, 92A, and 101.
 - c. Current State Building, Electrical and Life Safety Codes.
 - d. Americans with Disabilities Act (ADA).
 - e. Requirements of local Authorities Having Jurisdiction, including permitting and acceptance procedures.
5. Shop Drawings shall include:
 - a. Complete point-to-point riser diagram showing all equipment and size, type and number of all new conductors and devices.
 - b. Large scale drawings of control panels, annunciators, transponders, showing module placement and spare capacity allowances.
 - c. Complete, itemized bill of materials with quantities, descriptions.
 - d. Original catalog data sheets to assure compliance with these specifications. This equipment shall be subject to approval, and no equipment shall be ordered without prior approval.
 - e. Calculations to support size of standby batteries, notification appliance circuits (NAC) and audio amplifiers submitted. Circuit calculations shall demonstrate proper current draw, voltage drop, wire size considerations and spare capacity allowances. Calculations shall be based on UL nameplate RMS voltage ratings. NAC calculations shall demonstrate 25 percent spare capacity.
 - f. Complete description of system Sequence of Operation.
 - g. Details of any special installation procedures.
 - h. Complete floor plans showing network nodes and all device locations and corresponding addresses. Point identification lists shall be included to ensure proper coordination of alarm messages and shall include each device type address number and corresponding CCO text message.
 - i. Confirmation that equipment supplier will provide on-site project management and supervision during system installation, and perform system testing and instruction.
 - j. Operation and maintenance manuals.
6. Conform to UL and NFPA standards for testing of completed installation by UL approved testing company.
7. O & M Manuals shall include the following:
 - a. All information submitted in final reviewed shop drawings.
 - b. As-built documentation which incorporates all modifications to completed system, whether made as field change or by change order.
 - c. Include copy of final test report, Record of Completion, as-built documentation and Fire Alarm Support Contracts as described herein.

B. Sequence of Operation:

1. All new devices and appliances shall be incorporated into the existing sequence of operation. Confirm all work with the Warwick Fire Department.

C. General Requirements:

1. Equipment shall be new and unused. Components and systems shall be designed for uninterrupted duty. Equipment, materials and accessories covered by these requirements shall be provided by single manufacturer, or if provided by different manufacturers, recognized as compatible by both manufacturers.
2. Circuiting Guidelines. Each initiating device and indicating circuit shall be electronically supervised and individually addressable. Wiring shall match existing conventions as follows:
 - a. Individual Zone Addressable Modules shall be used to supervise and monitor waterflow, tamper, and status conditions from any related systems or devices.
 - b. Zone Addressable Control Modules and/or programmable relays shall provide auxiliary control functions.
 - c. Addressable loop wiring shall support all devices shown and allow for minimum of 25 percent spare capacity, and be wired in Class A, Style 7 fashion, with circuit isolation by floor and every 18 devices.

D. Fire Alarm Control Panel:

1. The existing panel was manufactured by Honeywell, Model E3. All new devices and appliances shall be compatible with this system.

E. Intelligent System Devices:

1. Analog Duct Smoke Detector: Provide analog photoelectric duct-mounted smoke detectors mounted in air ducts where shown and required. Duct detectors shall be programmed for alarm event sequencing or required by AHJ. Each detector shall be supplied with duct-mount housing, remote indicator/test station and sampling tubes sized according to duct width. Provide necessary auxiliary relay outputs via addressable relay control modules with each detector in order to ensure required HVAC control, override and status reporting functions.
2. Monitor Module: Provide Zone Addressable input Modules to enable monitoring and supervision of related systems and devices via SLC addressable loop.
3. Relay Module: Provide Addressable Relay to provide supervised control of auxiliary circuits (AHU's, door holders, etc.) via SLC addressable loop. Relay shall provide supervised output rated for 3 amps @ 30VDC or .5 amps at 120VAC. Where current exceeds limitations, provide isolation relay (PAM-1 or equal) rated for required load.
4. Isolation Modules: Where additional circuit isolation is required beyond isolation of the addressable loop interface, provide field-mounted Isolator Modules every 20 devices to protect circuit integrity in event of a wiring fault and ensure Style 6 wiring conventions.

F. System Accessories:

1. Remote Alarm Indicators: Provide remote LED indicators for sensors located behind locked doors. Provide permanent label on each indicator identifying device type and actual location.
2. Auxiliary Power Supplies: Provide distributed network power supplies as required. Power supplies shall communicate directly to main Fire Alarm System via SLC communications to support network-based synchronization, and supervision of each panel for ground fault, loss of AC power and Battery Failure. Each notification circuit served shall be individually supervised via on-board circuitry.

G. Installation:

1. Installation shall be supervised and tested by system supplier. Work shall be performed by skilled technicians under direction of experienced engineers, all of whom are properly trained and qualified.

H. Wiring:

1. Wiring for system shall be in accordance with Articles 760, 725, and 800 of National Electrical Code and local electrical codes. Cable shall be installed in conduit in accordance with manufacturer's instructions, with outgoing and return loops physically separated in accordance with applicable codes.
2. Provide complete wiring and conduit between all equipment. Devices shall be mounted upon and splices made in UL listed boxes. Wiring splices and transposing or changing of colors will not be permitted.
3. Junction boxes shall be painted red and labeled as 'Fire Alarm System' with decal or approved markings.
4. Fire Alarm control systems and equipment shall be connected to separate dedicated branch circuits, sized as required for proper service. Circuits shall be labeled 'FIRE ALARM'.

I. Final Tests, Records and Warranty:

1. Perform complete final test indicating proper functioning of system in accordance with all applicable codes and standards. Furnish copies of completed test report, as-built documentation and Record of Completion in accordance with NFPA 72 guideline to Owner and Architect for record purposes.
2. System test shall be conducted by UL certified testing company in accordance with UL guidelines and NFPA standards. Each and every device shall be tested in accordance with Manufacturer's recommendations.
3. Provide final test report and Record of Completion indicating proper functioning of the system and conformance to specifications. Test and Certificate of Completion shall be performed by factory-trained qualified technicians employed by Testing Contractor. Each and every device shall be tested, and standalone operation of remote panels shall be verified.
4. Final testing, certification and documentation shall be performed by same company that shall hold and execute Test and Inspection Contract.
5. In addition to pre-acceptance test, provide for complete and final Fire Department Acceptance Testing in accordance with requirements of Authorities Having Jurisdiction and applicable codes.

6. Provide a 3 year warranty from date of final acceptance on all equipment. Labor on installation shall be guaranteed for a period of 1 year. Provide warranty documentation in the submittal.
7. Guarantee all raceways and wiring to be free from inherent mechanical or electrical defects for one year from the date of final acceptance of system.

J. Annual Testing and Support Contracts:

1. Include as part of base bid cost of Test and Inspection contract which will be in effect for 1 Year.
2. Contract shall allow for quarterly tests according to UL, NFPA and local requirements. In addition to required testing and inspections, contract shall include cleaning and sensitivity test of each system detector following first year.
3. Upon expiration of warranty period and initial test and inspection contract, contract shall be renewable upon its expiration at discretion of Building Owner.

