

FORT MILL SCHOOL DISTRICT

**FORT MILL HIGH SCHOOL
HVAC RENOVATIONS**

BGA PROJECT NO: 20051

DECEMBER 14, 2020

PREPARED BY:



BUFORD GOFF & ASSOCIATES, INC.

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Columbia, South Carolina 29201
(803) 254-6302

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INVITATION FOR CONSTRUCTION BIDS

PROJECT

PROJECT NAME: Fort Mill High School HVAC Renovation
PROJECT NUMBER: 20051 LOCATION : Fort Mill High School
DESCRIPTION OF PROJECT: Replacement of existing units serving the gymnasium and auditorium. Provide new unit serving the wrestling room.

OWNER

OWNER NAME: Fort Mill School District
ADDRESS: 2233 Deerfield Drive
CITY: Fort Mill STATE: SC ZIP: 29715
OWNER REPRESENTATIVE: Jay Taylor
PHONE: (803) 548-4650 FAX: _____

ENGINEER

ENGINEERING FIRM: Buford Goff & Associates, Inc.
ADDRESS: 1331 Elmwood Avenue, Suite 200
CITY: Columbia STATE: S.C. ZIP: 29201
ELECTRICAL REPRESENTATIVE: Mr. Ed Weaver, Ed.Weaver@bgainc.com
MECHANICAL REPRESENTATIVE: Mr. Jonathan Burkett, Jonathan.Burkett@bgainc.com
PLUMBING REPRESENTATIVE: _____
PHONE: (803) 254-6302 FAX: (803) 771-6142

ARCHITECT

ARCHITECTURAL FIRM: N/A
ADDRESS: _____
CITY: _____ STATE: _____ ZIP: _____
ARCHITECTURAL REPRESENTATIVE: _____
PHONE: _____ FAX: _____

PRE-BID MANDATORY

PRE-BID DATE: January 5, 2021 TIME: 10:00 a.m.
PRE-BID LOCATION: Fort Mill High School, 215 N Highway 21 BYP, Fort Mill, SC 29715
COMMENTS: _____

BID

BID DATE: January 19, 2021 TIME: 10:00 a.m.
LOCATION: Bids to be submitted online through the Fort Mill School District Vendor Registry site

PLANS

AVAILABLE FROM: Fort Mill School District Vendor Registry site

PLAN DEPOSIT: \$ _____

APPROVED BY: _____ (PROJECT ENGINEER) _____ (DATE)

AIA® Document A701™ – 2018

Instructions to Bidders

for the following Project:

(Name, location, and detailed description)

THE OWNER:

(Name, legal status, address, and other information)

THE ARCHITECT:

(Name, legal status, address, and other information)

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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
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.6 Specifications

Section	Title	Date	Pages
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.7 Addenda:

Number	Date	Pages
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.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
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Supplementary and other Conditions of the Contract:

Document	Title	Date	Pages
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.9 Other documents listed below:

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

**BGA3
LUMP SUM BID FORM**

Bidders shall submit bids on only Bid Form BGA3.

BID SUBMITTED BY: _____
(Bidder's Name)

BID SUBMITTED TO: _____
(Owner's Name)

FOR: PROJECT NAME: Fort Mill High School HVAC Renovation
PROJECT NUMBER: 20051

OFFER

§ 1. In response to the Invitation for Construction Bids and in compliance with the Instructions to Bidders for the above-named Project, the undersigned Bidder proposes and agrees, if this Bid is accepted, to enter into a Contract with the Owner on the terms included in the Bidding Documents, and to perform all Work as specified or indicated in the Bidding Documents, for the prices and within the time frames indicated in this Bid and in accordance with the other terms and conditions of the Bidding Documents.

§ 2. Pursuant to Section 11-35-3030(1) of the SC Code of Laws, as amended, Bidder has submitted Bid Security as follows in the amount and form required by the Bidding Documents:

- Bid Bond with Power of Attorney** **Electronic Bid Bond** **Cashier's Check**
- (Bidder check one)*

§ 3. Bidder acknowledges the receipt of the following Addenda to the Bidding Documents and has incorporated the effects of said Addenda into this Bid:

(Bidder, check all that apply. Note, there may be more boxes than actual addenda. Do not check boxes that do not apply)

- ADDENDA:** #1 #2 #3 #4 #5

§ 4. Bidder accepts all terms and conditions of the Invitation for Construction Bids, including, without limitation, those dealing with the disposition of Bid Security. Bidder agrees that this Bid, including all Bid Alternates, if any, may not be revoked or withdrawn after the opening of bids, and shall remain open for acceptance for a period of sixty (60) Days following the Bid Date, or for such longer period of time that Bidder may agree to in writing upon request of the Owner.

§ 5. Bidder herewith offers to provide all labor, materials, equipment, tools of trades and labor, accessories, appliances, warranties and guarantees, and to pay all royalties, fees, permits, licenses and applicable taxes necessary to complete the following items of construction work:

§ 6.1 **BASE BID WORK** *(as indicated in the Bidding Documents and generally described as follows):* Replacement
of existing units serving the gymnasium and auditorium. Provide new unit serving the wrestling room.

\$ _____, which sum is hereafter called the Base Bid.
(Bidder to insert Base Bid Amount on line above in figures only)

**BGA3
LUMP SUM BID FORM**

§ 6.2 BID ALTERNATES (as indicated in the Bidding Documents and generally described as follows):

ALTERNATE # 1 (Brief Description): 5 year parts and labor warranty on the air handling units

ADD TO or **DEDUCT FROM BASE BID:** \$ _____

(Bidder to enter amount in figures only. Mark appropriate box to indicate an ADD or DELETE.)

ALTERNATE # 2 (Brief Description): _____

ADD TO or **DEDUCT FROM BASE BID:** \$ _____

(Bidder to enter amount in figures only. Mark appropriate box to indicate an ADD or DELETE.)

ALTERNATE # 3 (Brief Description): _____

ADD TO or **DEDUCT FROM BASE BID:** \$ _____

(Bidder to enter amount in figures only. Mark appropriate box to indicate an ADD or DELETE.)

§ 6.3 UNIT PRICES:

BIDDER offers for the Owner’s consideration and use, the following UNIT PRICES. The UNIT PRICES offered by BIDDER indicate the amount to be added to or deducted from the CONTRACT SUM for each item-unit combination. UNIT PRICES include all costs to the Owner, including those for materials, labor, equipment, tools of trades and labor, fees, taxes, insurance, bonding, overhead, profit, etc. The Owner reserves the right to include or not to include any of the following UNIT PRICES in the Contract and to negotiate the UNIT PRICES with BIDDER.