K. Training:

1. Provide services of manufacturer's representative-for an unlimited period, during normal business hours, to instruct owner's designated personnel and fire department response teams on operation of system.

L. Spare Equipment:

1. Provide system spare devices as follows:
 - a. Duct smoke detector head and housing - quantity of 4.
 - b. Addressable contact monitor modules - quantity of 4.
 - c. Addressable relay modules - quantity of 4.

2.17 SURGE PROTECTIVE DEVICES (SPD'S) (HIGH END)

A. Summary: Section Includes: Provide surge protective devices (SPD) at the main disconnect for the protection of building electrical system.

B. References:

1. ANSI/IEEE C.62.41 and C62.45
2. UL 1449 – Latest Edition
3. UL 1283
4. NEC – NFPA 70
5. NEMA LS1
6. NFPA

7. OSHA

8. IEEE Std. 1100

C. Submittals:

1. Shop Drawings: Provide Shop Drawings with wiring diagrams, installation information, testing and maintenance procedures, and operational information for the transient protection system. Shop Drawings shall be submitted to Engineer for approval before starting actual fabrication.
2. Submittal for Approval: Provide the following transient protection submittals:
 - a. Dimensional Drawing of each SPD type, indicating proposed mounting arrangements.
 - b. Written functional description of the transient protection circuit in terms of components, configuration, design approach, and performance capability per latest NEMA LS1.
 - c. The means of connection of the SPD to the electrical distribution system per latest NEMA LS1.
 - d. Manufacturer will provide UL-1449, latest edition data card showing the Suppressed Voltage Rating (SVR) for the specific catalog number submitted.
 - e. Per the requirements of NEC, the devices shall be marked with the short circuit current rating. This rating shall meet or exceed the available fault current. Test data from an independent testing laboratory shall be provided to demonstrate the short circuit current rating has been tested on a complete device.
 - f. Submit test report data clearly demonstrating the maximum surge current rating has been tested on a COMPLETE SPD unit including all necessary fusing/overcurrent protection, thermal disconnects, integral disconnects and monitoring systems. Manufacturers who cannot provide this data will not be considered.
 - g. Submit data demonstrating the complete SPD unit, including all overcurrent protection, is fully capable of a minimum repetitive surge current rating of 15,000 ANSI/IEEE C62.41, Category C3 (10kA) impulses without failure or a change in performance characteristics of more than 10%.
 - h. Written detailed response to each paragraph of the specification indicating that the proposed product meets or exceeds this specification. If specific paragraphs are not met, provide written explanation as to why not.

D. Warranty: Description: Manufacturer shall provide a product warranty for a period of not less than 10 years from date of installation. Warranty shall cover unlimited replacement of system protection modules during warranty period. The first five years of this warranty will include any field labor required to perform repair or replacement work.

E. Manufacturers:

1. Acceptable Manufacturers: Subject to compliance with requirements of the Contract Documents, acceptable manufacturers are as follows:
 - a. Eaton
 - b. Siemens
 - c. Square D

d. General Electric

2. Quality: The manufacturer shall be ISO 9001 certified, demonstrating world-class quality systems for the design and manufacture of the SPD units.

F. Environmental:

1. General Requirements:

- a. No audible noise shall be generated.
- b. No appreciable magnetic fields shall be generated. System shall be capable of use directly in computer rooms in any location without danger to disc units, disk packs, or tapes.
- c. Operating conditions:
 - 1) 30 – 130 Degrees F.
 - 2) 15 – 85 Percent Humidity Non-Condensing.

G. Surge Suppressors:

1. General Requirements:

- a. Rated for a 208Y/120 volt, 60 Hertz, 3 phase, 4 wire disconnect.
- b. Surge suppressors shall be in accordance with the following requirements:
- c. Unit shall be parallel in design and connect in parallel to main switchboard. Each surge suppression element (MOV) shall be individually fused so that a failure of one element and/or fuse shall not affect other surge suppression elements.
- d. Units shall be UL 1449, latest edition listed.
- e. Unit shall provide maximum UL 1449 latest edition Suppressed Voltage Rating (SVR) for 120, 120/208, or 120/240 volt system as follows:
 - 1) L-N = 330V.
 - 2) L-G = 400V.
 - 3) N-G = 400V.
 - 4) L-L = 600V.
- f. Unit shall provide maximum surge current rating of 200,000 amperes L-N based on ANSI/IEEE C62.41 standard 8 by 20 microsecond current waveform.
- g. Unit shall have a short circuit current rating, which equals or exceeds that of the main disconnect.
- h. Unit shall be UL 1283 listed as an electromagnetic interference filter and provide 50 Ohm noise attenuation of at least 40 dB at 100 kHz, 30 dB at 1 MHz, 35 dB at 10 MHz, and 50 dB at 100 MHz.
- i. Unit shall include solid-state, long-life externally mounted LED visual status indicators that indicate the on-line status and operational integrity of each phase of the unit.
- j. Unit shall have a Form C summary alarm output contact rated for at least 1 amp at 120VAC for remote annunciation of SPD status.

- k. Unit shall include a built-in, push-to-test feature that tests the integrity of all modules, MOV's and fuses in the system.
- l. Unit shall be provided with an integral, non-fused disconnect system which causes no interruption to the protected load for testing and maintenance. Disconnect system shall not require removal or replacement for warranty or other repairs.
- m. Unit shall have an audible alarm with an alarm on/off switch to silence the alarm and a push-to-test switch to test the alarm function.
- n. An adjustable (re-settable) counter shall be provided to totalize transient voltage surges in both the normal and common mode. The readout shall be at least a seven-digit LCD located on the unit front cover and provided with a 10-year battery backup to maintain counts in the event of power loss.

H. Grounding: Suppressor ground shall be bonded to the equipment grounding conductor and service entrance ground.

2.18 ACCESS PANELS

- A. Provide access panels for access to concealed junction boxes and to other concealed parts of system that require accessibility for operation and maintenance. In general, electrical work shall be laid out so access panels are not required.
- B. Access panels shall be located in a workmanlike manner in closets, storage rooms, and/or other non-public areas, positioned so that junction can be easily reached and size shall be sufficient for purpose (minimum size 12" x 16"). When access panels are required in corridors, lobbies, or other habitable areas, they shall be located as directed.
- C. Access panels shall be prime-painted and equipped with screwdriver operated cam locks.
- D. Acceptable Manufacturers:
 - 1. Inland Steel Products Company – Milcor
 - 2. Miami Carey
 - 3. Walsh-Hannon-Gladwin, Inc. – Way Locator
 - 4. Specific Types:
 - a. Acoustical Tile Ceiling "Milcor Type AT"
 - b. Plastered Surfaces "Milcor Type K"
 - c. Masonry Construction "Milcor Type M"
 - d. Drywall Construction "Milcor Type DW"
- E. Furnish access panel Shop Drawings.

PART 3 – EXECUTION

3.1 BASIC REQUIREMENTS

A. Adhere to best industry practice and the following:

1. All work shall be concealed.
2. Route circuitry runs embedded in concrete to coordinate with structural requirements.
3. Equip each raceway intended for the future installation of wire or cable with a nylon pulling cord 3/16" in diameter and clearly identify both ends of the raceway.
4. Provide all outlet boxes, junction boxes, and pull boxes for proper wire pulling and device installation. Include those omitted from the Contract Drawings due to symbolic methods of notation.
5. Utilize lugs of the limited type to make connections at both ends of cables installed on the line side of main service overcurrent and switching devices. Provide cable limiters for each end of each service entrance cable.
6. Beyond the termination of raceways, fireproof the following:
 - a. All wires and cables within pad-mounted transformer enclosure.
 - b. All service feeder cables ahead of main service overcurrent protection devices, and elsewhere where not in raceways.
 - c. Fireproofing of wires and cables shall be by means of a half-lapped layer of arc proof or by means of sleeving of a type specifically manufactured for the purpose. Ends of tape or sleeving shall be severed with twine. Fireproofing shall be extended up into raceways. After conductors have been finally shaped into their permanent configuration, fireproofing tape or sleeving shall be coated with silicate of soda (water glass). Fireproofing shall be applied in an overall manner to raceway groupings of conductors.
7. Provide all sleeves through fireproof and waterproof slabs, walls, etc., required for electric work.
 - a. Provide waterproof sealing for the sleeves through waterproof slabs, walls, etc.
 - b. Provide fireproof sealing for the sleeves through fireproof walls, slabs, etc.
 - c. Provide fireproof sealing for the openings in fireproof walls, slabs, etc., resulting from removal of existing electrical sleeves, conduits, poke-thru's etc.
8. No splicing of wires will be permitted in Fire Alarm System.
9. Bundle wiring passing through pull boxes and panelboards in a neat and orderly manner.
10. Turn branch circuits and auxiliary system wiring out of wiring gutters at 90 degrees to circuit breakers and terminal lugs.
11. In electric rooms with equipment rated 800 amps or more and over 6 feet wide that contains overcurrent devices, the Electrical Contractor shall provide a powered Exit sign at 18" AFF at each door.
12. All building mounted photovoltaic equipment shall be installed, tested and maintained in accordance

with NFPA 1 Section 11.12.

13. All panelboards shall be labeled in accordance with NFPA 70 Article 408.

3.2 TESTING REQUIREMENTS & INSTRUCTIONS

- A. The Electrical Subcontractor shall provide supervision, labor, materials, tools, test instruments and all other equipment or services and expenses required to test, adjust, set, calibrate, and operationally check work and components of the electrical systems and circuitry throughout Division 26 work.
- B. The Electrical Subcontractor shall pay for all tests specified in Division 26, including expenses incident to retests occasioned by defects and failures of equipment to meet Specifications, at no additional cost to the Owner. Any defects or deficiencies discovered in any of the Electrical work shall be corrected.
 - 1. The Electrical Subcontractor shall:
 - a. Replace wiring and equipment found defective (defined as failing to meet specified requirements) at no additional cost to the Owner.
 - b. Submit three (3) copies of test results to the Engineer.
 - 2. Do not void equipment warranties or guarantees by testing and checkout work. Checks and tests shall be supplemental to and compatible with the Manufacturer's installation instructions. Where deviations are apparent, obtain the Manufacturer's approved review of procedures prior to testing. Where any repairs, modifications, adjustments, tests or checks are to be made, the Contractor shall contact the Engineer to determine if the work should be performed by or with the Manufacturer's Representative.
 - 3. Tests are to:
 - a. Provide initial equipment/system acceptance.
 - b. Provide recorded data for future routine maintenance and trouble-shooting.
 - c. Provide assurance that each system component is installed satisfactorily and can be expected to perform, and continue to perform its specified function with reasonable reliability throughout the life of the facility.
 - 1) At any stage of construction and when observed, any electrical equipment or system determined to be damaged, or faulty, is to be reported to the Engineer. Corrective action by the Contractor requires prior Engineer approval, retesting, and inspection.
 - 2) Prior to testing and start-up, equipment and wiring shall be properly and permanently identified with nameplates, and other identification as specified in Section 3.7. Check and tighten terminals and connection points, remove shipping blocks and thoroughly clean equipment, repair damaged or scratched finishes, inspect for broken and missing parts and review and collect Manufacturer's Drawings and instructions for delivery to the Engineer. Make routine checks and tests as the job progresses to ensure that wiring and equipment is properly installed.
 - 3) Testing and checkout work is to be performed with fully qualified personnel skilled in the particular tests being conducted. Personnel are to have at least five (5) years of experience with tests of same type and size as specified.
 - 4) Inspections and tests shall be in accordance with the following applicable codes and standards as amended to date, unless otherwise specified.

- a) National Electrical Manufacturer's Association – NEMA.
- b) American Society for Testing and Materials _ ASTM.
- c) Institute of Electrical and Electronic Engineers – IEEE.
- d) National Electrical Testing Association – NETA.
- e) American National Standards Institute – ANSI.
- f) C2: National Electrical Safety Code.
- g) Z244-1: American National Standard for Personnel Protection.
- h) Insulated Cable Engineers Association – ICEA.
- i) Association of Edison Illuminating Companies – AEIC.
- j) Occupational Safety and Health Administration – OSHA.
- k) OSHA Part 1910; Subpart S, 1910.308.
- l) OSHA Part 1926; Subpart V, 1926.950 through 1926.960.
- m) National Fire Protection Association – NFPA.
- n) 70B: Electrical Equipment Maintenance.
- o) 70E: Electrical Safety Requirements for Employer Workplaces.
- p) 70: National Electrical Code.
- q) 78: Lightning Protection Code.
- r) 101: Life Safety Code.
- s) Inspections and tests shall utilize the following references:
- t) Contract Drawings and Specifications.
- u) Contractor's Short Circuit and Construction Study, in accordance with Section 26 00 00D.
- v) Manufacturer's printed test procedures for respective equipment.

4. Test Equipment:

- a. Test equipment used by the Contractor is to be inspected and calibrated.
- b. Perform calibration and setting checks with calibrated test instruments of at least twice that of the accuracy of the equipment, device, relay or meter under test. Dated calibration labels shall be visible on test equipment. Calibrations over six (6) months old are not acceptable on field test instruments. Inspect test instruments for proper operation prior to proceeding with the tests. Record serial and model numbers of the instruments used on the test forms.

5. Test Procedures:

- a. The Electrical Subcontractor is responsible for the preparation of the procedures and schedules for the work specified herein. This work is to be coordinated and compatible with both the work and schedule of the other crafts. Sequence the tests and checks so that the equipment can be energized immediately after the completion of the application tests.
- b. Submit proposed testing and checkout forms. The procedures shall provide specific instructions for the checking and testing of each electrical component of each system. Schedule tests and

inspections as the job progresses. Test procedures submitted shall include job safety rules.