No.	ITEM	Unit of Measure	ADD	DEDUCT
<u>1.</u>	_____	_____	\$ _____	\$ _____
<u>2.</u>	_____	_____	\$ _____	\$ _____
<u>3.</u>	_____	_____	\$ _____	\$ _____
<u>4.</u>	_____	_____	\$ _____	\$ _____
<u>5.</u>	_____	_____	\$ _____	\$ _____
<u>6.</u>	_____	_____	\$ _____	\$ _____

**BGA3
LUMP SUM BID FORM**

§ 7. LISTING OF PROPOSED SUBCONTRACTORS PURSUANT TO SECTION 3020(b)(i), CHAPTER 35, TITLE 11 OF THE SOUTH CAROLINA CODE OF LAWS, AS AMENDED
(See Instructions on the following page BF-4)

Bidder shall use the below-listed Subcontractors in the performance of the Subcontractor Classification work listed:

(A) SUBCONTRACTOR LICENSE CLASSIFICATION or SUBCLASSIFICATION NAME <i>(Completed by Owner)</i>	(B) LICENSE CLASSIFICATION or SUBCLASSIFICATION ABBREVIATION <i>(Completed by Owner)</i>	(C) SUBCONTRACTOR and/or PRIME CONTRACTOR <i>(Required – must be completed by Bidder)</i>	(D) SUBCONTRACTOR'S and/or PRIME CONTRACTOR'S SC LICENSE NUMBER <i>(Requested, but not required)</i>
BASE BID			
Electrical	EL		
ALTERNATE #1			
ALTERNATE #2			
ALTERNATE #3			

If a Bid Alternate is accepted, Subcontractors listed for the Bid Alternate shall be used for the work of both the Alternate and the Base Bid work.

BGA3 LUMP SUM BID FORM

INSTRUCTIONS FOR SUBCONTRACTOR LISTING

1. The subcontractor table of the Bid Form sets forth an Owner developed list of contractor/subcontractor specialties by contractor license category and/or subcategory for which bidder is required to identify the entity (subcontractor(s) and/or himself) Bidder will use to perform the work of each listed specialty.
 - a. **Columns A and B:** The Owner fills out these columns, which identifies the contractor/subcontractor specialties for which the bidder must list either a subcontractor or himself as the entity that will perform this work. Subcontractor specialties are identified by contractor license categories or subcategories listed in Title 40 of the South Carolina Code of laws. If the owner has not identified a specialty, the bidder does not list a subcontractor.
 - b. **Columns C and D:** In these columns, the Bidder identifies the subcontractors it will use for the work of each specialty listed by the Owner in Column A. Bidder must identify only the subcontractor(s) who will perform the work and no others. Bidders should make sure that their identification of each subcontractor is clear and unambiguous. A listing that could be any number of different entities may be cause for rejection of the bid as non-responsive. For example, a listing of M&M without more may be problematic if there are multiple different licensed contractors in South Carolina whose names start with M&M.
2. **Subcontractor Defined:** For purposes of subcontractor listing, a subcontractor is an entity who will perform work or render service to the prime contractor to or about the construction site pursuant to a contract with the prime contractor. Bidder should not identify sub-subcontractors in the spaces provided on the bid form but only those entities with which bidder will contract directly. Likewise, do not identify material suppliers, manufacturers, and fabricators that will not perform physical work at the site of the project but will only supply materials or equipment to the bidder or proposed subcontractor(s).
3. **Subcontractor Qualifications:** Bidder must only list subcontractors who possess a South Carolina Contractor's license with the license classification and/or subclassification identified by the Owner in the first column on the left. The subcontractor license must also be within the appropriate license group for the work of the specialty. If Bidder lists a subcontractor who is not qualified to perform the work, the Bidder will be rejected as non-responsive.
4. **Use of Own forces:** If under the terms of the Bidding Documents, Bidder is qualified to perform the work of a listed specialty and Bidder does not intend to subcontract such work but to use Bidder's own employees to perform such work, the Bidder must insert its own name in the space provided for that specialty.
5. **Use of Multiple Subcontractors:**
 - a. If Bidder intends to use multiple subcontractors to perform the work of a single specialty listing, Bidder must insert the name of each subcontractor Bidder will use, preferably separating the name of each by the word "**and**". If Bidder intends to use both his own employees to perform a part of the work of a single specialty listing and to use one or more subcontractors to perform the remaining work for that specialty listing, bidder must insert his own name and the name of each subcontractor, preferably separating the name of each with the word "**and**". Bidder must use each entity listed for the work of a single specialty listing in the performance of that work.
 - b. **Optional Listing Prohibited:** Bidder may not list multiple subcontractors for a specialty listing, in a form that provides the Bidder the option, after bid opening or award, to choose to use one or more but not all the listed subcontractors to perform the work for which they are listed. A listing, which on its face requires subsequent explanation to determine whether it is an optional listing, is non-responsive. If bidder intends to use multiple entities to perform the work for a single specialty listing, bidder must clearly set forth on the bid form such intent. Bidder may accomplish this by simply inserting the word "**and**" between the names of each entity listed for that specialty. The Owner will reject as non-responsive a listing that contains the names of multiple subcontractors separated by a blank space, the word "or", a virgule (that is a /), or any separator that the Owner may reasonably interpret as an optional listing.
6. If Bidder is awarded the contract, bidder must, except with the approval of the Owner for good cause shown, use the listed entities to perform the work for which they are listed.
7. If bidder is awarded the contract, bidder will not be allowed to substitute another entity as subcontractor in place of a subcontractor listed in the subcontractor table of the Bid Form except for one or more of the reasons allowed by the SC Code of Laws.
8. Bidder's failure to identify an entity (subcontractor or himself) to perform the work of a subcontractor specialty listed in the first column on the left will render the Bid non-responsive.

BGA3 LUMP SUM BID FORM

§ 8. LIST OF MANUFACTURERS, MATERIAL SUPPLIERS, AND SUBCONTRACTORS OTHER THAN SUBCONTRACTORS LISTED IN SECTION 7 ABOVE (*FOR INFORMATION ONLY*):

Pursuant to instructions in the Invitation for Construction Bids, if any, Bidder will provide to Owner upon the Owner's request and within 24 hours of such request, a listing of manufacturers, material suppliers, and subcontractors, other than those listed in Section 7 above, that Bidder intends to use on the project. Bidder acknowledges and agrees that this list is provided for purposes of determining responsibility and not pursuant to the subcontractor listing requirements of SC Code Ann § 11-35-3020(b)(i).