- c. After each electrical system installation is complete, perform the tests to determine that the entire system is in proper working order and in accordance with applicable codes, Manufacturer's instructions, Drawings, and Specifications. Tests are in addition to shop tests of individual items at the Manufacturer's plant. Perform insulation and ground resistance tests before operating tests.
 - d. Perform insulation tests on electrical equipment, apparatus, cables, motors, generators, transformers, circuit breakers and switches, switchgear, motor control centers, and similar electrical equipment, at the following items and conditions:
 - e. Prior to energization and/or placing into service.
 - f. When damage to the insulation is suspected or known to exist.
 - g. After repairs or modifications to the equipment affecting the insulation.
 - h. Where lightning or other surge conditions are known to have existed on the circuit.
 - i. Make openings in circuits for test instruments and place and connect instruments, equipment, and devices, required for the tests. Upon completion of tests, remove instruments and instrument connections and restore circuits to permanent condition.
 - j. List each circuit and measured resistance as test data. Maintain record of insulation resistance values. Identify conductor, or equipment, date that value was taken and resistance value. Arrange information in tabular form and submit to Engineer.
 - k. Report inspections, tests, and calibrations in writing on Engineer approved reports/forms. The recorded data form shall have the signatures of the persons conducting the tests, authorized Witnesses and the Engineer. The forms shall serve as the test and inspection checklist.
 - l. When the electrical tests and inspections specified or required within Division 26 are completed and results reported, reviewed, and approved by the Engineer, the Contractor may consider that portion of the electrical equipment system or installation electrically complete. The Contractor will then affix appropriate, approved, and dated completion or calibration labels to the tested equipment and notify the Engineer of electrical completion. If the Engineer finds completed work unacceptable, he will notify the Contractor in writing of the unfinished or deficient work, with the reason for his rejection, to be corrected by the Contractor. The Contractor will notify the Engineer in writing when exceptions have been corrected. The Contractor will prepare a "Notification or Substantial Electrical Completion" for approval by the Engineer following Engineer's acceptance of electrical completion. If later in-service operation or further testing identified problems attributable to the Contractor, these will be corrected by the Contractor, at no additional cost to the Authority.
- C. Specific Tests: Perform the following specified tests. De-energize and isolate equipment and cable prior to performing the tests.
- D. Motors:
1. Before energizing any machine, visually inspect for serviceability. Check Manufacturer's instruction manual for correct lubrication and ventilation. Align motor with driven equipment. Check nameplate for electrical power requirements.
 2. Test run motors uncoupled or unloaded, before placing into operation. Check the motor for rotation, speed, current and temperature rise under normal load and record the results. Maintain the proper color

codes for phase identifications. This may require swaps at the motor for proper rotation. Use motor phase rotation meter prior to lead connection at motor in order to minimize later swaps.

E. Grounding Systems:

1. Test main building loops and major equipment grounds to remote earth, directly referenced to an extremely low resistance (approximately 1 ohm) reference ground benchmark. Perform a visual inspection of the systems, raceway and equipment grounds to determine the adequacy and integrity of the grounding. Ground testing results shall be recorded, witnessed, and submitted to the Engineer.
2. Perform ground tests using a low resistance, null-balance type ground testing ohmmeter, with test lead resistance compensated for. Use the type of test instrument which compensates for potential and current rod resistances.
3. Test each ground rod and measure ground resistance. If resistance is not 25 ohms or less, drive additional rods to obtain a resistance of 25 ohms or less. Submit tabulation of results to Engineer. Include identification of electrode, date of reading and ground resistance value in the test reports.
4. Test each building and major equipment grounding system for continuity of connections and for resistance. Ground resistance of conduits, equipment cases, and supporting frames, shall not exceed 5 ohms to ground. Submit all readings to the Engineer.
5. Where ground test results identify the need for additional grounding conductors or rods that are not indicated or specified, design changes will be initiated to obtain the acceptable values. The Contractor is responsible for the proper installation of the grounding indicated and specified.
6. Wire and Cable: (All conductors originating from main distribution panels).
 - a. Before energizing any cable or wire, megger the insulation resistance of every external circuit wire to each other and to ground. Tests shall be conducted at voltages of 500 volts or lower. Continuity test each wire and cable to verify the field-applied tag per conductor. Continuity test each wire and cable to verify the field-applied tag per conductor. Minimum insulation resistance values shall not be less than two (2) megohms.
 - b. Take insulation resistance measurements for motor feeders. With motors disconnected, measure insulation resistance from load side of contactors or circuit breakers.
 - c. Check cables and wires for the proper identification numbering and/or color coding.
 - d. Inspect cables for physical damage and proper connection in accordance with single line diagram.

F. Power Distribution System:

1. Main Disconnect:
 - a. Inspect for physical, electrical and mechanical condition.
 - b. Compare equipment nameplate information with latest single-line diagram and report discrepancies in writing to Engineer within 24 hours.
 - c. Check for proper anchorage, required area clearance, physical damage, and proper alignment.
 - d. Inspect all doors, panels and sections for paint, dents, scratches, fit and missing hardware.
 - e. Verify that fuse and/or circuit breaker sizes and types correspond to Drawings. Report deviations

to Engineer in writing within 24 hours.

- f. Inspect all bus connections for high resistance. Use low resistance ohmmeter, or check tightness of bolted bus joints by calibrated torque wrench method. Refer to manufacturer's instructions for proper torque levels.
 - g. Clean entire disconnect using manufacturer's approved methods and materials prior to energizing system and a second time just prior to turning over system to Owner.
 - h. Inspect insulators for evidence of physical damage or contaminated surfaces.
 - i. Verify proper barrier and shutter installation and operation.
 - j. Verify appropriate contact lubricant on moving current carrying parts.
 - k. Exercise all active components.
 - l. Inspect all indicating devices for proper operation.
2. Circuit Breakers – Molded Case:
- a. Circuit breaker shall be checked for proper mounting, conductor size and feeder designation.
 - b. Operate circuit breaker to ensure smooth operation.
 - c. Inspect case for cracks or other defects.
 - d. Check tightness of connections with calibrated torque wrench. Refer to manufacturer's instruction for proper torque levels.
 - e. Perform a contract resistance test or measure millivolt drop at rated current.
 - f. Perform an insulation resistance test at 1000 volts DC for one (1) minute from pole-to-pole and from each pole-to-ground with breaker closed and across open contract in each phase – 500V DC if circuit breaker is solid state.
 - g. Perform adjustments for final settings in accordance with breaker setting sheet if applicable to the particular breaker.
3. Motor Control:
- a. Inspect for physical damage, proper anchorage and grounding.
 - b. Compare equipment nameplate data with design plans or starter schedule.
4. Motor Running Protection:
- a. Compare overload heater rating with motor full-load current rating to verify proper sizing
 - b. If motor running protection is provided by fuses, verify proper rating considering motor characteristics.
 - c. Check tightness of bolted connections.
 - d. Measure insulation resistance of each bus section phase-to-phase and phase-to-ground for one (1) minute.
 - e. Bolt torque levels shall be in accordance with Manufacturer's recommendations.
 - f. Control wiring insulation test voltage shall be 1000 VDC. Manufacturer shall be consulted for test voltage where solid-state control devices are utilized.