§ 9. TIME OF CONTRACT PERFORMANCE AND LIQUIDATED DAMAGES

a) CONTRACT TIME

Bidder agrees that the Date of Commencement of the Work shall be established in a Notice to Proceed to be issued by the Owner. Bidder agrees to substantially complete the Work within 180 Calendar Days from the Date of Commencement, subject to adjustments as provided in the Contract Documents.

b) LIQUIDATED DAMAGES

Bidder further agrees that from the compensation to be paid, the Owner shall retain as Liquidated Damages the amount of \$ 500 for each Calendar Day the actual construction time required to achieve Substantial Completion exceeds the specified or adjusted time for Substantial Completion as provided in the Contract Documents. This amount is intended by the parties as the predetermined measure of compensation for actual damages, not as a penalty for nonperformance.

§ 10. AGREEMENTS

- a) Bidder agrees that this bid is subject to the requirements of the laws of the State of South Carolina.
- b) Bidder agrees that at any time prior to the issuance of the Notice to Proceed for this Project, this Project may be canceled for the convenience of, and without cost to, the Owner.
- c) Bidder agrees that neither the Owner nor any of its agencies, employees or agents shall be responsible for any bid preparation costs, or any costs or charges of any type, should all bids be rejected or the Project canceled for any reason prior to the issuance of the Notice to Proceed.

§ 11. ELECTRONIC BID BOND

By signing below, the Principal is affirming that the identified electronic bid bond has been executed and that the Principal and Surety are firmly bound unto the State of South Carolina under the terms and conditions of the AIA Document A310, Bid Bond, included in the Bidding Documents.

ELECTRONIC BID BOND NUMBER: _____

SIGNATURE AND TITLE: _____

**BGA3
LUMP SUM BID FORM**

CONTRACTOR'S CLASSIFICATIONS AND SUBCLASSIFICATIONS WITH LIMITATION

SC Contractor's License Number(s): _____

Classification(s) & Limits: _____

Subclassification(s) & Limits: _____

By signing this Bid, the person signing reaffirms all representation and certification made by both the person signing and the Bidder, including without limitation, those appearing in Article 2 of the AIA Document A701, Instructions to Bidders, is expressly incorporated by reference.

BIDDER'S LEGAL NAME: _____

ADDRESS: _____

TELEPHONE: _____

EMAIL: _____

SIGNATURE: _____ **DATE:** _____

PRINT NAME: _____

TITLE: _____

AIA DOCUMENT
A310 (2010 Edition)
Bid Bond

Note:

The original document is available for viewing at the following location:

Buford Goff & Associates, Inc.
1331 Elmwood Avenue, Suite 200
Columbia, South Carolina 29201
Phone 803-254-6302

Contact Buford Goff & Associates to schedule a time for viewing this document.



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)

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

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

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

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.

The Owner and Contractor agree as follows.

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 _____ day of a month, the Owner shall make payment of the amount certified to the Contractor not later than the _____ day of the 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 () 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.)

§ 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.)

§ 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.)

§ 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.)

- 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.)

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)



AIA[®] Document A201[®] – 2017

General Conditions of the Contract for Construction

for the following PROJECT:
(Name and location or address)

THE OWNER:
(Name, legal status and address)

THE ARCHITECT:
(Name, legal status and address)

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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ARTICLE 1 GENERAL PROVISIONS

§ 1.1 Basic Definitions

§ 1.1.1 The Contract Documents

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

§ 1.1.2 The Contract

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

§ 1.1.3 The Work

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

§ 1.1.4 The Project

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

§ 1.1.5 The Drawings

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

§ 1.1.6 The Specifications

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

§ 1.1.7 Instruments of Service

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

§ 1.1.8 Initial Decision Maker

The Initial Decision Maker is the person identified in the Agreement to render initial decisions on Claims in accordance with Section 15.2. 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 one shall be as binding as if required by all; performance by the Contractor shall be required only to the extent consistent with the Contract Documents and reasonably inferable from them as being necessary to produce the indicated results.

§ 1.2.1.1 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.

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

§ 1.3 Capitalization

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

§ 1.4 Interpretation

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

§ 1.5 Ownership and Use of Drawings, Specifications, and Other Instruments of Service

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

§ 1.5.2 The Contractor, Subcontractors, Sub-subcontractors, and 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.

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

§ 2.2 Evidence of the Owner's Financial Arrangements

§ 2.2.1 Prior to 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. The Contractor shall have no obligation to commence the Work until the Owner provides such evidence. If commencement of the Work is delayed under this Section 2.2.1, the Contract Time shall be extended appropriately.

§ 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 surveys describing physical characteristics, legal limitations and utility locations for the

site of the Project, and a legal description of the site. The Contractor shall be entitled to rely on the accuracy of information furnished by the Owner but shall exercise proper precautions relating to the safe performance of the Work.

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

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

§ 2.4 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, except to the extent required by Section 6.1.3.

§ 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 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.

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.

§ 3.2 Review of Contract Documents and Field Conditions by Contractor

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

§ 3.2.2 Because the Contract Documents are complementary, the Contractor shall, before starting each portion of the Work, carefully study and compare the various Contract Documents relative to that portion of the Work, as well as the information furnished by the Owner pursuant to Section 2.3.4, 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. These obligations are for the purpose of facilitating coordination and construction by the Contractor and are not for the purpose of discovering errors, omissions, or inconsistencies in the Contract Documents; however, the Contractor shall promptly report to the Architect any errors, inconsistencies or omissions discovered by or made known to the Contractor as a request for information in such form as the Architect may require. It is recognized that the Contractor's review is made in the Contractor's

capacity as a contractor and not as a licensed design professional, unless otherwise specifically provided in the Contract Documents.

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

§ 3.2.4 If the Contractor believes that additional cost or time is involved because of clarifications or instructions the Architect issues in response to the Contractor's notices or requests for information pursuant to Sections 3.2.2 or 3.2.3, the Contractor shall 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. If the Contractor performs those obligations, the Contractor shall not be liable to the Owner or Architect for damages resulting from errors, inconsistencies or omissions in the Contract Documents, for differences between field measurements or conditions and the Contract Documents, or for nonconformities of the Contract Documents to applicable laws, statutes, ordinances, codes, rules and regulations, and lawful orders of public authorities.

§ 3.3 Supervision and Construction Procedures

§ 3.3.1 The Contractor shall supervise and direct the Work, using the Contractor's best skill and attention. The Contractor shall be solely responsible for, and have control over, construction means, methods, techniques, sequences, and procedures, and for coordinating all portions of the Work under the Contract. If the Contract Documents give specific instructions concerning construction means, methods, techniques, sequences, or procedures, the Contractor shall evaluate the jobsite safety thereof and shall be solely responsible for the jobsite safety of such means, methods, techniques, sequences, or procedures. If the Contractor determines that such means, methods, techniques, sequences or procedures may not be safe, the Contractor shall give timely notice to the Owner and Architect, and shall propose alternative means, methods, techniques, sequences, or procedures. The Architect shall evaluate the proposed alternative solely for conformance with the design intent for the completed construction. Unless the Architect objects to the Contractor's proposed alternative, the Contractor shall perform the Work using its alternative means, methods, techniques, sequences, or procedures.

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

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

§ 3.4 Labor and Materials

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

§ 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.

§ 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. The Contractor further warrants that the Work will conform to the requirements of the Contract Documents and will be free from defects, except for those inherent in the quality of the Work the Contract Documents require or permit. Work, materials, or equipment not conforming to these requirements may be considered defective. The Contractor's warranty excludes

remedy for damage or defect caused by abuse, alterations to the Work not executed by the Contractor, improper or insufficient maintenance, improper operation, or normal wear and tear and normal usage. If required by the Architect, the Contractor shall furnish satisfactory evidence as to the kind and quality of materials and equipment.

§ 3.5.2 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.

§ 3.6 Taxes

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

§ 3.7 Permits, Fees, Notices and Compliance with Laws

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

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

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

§ 3.7.4 Concealed or Unknown Conditions

If the Contractor encounters conditions at the site that are (1) subsurface or otherwise concealed physical conditions that differ materially from those indicated in the Contract Documents or (2) unknown physical conditions of an unusual nature that differ materially from those ordinarily found to exist and generally recognized as inherent in construction activities of the character provided for in the Contract Documents, the Contractor shall promptly provide notice to the Owner and the Architect before conditions are disturbed and in no event later than 14 days after first observance of the conditions. The Architect will promptly investigate such conditions and, if the Architect determines that they differ materially and cause an increase or decrease in the Contractor's cost of, or time required for, performance of any part of the Work, will recommend that an equitable adjustment be made in the Contract Sum or Contract Time, or both. If the Architect determines that the conditions at the site are not materially different from those indicated in the Contract Documents and that no change in the terms of the Contract is justified, the Architect shall promptly notify the Owner and Contractor, stating the reasons. If either party disputes the Architect's determination or recommendation, that party may submit a Claim as provided in Article 15.

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

§ 3.8 Allowances

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

§ 3.8.2 Unless otherwise provided in the Contract Documents,

- .1 allowances shall cover the cost to the Contractor of materials and equipment delivered at the site and all required taxes, less applicable trade discounts;
- .2 Contractor's costs for unloading and handling at the site, labor, installation costs, overhead, profit, and other expenses contemplated for stated allowance amounts shall be included in the Contract Sum but not in the allowances; and

- .3 whenever costs are more than or less than allowances, the Contract Sum shall be adjusted accordingly by Change Order. The amount of the Change Order shall reflect (1) the difference between actual costs and the allowances under Section 3.8.2.1 and (2) changes in Contractor's costs under Section 3.8.2.2.

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

§ 3.9 Superintendent

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

§ 3.9.2 The Contractor, as soon as practicable after award of the Contract, shall 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.

§ 3.10 Contractor's Construction and Submittal Schedules

§ 3.10.1 The Contractor, promptly 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 Project.

§ 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.

§ 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.

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

§ 3.12.8 The Work shall be in accordance with approved submittals except that the Contractor shall not be relieved of responsibility for deviations from 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, provided the Owner and Architect have specified to the Contractor the performance and design criteria that such services must satisfy. 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.

§ 3.13 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.

§ 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.

§ 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.

§ 3.16 Access to Work

The Contractor shall provide the Owner 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, provided that such claim, damage, loss, or expense is attributable to bodily injury, sickness, disease or death, or to injury to or destruction of tangible property (other than the Work itself), but only to the extent caused by the negligent acts or omissions of the Contractor, a Subcontractor, anyone directly or indirectly employed by them, or anyone for whose acts they may be liable, regardless of whether or not such claim, damage, loss, or expense is caused in part by a party indemnified hereunder. Such obligation shall not be construed to negate, abridge, or reduce other rights or obligations of indemnity that would otherwise exist as to a party or person described in this Section 3.18.

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

ARTICLE 4 ARCHITECT

§ 4.1 General

§ 4.1.1 The 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, Contractor, and Architect. Consent 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 reasonably 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 If the Owner and Architect agree, the Architect will provide one or more Project representatives to assist in carrying out the Architect's responsibilities at the site. The Owner shall notify the Contractor of any change in the duties, responsibilities and limitations of authority of the Project representatives.

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

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

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

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

ARTICLE 5 SUBCONTRACTORS

§ 5.1 Definitions

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

§ 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. Failure of the Architect to provide notice within the 14-day period shall constitute notice of no reasonable objection.

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

§ 5.2.3 If the Owner or Architect has reasonable objection to a person or entity proposed by the Contractor, the

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

§ 5.2.4 The Contractor shall not substitute a Subcontractor, person, or entity 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 Section 14.2 and only for those subcontract agreements that the Owner accepts by notifying the Subcontractor and Contractor; and
- .2 assignment is subject to the prior rights of the surety, if any, obligated under bond relating to the Contract.

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

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

§ 5.4.3 Upon assignment to the Owner under this Section 5.4, the Owner may further assign the subcontract to a successor contractor or other entity. If the Owner assigns the subcontract to a successor contractor or other entity, the Owner shall nevertheless remain legally responsible for all of the successor contractor's obligations under the subcontract.

ARTICLE 6 CONSTRUCTION BY OWNER OR BY SEPARATE CONTRACTORS

§ 6.1 Owner's Right to Perform Construction and to Award Separate Contracts

§ 6.1.1 The 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, including those provisions of the Conditions of the Contract related to insurance and waiver of subrogation.

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

§ 6.2 Mutual Responsibility

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

§ 6.2.2 If part of the Contractor's Work depends for proper execution or results upon construction or operations by the Owner or a Separate Contractor, the Contractor shall, prior to proceeding with that portion of the Work, promptly 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. The Owner shall be responsible to the Contractor for costs the Contractor incurs because of a Separate Contractor's delays, improperly timed activities, damage to the Work or defective construction.

§ 6.2.4 The Contractor shall promptly remedy damage 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.

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

§ 6.3 Owner's Right to Clean Up

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

ARTICLE 7 CHANGES IN THE WORK

§ 7.1 General

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

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

§ 7.1.3 Changes in the Work shall be performed under applicable provisions of the Contract Documents. 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.

§ 7.3 Construction Change Directives

§ 7.3.1 A Construction Change Directive is a written order prepared by the Architect and signed by the Owner and Architect, directing a change in the Work prior to agreement on adjustment, if any, in the Contract Sum or Contract Time, or both. The Owner may by Construction Change Directive, without invalidating the Contract, order changes in the Work within the general scope of the Contract consisting of additions, deletions, or other revisions, the Contract Sum and Contract Time being adjusted accordingly.