- g. Perform overload tests at 300% of motor full-load current. Trip times shall be in accordance with Manufacturer's tolerances. Investigate values in excess of 120 seconds.
- 5. Panelboards:
 - a. Inspect for physical damage and proper grounding.
 - b. Compare nameplate information with schedules and report any discrepancies.
 - c. Inspect all panelboards for cleanliness, workmanship, etc.
- 6. The following systems shall adhere to the general requirements of this section in addition to complying with the specific test requirements outlined in the respective sections listed:
 - a. Fire Alarm System.

3.3 BRANCH CIRCUITRY

- A. For all lighting and appliance branch circuitry, raceway sizes shall conform to industry standard maximum permissible occupancy requirements except where these are exceeded by other requirements specified elsewhere.
- B. Circuits shall be balanced on phases at their supply as evenly as possible.
- C. Feeder connections shall be in the phase rotation which establishes proper operation for all equipment supplied.
- D. Reduced size conductors indicated for any feeders shall be taken as their grounding conductors.
- E. Feeders consisting of multiple cables and raceways shall be arranged such that each raceway of the feeder contains one (1) cable for each leg and one (1) neutral cable, if any.
- F. For circuitry indicated as being protected at 20 Amps or less, abide by the following:
 - 1. All 20 amp, 120/208 volt, 3-phase, 4-wire combined branch circuit homeruns shall be provided with a #8 AWG neutral conductor.
 - 2. Minimum conductor size shall be No. 12 AWG copper.
 - 3. Conductors operating at 120 volts extending in excess of 100 ft. or at 277 volts extending in excess of 200 ft., or the last outlet or fixture tap shall be No. 10 AWG copper throughout.
 - 4. Lighting fixtures and receptacles shall not be connected to the same circuit.
 - 5. Circuits shall be balanced on phases at their supply point as evenly as possible.
- G. Type MC Cable Installation:
 - 1. Where cable is permitted under the products section, the installation of same shall be done in accordance with code and the following:
 - a. Cable shall be supported in accordance with code. Tie wire is not an acceptable means of support. Cable supports such as Caddy WMX-6, MX-3, and clamps such as Caddy 449 shall be used.

Where cables are supported by the structure and only need securing in place, then ty-raps will be acceptable. Ty-raps are not acceptable as a means of support. All fittings, hangers, and clamps for support and termination of cables shall be of type specifically designed for use with cable, i.e., romex connectors not acceptable.

- b. Armor of cable shall be removed with rotary cutter device equal to roto-split by Seatek Co.; not with a hacksaw.
- c. Use split "Insuliner" sleeves at terminations.

3.4 REQUIREMENTS GOVERNING ELECTRICAL WORK IN DAMP OR WET LOCATIONS

- A. Outlets and outlet size boxes shall be of galvanized cast ferrous metal only.
- B. The finish of threaded steel conduit shall be galvanized only.
- C. Wires for pulling into raceways for lighting and appliance branch circuitry shall be limited to "THWN".
- D. Wires for pulling into raceways for feeders shall be limited to "XHHW".
- E. Plates for toggle switches and receptacles shall have gasketed snap shut covers suitable for wet locations while in use.
- F. Final connections of flexible conduit shall be neoprene sheathed.
- G. Apply one (1) layer of half looped plastic electric insulating tape over wire nuts used for joining the conductors of wires.
- H. Enclosures, junction boxes, pull boxes, cabinets, cabinet trims, wiring troughs and the like, shall be fabricated of galvanized sheet metal, shall conform to the following:
 - 1. They shall be constructed with continuously welded joints and seams.
 - 2. Their edges and weld spots shall be factory treated with cold galvanizing compound.
 - 3. Their connection to circuitry shall be by means of watertight hub connectors with sealing rings.
- I. Enclosures for individually mounted switching and overcurrent devices shall be NEMA Class IV weatherproof construction.
- J. The covers, doors and plates and trims used in conjunction with all enclosures, pull boxes, outlet boxes, junction boxes, cabinets and the like shall be equipped with gaskets.
- K. Panels shall be equipped with doors without exception.
- L. The following shall be interpreted as damp or wet locations within building confines:
 - 1. Spaces where any designations indicating weatherproof (WP) or vapor proof appear on the Contract Drawings.
 - 2. Below waterproofing in slabs applied directly on grade.

3. Spaces defined as wet or damp locations by Article 100 of the National Electric Code.

3.5 REQUIREMENTS GOVERNING ELECTRIC WORK IN AIR HANDLING SPACES

A. Within air handling plenums:

1. Abide by the requirements specified for electric work in damp locations within building confines.
2. All cabling and electrical equipment installed within plenums shall be listed for plenum use.
3. Exclude the installation of type NM or NMC cable.

B. In spaces within suspended ceilings used for air handling purposes, abide by the requirements specified for normal electric work conditions except:

1. Lighting fixtures recessed into the ceilings shall be certified as being suitable for this purpose.

3.6 UNDERGROUND CONDUIT BANKS

A. The Electrical work required in conjunction with underground conduit banks shall include providing all conduits.

B. Conduits for underground banks shall be:

1. Trade diameter size as indicated but in no case less than one inch.
2. Polyvinyl chloride Schedule 40 (approved for encased burial) duct, rigid steel conduit for vertical elbows and straight sections used to penetrate equipment pads, building foundation walls and concrete slabs.

C. All conduits indicated as being incorporated into conduit banks unless specifically noted as rigid steel conduits shall be encased in a concrete envelope which accommodates the indicated configuration of conduits and which encompasses dimensions as follows:

1. Outside surfaces of conduits to outside surface of envelope where reinforcement of encasement is required – 6” minimum.
2. Outside surfaces of conduits to outside surface of envelope where no reinforcement of encasement is required – 3” minimum.
3. Spacing between centerlines of conduits assigned to different categories of use primary feeders, secondary feeders, communications and signaling – 10-1/2” minimum.
4. Spacing between centerlines of conduits assigned to the same category of use – 7-1/2” minimum.

D. Reinforcement of the concrete encasement for conduit banks where required shall consist of No. 4 longitudinal reinforcing bars located 3” from the outside surface of the envelope and spaced 6” on centers all around. No. 8 wire reinforcing hoops set 8” apart shall be used to tie the longitudinal bars together.