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

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

- .1 Mutual acceptance of a lump sum properly itemized and supported by sufficient substantiating data to permit evaluation;
- .2 Unit prices stated in the Contract Documents or subsequently agreed upon;
- .3 Cost to be determined in a manner agreed upon by the parties and a mutually acceptable fixed or percentage fee; or
- .4 As provided in Section 7.3.4.

§ 7.3.4 If the Contractor does not respond promptly or disagrees with the method for adjustment in the Contract Sum, the Architect shall determine the adjustment on the basis of reasonable expenditures and savings of those performing the Work attributable to the change, including, in case of an increase in the Contract Sum, an amount for overhead and profit as set forth in the Agreement, or if no such amount is set forth in the Agreement, a reasonable amount. In such case, and also under Section 7.3.3.3, the Contractor shall keep and present, in such form as the Architect may prescribe, an itemized accounting together with appropriate supporting data. Unless otherwise provided in the Contract Documents, costs for the purposes of this Section 7.3.4 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 and insurance, permit fees, and sales, use, or similar taxes, 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 recorded as 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 that change.

§ 7.3.9 Pending final determination of the total cost of a Construction Change Directive to the Owner, the Contractor may request payment for Work completed under the Construction Change Directive in Applications for Payment. The

Architect will make an interim determination for purposes of monthly certification for payment for those costs and certify for payment the amount that the Architect determines, in the Architect's professional judgment, to be reasonably justified. The Architect's interim determination of cost shall adjust the Contract Sum on the same basis as a Change Order, subject to the right of either party to disagree and assert a Claim in accordance with Article 15.

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

§ 7.4 Minor Changes in the Work

The Architect 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.

§ 8.3 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 pending mediation and binding dispute resolution; 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.

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

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

ARTICLE 9 PAYMENTS AND COMPLETION

§ 9.1 Contract Sum

§ 9.1.1 The Contract Sum is stated in the Agreement and, including authorized adjustments, is the total amount payable

by the Owner to the Contractor for performance of the Work under the Contract Documents.

§ 9.1.2 If unit prices are stated in the Contract Documents or subsequently agreed upon, and if quantities originally contemplated are materially changed so that application of such unit prices to the actual quantities causes substantial inequity to the Owner or Contractor, 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.

§ 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.

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

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

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

§ 9.3.3 The Contractor warrants that title to all Work covered by an Application for Payment will pass to the Owner no later than the time of payment. The Contractor further warrants that upon submittal of an Application for Payment all Work for which Certificates for Payment have been previously issued and payments received from the Owner shall, to the best of the Contractor's knowledge, information, and belief, be free and clear of liens, claims, security interests, or 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 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;
- .6 reasonable evidence that the Work will not be completed within the Contract Time, and that the unpaid balance would not be adequate to cover actual or liquidated damages for the anticipated delay; or
- .7 repeated failure to carry out the Work in accordance with the Contract Documents.

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

§ 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.

§ 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. If the Contractor fails to furnish such evidence within seven days, 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 The Contractor's payments to suppliers shall be treated in a manner similar to that provided in Sections 9.6.2, 9.6.3 and 9.6.4.

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

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

§ 9.6.8 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 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 Failure of Payment

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

§ 9.8 Substantial Completion

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

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

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

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

§ 9.9 Partial Occupancy or Use

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

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

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

§ 9.10 Final Completion and Final Payment

§ 9.10.1 Upon receipt of the Contractor's 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.

§ 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 a Subcontractor refuses to furnish a release of waiver required by the Owner, the Contractor may furnish a bond satisfactory to the Owner to indemnify the Owner against such lien, claim, security interest, or encumbrance. If a lien, claim, security interest, or encumbrance remains unsatisfied after payments are made, the Contractor shall refund to the Owner all money that the Owner may be compelled to pay in discharging the lien, claim, security interest, or encumbrance, including all costs and reasonable attorneys' fees.

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

constitute a waiver of Claims.

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

- .1 liens, Claims, security interests, or encumbrances arising out of the Contract and unsettled;
- .2 failure of the Work to comply with the requirements of the Contract Documents;
- .3 terms of special warranties required by the Contract Documents; or
- .4 audits performed by the Owner, if permitted by the Contract Documents, after final payment.

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

ARTICLE 10 PROTECTION OF PERSONS AND PROPERTY

§ 10.1 Safety Precautions and Programs

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

§ 10.2 Safety of Persons and Property

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

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

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

§ 10.2.3 The Contractor shall 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 and 10.2.1.3 caused in whole or in part by the Contractor, a Subcontractor, a Sub-subcontractor, or anyone directly or indirectly employed by any of them, or by anyone for whose acts they may be liable and for which the Contractor is responsible under Sections 10.2.1.2 and 10.2.1.3. The Contractor may make a Claim for the cost to remedy the damage or loss to the extent such damage or loss is attributable to acts or omissions of the Owner or Architect or anyone directly or indirectly employed by either of them, or by anyone for whose acts either of them may be liable, and not attributable to the fault or negligence of the Contractor. The foregoing obligations of the Contractor are in addition to the Contractor's obligations under Section 3.18.

§ 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.

§ 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. If the Contractor encounters a hazardous material or substance not addressed in the Contract Documents and if reasonable precautions will be inadequate to prevent foreseeable bodily injury or death to persons resulting from a material or substance, including but not limited to asbestos or polychlorinated biphenyl (PCB), encountered on the site by the Contractor, the Contractor shall, upon recognizing the condition, immediately stop Work in the affected area and notify the Owner and Architect of the condition.

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

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

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

§ 10.3.5 The Contractor shall 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 Section 10.3.1, except to the extent that the cost and expense are due to the Owner's fault or negligence.

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

§ 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 Insurance and Bonds

§ 11.1.1 The Contractor shall purchase and maintain insurance of the types and limits of liability, containing the

endorsements, and subject to the terms and conditions, as described in the Agreement or elsewhere in the Contract Documents. The Contractor shall purchase and maintain the required insurance from an insurance company or insurance companies lawfully authorized to issue insurance in the jurisdiction where the Project is located. The Owner, Architect, and Architect's consultants shall be named as additional insureds under the Contractor's commercial general liability policy or as otherwise described in the Contract Documents.

§ 11.1.2 The Contractor shall provide surety bonds of the types, for such penal sums, and subject to such terms and conditions as required by the Contract Documents. The Contractor shall purchase and maintain the required bonds from a company or companies lawfully authorized to issue surety bonds in the jurisdiction where the Project is located.

§ 11.1.3 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.