E. Install conduit in such a manner as to provide a minimum cover of 30 inches after final grading except the

cover may be reduced to a minimum of 18 inches to:

1. Tie into existing work.
 2. Pass over other underground utilities.
 3. Pass over underground obstructions.
 4. Assist in the avoidance of low points.
- F. Increase the minimum cover where required by field conditions.
- G. Lay conduit to avoid low points during run. Pitch at a minimum of 3 inches per 100 feet away from building.
- H. Provide reinforcement for the concrete encasement of a conduit bank where:
1. It passes under or over underground utilities.
 2. It passes under or over underground obstructions.
 3. Its cover is reduced to less than 30 inches.
 4. It runs through foundation walls and other building construction.
- I. Concrete encasement reinforcing shall extend in each case 5 feet beyond the points at which the determining conditions terminate.
- J. Bends in conduit shall have minimum radii as follows:
1. For primary feeder 15'-0" except where specifically indicated otherwise or where turning up at termination point.
 2. For primary feeder turning up at termination point – 4'-0".
- K. Install conduit so that adjacent joints are staggered at least 6 inches from one another.
- L. Offsets to accommodate field conditions shall be accomplished with two (2) bends of not more than ten (10) degrees each.
- M. Plug both ends of all conduit stubs.
- N. Seal the end of each conduit run terminating inside a building utilizing a water and gas-tight sealant manufactured specifically for the purpose.
- O. After conduit has been installed with concrete encasement completed, clear each conduit of all obstructions and foreign matter by pulling a flexible mandrel (12" minimum length and a diameter 1/4" less than that of the conduit) and brush through it. In the event that obstructions are encountered in any conduit which will not permit the mandrel to pass, remove and replace the blocked section. Include in the electric work all excavation, backfilling, repair of concrete encasement and restoration of surface at grade involved in the conduit replacement.

- P. Provide a nylon cord for the pulling of cable in each conduit in which no cable is to be installed as part of the electric work.
- Q. The Electrical Subcontractor shall provide all insulated racks as required for proper support of all cables and wires.
- R. Provide magnetic warning tape above each full length of duct bank 12 inches below grade.

3.7 IDENTIFICATION AND TAGGING

- A. Identify individually:
 - 1. Each panelboard.
 - 2. Each switch and circuit breaker.
 - 3. Each feeder, wire or cable of all systems.
 - 4. Each end of nylon pullwire in empty conduit.
- B. Each wire or cable in a feeder shall be identified at its terminal points of connection and in each pullbox, junction box and panel gutter through which it passes.
- C. The nomenclature used to identify panelboards or load center shall designate the numbers assigned to them.
- D. The nomenclature used to identify switches or circuit breakers shall:
 - 1. Where they disconnect mains or services designate this fact.
 - 2. Where they control feeders, designate the feeder number and the name of the load supplied.
 - 3. Where they control lighting and appliance branch circuitry, designate the name of the space and the load supplied.
- E. The nomenclature used to identify feeder wires and cables shall designate the feeder number.
- F. Identification for panelboards or load centers shall be by means of engraved Lamacoid nameplates showing 1/4" high white lettering on a black background fastened to the outside face of the front.
- G. Identification for switches or circuit breakers shall be by means of the following:
 - 1. Where individually enclosed – engraved Lamacoid nameplates showing 1/8" high white lettering on a black background fastened on the outside front face of the enclosure.
 - 2. Where in panelboards or load centers without doors – same as for individually enclosed.
 - 3. Where in panelboards or load centers with doors – typewritten directories mounted behind transparent plastic covers, in metal frames fastened on the inside face of the doors.
- H. Identification for wires and cables shall be by means of wrap around "brady" type labels.

- I. Device plates for local toggle switches, toggle switch type motor starters, pilot lights and the like, whose function is not readily apparent shall be engraved with 1/8" high letters suitably describing the equipment controlled or indicated.
- J. Phase identification letters shall be stamped into the metal of the bus bars of each phase of the main busses of each switchboard and each panelboard. The letters shall be visible from at least one (1) "normal posture" location without having to demount any current carrying or supporting elements.
- K. Equip the front face of all switchboard pull boxes junction boxes and the like containing cables, busing or devices operating in excess of 600 volts with enameled sheetmetal "red on white" signs reading "DANGER-HIGH VOLTAGE."
- L. Equip all electric closets and the like with enameled sheet metal "red on white" signs reading "Electrical Equipment Room – No Storage Permitted". Signs shall be mounted at clearly visible locations within the rooms.
- M. Provide a sign at the service entrance equipment room indicating the type and location of all on-site emergency or standby power sources.
- N. Identify each outlet box, junction box, and cabinet used in conjunction with empty raceway for wires of a future system by means of indelible markings on the inside denoting the system.
- O. Prior to installing identifying tags and nameplates, submit their nomenclature for approval. Conform to all revisions issued by the Architect.

3.8 LIMITING NOISE PRODUCED BY ELECTRICAL INSTALLATION

- A. Perform the following work in accordance with field instructions issued by the Architect to assure that minimal noise is produced by electrical installations due to equipment furnished as part of the Electrical work.
- B. Check and tighten the fastenings of sheet metal plates, covers, doors and trims used in the enclosures of electrical equipment.
- C. Remove and replace any individual device containing one or more magnetic flux path metallic cores (e.g., discharge lamp ballast, transformer, reactor, dimmer, solenoid) which is found to have a noise output exceeding that of other identical devices installed at the project.

3.9 SUPPORTS AND FASTENINGS

- A. Support work in accordance with best industry standards, Local Electric Code and the following:
 - 1. Include supporting frames or racks for equipment, intended for vertical surface mounting, which is required in a freestanding position.
 - 2. Supporting frames or racks shall be of standard angle, standard channel or specialty support system steel members. They shall be rigidly bolted or welded together and adequately braces to form a substantial structure. Racks shall be of ample size to assure a workmanlike arrangement of all equipment mounted on them.

3. No work intended for exposed installation shall be mounted directly on any building surface. In such locations, flat bar members or spaces shall be used to create a minimum of ¼" air space between the building surfaces and the work. Provide ¾" thick exterior grade plywood painted with two (2) coats of fire-retardant gray paint for mounting of panelboards.
4. Nothing (including outlet, pull and junction boxes and fittings) shall depend on electric conduits, raceways or cables for support.
5. Nothing shall rest on, or depend for support on, suspended ceiling media.
6. Support less than 2" trade size, vertically run, conduits at intervals no greater than 8'. Support such conduits, 2-1/2" trade size or larger, at intervals no greater than they story height, or 15', whichever is smaller.
7. Where they are not embedded in concrete, support less than 1" trade size, horizontally run, conduits at intervals no greater than 7'. Support such conduits, 1" trade size or larger, at intervals no greater than 10'.
8. Support all lighting fixtures directly from structural slab, intermediate decking or framing member as directed by the Architect. No light fixtures shall be supported directly from the roof deck.
9. Where fixtures and ceilings are such as to require fixture support from ceiling openings frames, include in the electric work the members necessary to tie back the ceiling opening frames to ceiling suspension members or slabs so as to provide actual support for the fixtures noted above.
10. Support all runs of conduit and/or circuitry directly from structural slabs, intermediate decking or framing members.
11. Fasten electric work to building structure in accordance with the best industry practice.
12. Floor mounted equipment shall not be held in place solely by its own dead weight. Include floor anchor fastenings in all cases.
13. For items which are shown as being ceiling mounted at locations where fastenings to the building construction element above is not possible, provide suitably auxiliary channel or angle iron bridging tying to building structural elements.
14. As a minimum procedure, where weight applied to the attachment points is 100 lbs. or less, fasten to concrete and solid masonry with bolts and expansion shields.
15. As a minimum procedure, where weight applied to building attachment points exceed 100 lbs., but is 300 lbs. or less, conform to the following:
 - a. At field poured concrete slabs, utilize inserts with 20' minimum length slip-through steel rods, set transverse to reinforcing steel.