§ 11.1.4 Notice of Cancellation or Expiration of Contractor's Required Insurance. Within three (3) business days of the date the Contractor becomes aware of an impending or actual cancellation or expiration of any insurance required by the Contract Documents, the Contractor shall provide notice to the Owner of such impending or actual cancellation or expiration. Upon receipt of notice from the Contractor, the Owner shall, unless the lapse in coverage arises from an act or omission of the Owner, have the right to stop the Work until the lapse in coverage has been cured by the procurement of replacement coverage by the Contractor. The furnishing of notice by the Contractor shall not relieve the Contractor of any contractual obligation to provide any required coverage.

§ 11.2 Owner's Insurance

§ 11.2.1 The Owner shall purchase and maintain insurance of the types and limits of liability, containing the endorsements, and subject to the terms and conditions, as described in the Agreement or elsewhere in the Contract Documents. The Owner shall purchase and maintain the required insurance from an insurance company or insurance companies lawfully authorized to issue insurance in the jurisdiction where the Project is located.

§ 11.2.2 Failure to Purchase Required Property Insurance. If the Owner fails to purchase and maintain the required property insurance, with all of the coverages and in the amounts described in the Agreement or elsewhere in the Contract Documents, the Owner shall inform the Contractor in writing prior to commencement of the Work. Upon receipt of notice from the Owner, the Contractor may delay commencement of the Work and may obtain insurance that will protect the interests of the Contractor, Subcontractors, and Sub-Subcontractors in the Work. When the failure to provide coverage has been cured or resolved, the Contract Sum and Contract Time shall be equitably adjusted. In the event the Owner fails to procure coverage, the Owner waives all rights against the Contractor, Subcontractors, and Sub-subcontractors to the extent the loss to the Owner would have been covered by the insurance to have been procured by the Owner. The cost of the insurance shall be charged to the Owner by a Change Order. If the Owner does not provide written notice, and the Contractor is damaged by the failure or neglect of the Owner to purchase or maintain the required insurance, the Owner shall reimburse the Contractor for all reasonable costs and damages attributable thereto.

§ 11.2.3 Notice of Cancellation or Expiration of Owner's Required Property Insurance. Within three (3) business days of the date the Owner becomes aware of an impending or actual cancellation or expiration of any property insurance required by the Contract Documents, the Owner shall provide notice to the Contractor of such impending or actual cancellation or expiration. Unless the lapse in coverage arises from an act or omission of the Contractor: (1) the Contractor, upon receipt of notice from the Owner, shall have the right to stop the Work until the lapse in coverage has been cured by the procurement of replacement coverage by either the Owner or the Contractor; (2) the Contract Time and Contract Sum shall be equitably adjusted; and (3) the Owner waives all rights against the Contractor, Subcontractors, and Sub-subcontractors to the extent any loss to the Owner would have been covered by the insurance had it not expired or been cancelled. If the Contractor purchases replacement coverage, the cost of the insurance shall be charged to the Owner by an appropriate Change Order. The furnishing of notice by the Owner shall not relieve the Owner of any contractual obligation to provide required insurance.

§ 11.3 Waivers of Subrogation

§ 11.3.1 The Owner and Contractor waive all rights against (1) each other and any of their subcontractors, sub-subcontractors, agents, and employees, each of the other; (2) the Architect and Architect's consultants; and (3) Separate Contractors, if any, and any of their subcontractors, sub-subcontractors, agents, and employees, for damages caused by fire, or other causes of loss, to the extent those losses are covered by property insurance required by the Agreement or other property insurance applicable to the Project, except such rights as they have to proceeds of such insurance. The

Owner or Contractor, as appropriate, shall require similar written waivers in favor of the individuals and entities identified above from the Architect, Architect's consultants, Separate Contractors, subcontractors, and sub-subcontractors. The policies of insurance purchased and maintained by each person or entity agreeing to waive claims pursuant to this section 11.3.1 shall not prohibit this waiver of subrogation. This waiver of subrogation shall be effective as to a person or entity (1) even though that person or entity would otherwise have a duty of indemnification, contractual or otherwise, (2) even though that person or entity did not pay the insurance premium directly or indirectly, or (3) whether or not the person or entity had an insurable interest in the damaged property.

§ 11.3.2 If during the Project construction period the Owner insures properties, real or personal or both, at or adjacent to the site by property insurance under policies separate from those insuring the Project, or if after final payment property insurance is to be provided on the completed Project through a policy or policies other than those insuring the Project during the construction period, to the extent permissible by such policies, the Owner waives all rights in accordance with the terms of Section 11.3.1 for damages caused by fire or other causes of loss covered by this separate property insurance.

§ 11.4 Loss of Use, Business Interruption, and Delay in Completion Insurance

The Owner, at the Owner's option, may purchase and maintain insurance that will protect the Owner against loss of use of the Owner's property, or the inability to conduct normal operations, due to fire or other causes of loss. The Owner waives all rights of action against the Contractor and Architect for loss of use of the Owner's property, due to fire or other hazards however caused.

§ 11.5 Adjustment and Settlement of Insured Loss

§ 11.5.1 A loss insured under the property insurance required by the Agreement shall be adjusted by the Owner as fiduciary and made payable to the Owner as fiduciary for the insureds, as their interests may appear, subject to requirements of any applicable mortgagee clause and of Section 11.5.2. The Owner shall pay the Architect and Contractor their just shares of insurance proceeds received by the Owner, and by appropriate agreements the Architect and Contractor shall make payments to their consultants and Subcontractors in similar manner.

§ 11.5.2 Prior to settlement of an insured loss, the Owner shall notify the Contractor of the terms of the proposed settlement as well as the proposed allocation of the insurance proceeds. The Contractor shall have 14 days from receipt of notice to object to the proposed settlement or allocation of the proceeds. If the Contractor does not object, the Owner shall settle the loss and the Contractor shall be bound by the settlement and allocation. Upon receipt, the Owner shall deposit the insurance proceeds in a separate account and make the appropriate distributions. Thereafter, if no other agreement is made or the Owner does not terminate the Contract for convenience, the Owner and Contractor shall execute a Change Order for reconstruction of the damaged or destroyed Work in the amount allocated for that purpose. If the Contractor timely objects to either the terms of the proposed settlement or the allocation of the proceeds, the Owner may proceed to settle the insured loss, and any dispute between the Owner and Contractor arising out of the settlement or allocation of the proceeds shall be resolved pursuant to Article 15. Pending resolution of any dispute, the Owner may issue a Construction Change Directive for the reconstruction of the damaged or destroyed Work.

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.

§ 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. During the one-year period for correction of Work, if the Owner fails to notify the Contractor and give the Contractor an opportunity to make the correction, the Owner waives the rights to require correction by the Contractor and to make a claim for breach of warranty. If the Contractor fails to correct nonconforming Work within a reasonable time during that period after receipt of notice from the Owner or Architect, the Owner may correct it in accordance with Section 2.5.