3.10 SPLICING AND TERMINATING WIRES AND CABLES

- A. Maintain all splices and joints in removable cover boxes or cabinets where they may be easily inspected.

- B. Locate each completed conductor splice or joint in the outlet box, junction box, or pull box containing it, so that it is accessible from the removal cover side of the box.
- C. Join solid conductors No. 8 AWG and smaller by securely twisting them together and soldering, or by using insulated coiled steel spring "wire nut" type connectors. Exclude "wire nuts" employing non-expandable springs. Terminate conductors No. 8 AWG and smaller by means of a neat and fast holding application of the conductors directly to the binding screws or terminals of the equipment or devices to be connected.
- D. Join, tap and terminate standard conductors No. 6 AWG and larger by means of solder sleeves, taps, and lugs with applied solder or by means of bolted saddle type or pressure indent type connectors, taps and lugs. Exclude connectors and lugs of the types which apply set screws directly to conductors. Where equipment or devices are equipped with set screw type terminals which are impossible to change, replace the factory supplied set screws with a type having a ball bearing tip. Apply pressure indent type connectors, taps and lugs utilizing tools manufactured specifically for the purpose and having features preventing their release until the full pressure has been exerted on the lug or connector.
- E. Except where wire nuts are used, build up insulation over conductor joints to a value, equal both in thickness and dielectric strength, to that of the factory applied conductor insulation. Insulation of conductor taps and joints shall be by means of half-lapped layers of rubber tape, with an outer layer of friction tape; by means of half-lapped layers of approved plastic electric insulating tape; or by a means of split insulating casings manufactured specifically to insulate the particular connector and conductor, and fastened with stainless steel or non-metallic snaps or clips.
- F. Exclude splicing procedures for neutral conductors in lighting and appliance branch circuitry which utilize device terminals as the splicing points.
- G. Exclude joints or terminations utilizing solder in any conductors used for grounding or bonding purposes.
- H. Exclude all but solder or pressure indent type joints in conductors used for signaling or communication purposes.
- I. Lugs for conductors used to make phase leg connections on the line side of the main service overcurrent and switching device shall be of the limiter type.

3.11 PULLING WIRES INTO CONDUITS AND RACEWAYS

- A. Delay pulling wires or cables in until the project has progressed to a point when general construction procedures are not liable to injure wires and cables, and when moisture is excluded from raceways.
- B. Utilize nylon snakes or metallic fish tapes with ball type heads to set up for pulling. In raceways 2" trade size and larger, utilize a pulling assembly ahead of wires consisting of a suitable brush followed by a 3-1/2" diameter ball mandrel.
- C. Leave sufficient slack on all runs of wire and cable to permit the secure connection of devices and equipment.
- D. Include circular wedge-type cable supports for wires and cables at the top of any vertical raceway longer than 20 feet. Also include additional supports spaced at intervals which are no greater than 10'. Supports shall be located in accessible pull boxes. Supports shall be of a non-deteriorating insulating material

manufactured specifically for the purpose.

- E. Pulling lubricants shall be used. They shall be products manufactured specifically for the purpose.
- F. Slack on wires and cables located in cabinets and pull boxes shall be formed and set in place in groupings corresponding to their occupancy of raceways. They shall also be arranged, with insulators and supports provided where necessary, such that cable shims or other such temporary expedients do not have to be left permanently in place to prevent the wires and cables from shifting when covers or trims are removed.

3.12 REQUIREMENTS FOR THE INSTALLATION OF JUNCTION BOXES, OUTLET BOXES AND PULL BOXES

- A. Flush wall-mounted outlet boxes shall not be set back to back but shall be offset at least 12" horizontally regardless of any indication on the Contract Drawings.
- B. Locate all boxes so that their removable covers are accessible without necessitating the removal of parts of permanent building structure, including piping, ductwork, and other permanent mechanical elements.
- C. In conjunction with concealed circuitry, abide by one of the following instructions (as may be applicable to the conditions) in order to assure the aforementioned accessibility. (Not required for circuitry concealed by removable suspended ceiling tiles.)
 - 1. For a small (outlet size) box on circuitry concealed in a partition or wall, locate box or fitting so that its removable cover side, (or the face of any applied raised cover) penetrates through to within 1/8" of the exposed surface of the building materials concealing the circuitry and apply a blank or device plate to suit the functional requirements.
 - 2. For a large box on circuitry concealed in a partition, suspended ceiling, or wall, locate box totally hidden but with its removable cover directly behind an architectural access door or panel (included for the purpose, separate from the electric work) in the building construction which conceals the circuitry.
 - 3. For a small (outlet size) box on circuitry concealed above and intended as an outlet for a surface mounted lighting fixture or other such electrical item, locate box so that its removable cover side penetrates through to the exposed surface of the building materials concealing the circuitry. Arrange the mounting of the lighting fixture or other item so that it completely covers the opening in the building construction caused by the box.
 - 4. For a small (outlet size) box on circuitry concealed in a suspended ceiling, and intended as an outlet for a non-demountable type of recessed lighting fixtures or other such electrical items, locate box totally hidden but with its removable cover not more than 1' away from the building construction opening occupied by the demountable items.
- D. Apply junction and pull boxes in accordance with the following:
 - 1. Include all pull boxes in long straight runs of raceway to assure that cables are not damaged when they are pulled in.
 - 2. Include junction and pull boxes to assure a neat and workmanlike installation of raceways.
 - 3. Include junction and pull boxes to fulfill requirements pertaining to the limitations to the number of

bends permitted in raceway between cable access points, the accessibility of cable joints and splices, and the application of cable supports.

4. Include all required junction and pull boxes regardless of indications on the Contract Drawings (which, due to symbolic methods of notation, may omit to show some of them).

E. Apply outlet boxes in accordance with the following:

1. Unless noted below or otherwise specifically indicated, include a separate outlet box for each individual wiring device, lighting fixture and signal or communication system outlet component. Outlet boxes supplied attached to lighting fixtures shall not be used as replacements for the boxes specified herein.
2. A continuous row of fixtures of the end-to-end channel type, designed for "through wiring", and wired in accordance with the specification hereinafter pertaining to circuitry through a series of lighting fixtures, may be supplied through a single outlet box.
3. A series of separate fixtures, designed for "through wiring", spaced not more than 4' apart, and interconnected with conduit or raceway and circuitry which is in accordance with the Specifications hereinafter pertaining to circuitry through a series of lighting fixtures, may be supplied through a single outlet box.
4. Connection to recessed ceiling fixtures supplied with pigtails may be arranged so that more than one (1), but not more than four (4) such fixtures are connected into a single outlet box. When adopting this procedure:
 - a. Utilize an outlet box no smaller than 5" square by 2-1/2" deep.
 - b. Allow no fixture to be supplied from an outlet box in another room.
5. Multiple local switches indicated at a single location shall be gang-mounted in a single outlet box.
6. Include all required outlet boxes regardless of indications on the Contract Drawings (which due to symbolic methods of notation, may omit to show some of them).