§ 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 law of the place where the Project is located, excluding that jurisdiction's choice of law rules. If the parties have selected arbitration as the method of binding dispute resolution, the Federal Arbitration Act shall govern Section 15.4.

§ 13.2 Successors and Assigns

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

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

§ 13.3 Rights and Remedies

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

§ 13.4.5 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.

ARTICLE 14 TERMINATION OR SUSPENSION OF THE CONTRACT

§ 14.1 Termination by the Contractor

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

- .1 Issuance of an order of a court or other public authority having jurisdiction that requires all Work to be stopped;
- .2 An act of government, such as a declaration of national emergency, that requires all Work to be stopped;
- .3 Because the Architect has not issued a Certificate for Payment and has not notified the Contractor of the reason for withholding certification as provided in Section 9.4.1, or because the Owner has not made payment on a Certificate for Payment within the time stated in the Contract Documents; or
- .4 The Owner has failed to furnish to the Contractor reasonable evidence as required by Section 2.2.

§ 14.1.2 The Contractor may terminate the Contract if, 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, repeated suspensions, delays, or interruptions of the entire Work by the Owner as described in Section 14.3, constitute in the aggregate more than 100 percent of the total number of days scheduled for completion, or 120 days in any 365-day period, whichever is less.

§ 14.1.3 If one of the reasons described in Section 14.1.1 or 14.1.2 exists, the Contractor may, upon seven days' notice to the Owner and Architect, terminate the Contract and recover from the Owner payment for Work executed, as well as reasonable overhead and profit on Work not executed, and costs incurred by reason of such termination.

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

§ 14.2 Termination by the Owner for Cause

§ 14.2.1 The Owner may terminate the Contract if the Contractor

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

§ 14.2.2 When any of the 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. Upon written request of the Contractor, the Owner shall furnish to the Contractor a detailed accounting of the costs incurred by the Owner in finishing the Work.

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

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

§ 14.3 Suspension by the Owner for Convenience

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

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

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

§ 14.4 Termination by the Owner for Convenience

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

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

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

§ 14.4.3 In case of such termination for the Owner's convenience, the Owner shall pay the Contractor for Work properly executed; costs incurred by reason of the termination, including costs attributable to termination of Subcontracts; and the termination fee, if any, set forth in the Agreement.

ARTICLE 15 CLAIMS AND DISPUTES

§ 15.1 Claims

§ 15.1.1 Definition

A Claim is a demand or assertion by one of the parties seeking, as a matter of right, payment of money, a change in the Contract Time, or other relief with respect to the terms of the Contract. The term "Claim" also includes other disputes and matters in question between the Owner and Contractor arising out of or relating to the Contract. The responsibility to substantiate Claims shall rest with the party making the Claim. This Section 15.1.1 does not require the Owner to file a Claim in order to impose liquidated damages in accordance with the Contract Documents.

§ 15.1.2 Time Limits on Claims

The Owner and Contractor shall commence all Claims and causes of action against the other and arising out of or related to the Contract, whether in contract, tort, breach of warranty or otherwise, in accordance with the requirements of the binding dispute resolution method selected in the Agreement and within the period specified by applicable law, but in any case not more than 10 years after the date of Substantial Completion of the Work. The Owner and Contractor waive all Claims and causes of action not commenced in accordance with this Section 15.1.2.

§ 15.1.3 Notice of Claims

§ 15.1.3.1 Claims by either the Owner or Contractor, where the condition giving rise to the Claim is first discovered prior to expiration of the period for correction of the Work set forth in Section 12.2.2, shall be initiated by notice to the other party and to the Initial Decision Maker with a copy sent to the Architect, if the Architect is not serving as the Initial Decision Maker. Claims by either party under this Section 15.1.3.1 shall be initiated within 21 days after occurrence of the event giving rise to such Claim or within 21 days after the claimant first recognizes the condition giving rise to the Claim, whichever is later.

§ 15.1.3.2 Claims by either the Owner or Contractor, 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, shall be initiated by notice to the other party. In such event, no decision by the Initial Decision Maker is required.

§ 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 Section 9.7 and Article 14, the Contractor shall proceed diligently with performance of the Contract and the Owner shall continue to make payments in accordance with the Contract Documents.

§ 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 cost and of probable effect of delay on progress of the Work. In the case of a continuing delay, only one Claim is necessary.

§ 15.1.6.2 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.

Sample

BGA8
PERFORMANCE BOND

KNOW ALL MEN BY THESE PRESENTS, that *(Insert full name or legal title and address of Contractor)*

Name: _____

Address: _____

hereinafter referred to as "Contractor", and *(Insert full name and address of principal place of business of Surety)*

Name: _____

Address: _____

hereinafter called the "surety", are jointly and severally held and firmly bound unto *(Insert full name and address of Owner)*

Name: _____

Address: _____

hereinafter referred to as "Owner", or its successors or assigns, the sum of _____ (\$ _____), being the sum of the Bond to which payment to be well and truly made, the Contractor and Surety bind themselves, their heirs, executors, administrators, successors and assigns, jointly and severally, firmly by these presents.

WHEREAS, Contractor has by written agreement dated _____ entered into a contract with Owner to construct

Project Name: Fort Mill High School HVAC Renovation

Project Number: 20051

Brief Description of Awarded Work: Replacement of existing units serving the gymnasium and auditorium. Provide new unit serving the wrestling room.

in accordance with Drawings and Specifications prepared by *(Insert full name and address of A-E)*

Name: Jonathan Burkett

Address: Buford Goff & Associates, Inc.

1331 Elmwood Avenue, Suite 200. Columbia, S.C. 29201

which agreement is by reference made a part hereof, and is hereinafter referred to as the Contract.

IN WITNESS WHEREOF, Surety and Contractor, intending to be legally bound hereby, subject to the terms stated herein, do each cause this Performance Bond to be duly executed on its behalf by its authorized officer, agent or representative.