F. Install junction boxes, pull boxes and outlet boxes in conjunction with concealed circuitry.

1. Exclude surface-mounted outlet boxes in conjunction with concealed circuitry.
2. Exclude unused circuitry openings in junction and pull boxes. In larger boxes each such opening shall be closed with a galvanized sheet steel plate fastened with a continuous weld all around. In small outlet type boxes, utilize plugs as specified for such boxes.
3. Close up all unused circuitry openings in outlet boxes. Unused openings in cast boxes shall be closed with approved cast metal threaded plugs. Unused openings in sheet metal boxes shall be closed with sheet metal knock-out plugs.
4. Outlet boxes for switches shall be located at the strike side of doors. Indicate door swings are subject to field change. Outlet boxes shall be located on the basis of final door swing arrangements.
5. Boxes and plaster covers for duplex receptacles shall be arranged for vertical mounting of the

receptacle.

6. Equip outlet boxes used for devices which are connected to wires of systems supplied by more than one set of voltage characteristics with barriers to separate the different systems.

G. Barriers in junction and pull boxes of outlet size shall be of the same metal as the box.

1. Barriers in junction and pull boxes which are larger than outlet size shall be of the polyester resin fiberglass of adequate thickness for mechanical strength, but in no case less than 1/4" thick. Each barrier shall be mounted, without fastenings, between angle iron guides so that they may be readily removed.

3.13 LOCATING AND ROUTING OF CIRCUITRY

A. In general, all circuitry shall be run concealed except that it shall be run exposed where the following conditions occur:

1. Horizontally at the ceiling of permanently unfinished spaces which are not assigned to mechanical or electrical equipment.
2. Horizontally and vertically in mechanical equipment spaces.
3. Horizontally and vertically in electric equipment rooms.

B. Concealed circuitry shall be so located that building construction materials can be applied over its thickest elements without being subject to spalling or cracking.

C. All circuitry and raceways shall not be run within slabs. If field conditions requires raceways to be embedded in field-poured structural building construction concrete fill or slab shall conform to the following:

1. All proposed embedded raceways shall be indicated on plan and elevation and submitted to the Architect and Structural Engineer for review and written approval prior to installation. Any costs associated with the review and approval shall be borne by the Electrical Subcontractor.
2. They shall be run "single layer" with their outside surface no closer than 1" to any surface of the structural concrete.
3. They shall not be located in any configuration which places the outside surface of one closer than 3" to outside surface of another, except at tees, crosses or other single level wide angle junction points.
4. Where crossovers or close grouping are unavoidable, circuitry shall be carefully field coordinated so as not to cause structural weakness.
5. Where turned up or down into a wall or partition they shall, before entering same, be routed parallel for a long enough distance to assure that no relocation of the wall or partition will be necessary to conceal the required bend.
6. They shall be routed in such a manner as to coordinate with the structural requirements of the building.

7. They shall be routed in accordance with field instructions issued by the Architect where such instructions differ from Specifications set forth herein.
- D. Circuitry run exposed shall be routed parallel to building walls and column lines.
- E. Exposed circuitry located overhead shall be run in a completely accessible manner on the underside of all piping and ductwork.
- F. Circuitry run in suspended ceilings shall be routed parallel to building walls, column lines, etc.
- G. Circuitry shall be routed so as to prevent electric conductors from being subject to high ambient temperature. Minimum clearances from heated lines or surfaces shall be maintained as follows:
 1. Crossing where uninsulated: 3”.
 2. Crossing where insulated: 1”
 3. Running parallel where uninsulated: 36”.
 4. Running parallel where insulated: 6”.
- H. Circuitry shall not be run in elevator shafts, hoistways, and the like. Where outlets for trail cables, pit lights, run be level lights, and the like, are involved, only the “final connection” outlet boxes themselves shall be located within or open into, the confines of the shaft.
- I. Circuitry for miscellaneous systems indicated without notation as to location and routing shall be run as per the requirements and notations governing the adjacent light and power circuitry.

3.14 INSTALLING CIRCUITRY

- A. The outside surface of circuitry, which is to be embedded in cinder concrete, shall be coated with asphaltum paint.
- B. In runs of conduit or raceway including flexible limit the number of bends between cable access points to a total which does not exceed the maximum specified for the particular system. Where no such maximum is specified, limit the number to four (4) right angle bends or the equivalent thereof.
- C. In each conduit or raceway assigned for the future pulling in of wires, include a nylon drag cord. In raceways 2” trade size and larger, the cord shall be pulled in utilizing a suitable brush, followed by an 85% diameter ball mandrel ahead of the cord in the pulling assembly. In the event that obstructions are encountered, which will not permit the drag cord to be installed, the blocked section of raceway shall be replaced and any cutting and patching of the structure involved in such replacement shall be included as part of the electric work.
- D. Circuitry shall be arranged such that conductors of one feeder or circuitry carrying “going” current are not separated from conductors of the same feeder or circuitry carrying “return” current by any ferrous or other metal. Where not within raceways, all “going” and “return” current conductors of one feeder or circuit shall be laced together so as to minimize induction heating of adjacent metal components.
- E. Sleeves used where circuitry is to penetrate waterproof slabs, decks and walls, shall be of a type selected to

suit the water condition encountered in the field.

3.15 CLEANING UP

- A. Upon completion of all work, and testing, thoroughly inspect all exposed portions of the installation and completely remove all exposed labels, markings, and foreign material.
- B. The interior of all boxes and cabinets shall be left clean; exposed surfaces shall be cleaned and plated surfaces polished.
- C. Repair damage to finish surfaces resulting from work under this Section.
- D. Remove material and equipment from areas of work and storage areas.
- E. All equipment shall be clean from dirt, dust, and fingerprints prior to final acceptance.
- F. Touch up all damaged pre-finished equipment using materials and methods recommended by the Manufacturer.

3.16 PROJECT CLOSEOUT

- A. Provide close out submittals as required herein and in SECTION 01700 - PROJECT CLOSEOUT including the following close out submittals.
 - 1. Operation and Maintenance Manuals:
 - 2. Record Drawings.
 - 3. Test Reports.
 - 4. Extra Materials.
- B. Obtain written receipts of acceptance close out submittals submitted. Receipts shall specifically detail what is being delivered (description, quantity and specification section) and shall be dated and signed by firm delivering materials and by the Owner's Representative.
- C. All sketches, drawings, and charts herein are for the purpose of providing for specifications in a simplified format. Errors and omissions in such does not relive the Contractor of the responsibility for providing a fully complete, secure and properly operating integrated instructional technology network system suitable for the intended use. Bidders must obtain a complete set of Project Drawings and Specifications to determine the full scope of work. In case of conflict the Project Drawings and Specifications shall prevail.

END OF SECTION