DATED this _____ **day of** _____, **2** _____
(shall be no earlier than Date of Contract)

BOND NUMBER _____

CONTRACTOR

SURETY

By: _____
(Seal)

By: _____
(Seal)

Print Name: _____

Print Name: _____

Print Title: _____

Print Title: _____
(Attach Power of Attorney)

Witness: _____

Witness: _____

(Additional Signatures, if any, appear on attached page)

BGA8

PERFORMANCE BOND

NOW, THEREFORE, THE CONDITION OF THIS OBLIGATION IS SUCH THAT:

1. The Contractor and the Surety, jointly and severally, bind themselves, their heirs, executors, administrators, successors and assigns to the Owner for the full and faithful performance of the contract, which is incorporated herein by reference.
2. If the Contractor performs the contract, the Surety and the Contractor have no obligation under this Bond, except to participate in conferences as provided in paragraph 3.1.
3. The Surety's obligation under this Bond shall arise after:
 - 3.1 The Owner has notified the Contractor and the Surety at the address described in paragraph 10 below, that the Owner is considering declaring a Contractor Default and has requested and attempted to arrange a conference with the Contractor and the Surety to be held not later than 15 days after receipt of such notice to discuss methods of performing the Contract. If the Owner, the Contractor and the Surety agree, the Contractor shall be allowed a reasonable time to perform the Contract, but such an agreement shall not waive the Owner's right, if any, subsequently to declare a Contractor Default; or
 - 3.2 The Owner has declared a Contractor Default and formally terminated the Contractor's right to complete the Contract.
4. The Surety shall, within 15 days after receipt of notice of the Owner's declaration of a Contractor Default, and at the Surety's sole expense, take one of the following actions:
 - 4.1 Arrange for the Contractor, with consent of the Owner, to perform and complete the Contract; or
 - 4.2 Undertake to perform and complete the Contract itself, through its agents or through independent contractors; or
 - 4.3 Obtain bids or negotiated proposals from qualified contractors acceptable to the Owner for a contract for performance and completion of the Contract, arrange for a contract to be prepared for execution by the Owner and the 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 Contract, and pay to the Owner the amount of damages as described in paragraph 7 in excess of the Balance of the Contract Sum incurred by the Owner resulting from the Contractor Default; or
 - 4.4 Waive its right to perform and complete, arrange for completion, or obtain a new contractor, and:
 - 4.4.1 After investigation, determine the amount for which it may be liable to the Owner and, within 60 days of waiving its rights under this paragraph, tender payment thereof to the Owner; or
 - 4.4.2 Deny liability in whole or in part and notify the Owner, citing the reasons therefore.
5. Provided Surety has proceeded under paragraphs 4.1, 4.2, or 4.3, the Owner shall pay the Balance of the Contract Sum to either:
 - 5.1 Surety in accordance with the terms of the Contract; or
 - 5.2 Another contractor selected pursuant to paragraph 4.3 to perform the Contract.
- 5.3 The balance of the Contract Sum due either the Surety or another contractor shall be reduced by the amount of damages as described in paragraph 7.
6. If the Surety does not proceed as provided in paragraph 4 with reasonable promptness, the Surety shall be deemed to be in default on this Bond 15 days after receipt of 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.
 - 6.1 If the Surety proceeds as provided in paragraph 4.4 and the Owner refuses the payment tendered or the Surety has denied liability, in whole or in part, then without further notice the Owner shall be entitled to enforce any remedy available to the Owner.
 - 6.2 Any dispute, suit, action or proceeding arising out of or relating to this Bond shall be governed by the Dispute Resolution process defined in the Contract Documents and the laws of the State of South Carolina.
7. After the Owner has terminated the Contractor's right to complete the Contract, and if the Surety elects to act under paragraph 4.1, 4.2, or 4.3 above, then the responsibilities of the Surety to the Owner shall be those of the Contractor under the Contract, and the responsibilities of the Owner to the Surety shall be those of the Owner under the Contract. To a limit of the amount of this Bond, but subject to commitment by the Owner of the Balance of the Contract Sum to mitigation of costs and damages on the Contract, the Surety is obligated to the Owner without duplication for:
 - 7.1 The responsibilities of the Contractor for correction of defective Work and completion of the Contract; and
 - 7.2 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 paragraph 4; and
 - 7.3 Damages awarded pursuant to the Dispute Resolution Provisions of the Contract. Surety may join in any Dispute Resolution proceeding brought under the Contract and shall be bound by the results thereof; and
 - 7.4 Liquidated Damages, or if no Liquidated Damages are specified in the Contract, actual damages caused by delayed performance or non-performance of the Contractor.
8. The Surety shall not be liable to the Owner or others for obligations of the Contractor that are unrelated to the Contract, and the Balance of the Contract Sum 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, or successors.
9. The Surety hereby waives notice of any change, including changes of time, to the contract or to related subcontracts, purchase orders and other obligations.
10. Notice to the Surety, the Owner or the Contractor shall be mailed or delivered to the address shown on the signature page.
11. Definitions
 - 11.1 Balance of the Contract Sum: The total amount payable by the Owner to the Contractor under the Contract after all proper adjustments have been made, including allowance to the Contractor of any amounts 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 Contract.
 - 11.2 Contractor Default: Failure of the Contractor, which has neither been remedied nor waived, to perform the Contract or otherwise to comply with the terms of the Contract.

BGA9 LABOR & MATERIAL PAYMENT BOND

KNOW ALL MEN BY THESE PRESENTS, that *(Insert full name or legal title and address of Contractor)*

Name: _____

Address: _____

hereinafter referred to as "Contractor", and *(Insert full name and address of principal place of business of Surety)*

Name: _____

Address: _____

hereinafter called the "surety", are jointly and severally held and firmly bound unto *(Insert full name and address of Owner)*

Name: _____

Address: _____

hereinafter referred to as "Owner", or its successors or assigns, the sum of _____ (\$ _____), being the sum of the Bond to which payment to be well and truly made, the Contractor and Surety bind themselves, their heirs, executors, administrators, successors and assigns, jointly and severally, firmly by these presents.

WHEREAS, Contractor has by written agreement dated _____ entered into a contract with Owner to construct

Project Name: Rock Hill High School HVAC Renovation

Project Number: 20051

Brief Description of Awarded Work: Replace existing units serving the gymnasium and auditorium. Provide new unit serving the wrestling room.

in accordance with Drawings and Specifications prepared by *(Insert full name and address of A-E)*

Name: Jonathan Burkett

Address: Buford Goff & Associates, Inc.

1331 Elmwood Avenue, Suite 200. Columbia, S.C. 29201

which agreement is by reference made a part hereof, and is hereinafter referred to as the Contract.

IN WITNESS WHEREOF, Surety and Contractor, intending to be legally bound hereby, subject to the terms stated herein, do each cause this Labor and Material Payment Bond to be duly executed on its behalf by its authorized officer, agent or representative.

DATED this _____ **day of** _____, **2** _____
(shall be no earlier than Date of Contract)

BOND NUMBER _____

CONTRACTOR

SURETY

By: _____
(Seal)

By: _____
(Seal)

Print Name: _____

Print Name: _____

Print Title: _____

Print Title: _____
(Attach Power of Attorney)

Witness: _____

Witness: _____

(Additional Signatures, if any, appear on attached page)

LABOR AND MATERIAL PAYMENT BOND**NOW, THEREFORE, THE CONDITION OF THIS OBLIGATION IS SUCH THAT:**

1. The Contractor and the Surety, jointly and severally, bind themselves, their heirs, executors, administrators, successors and assigns to the Owner to pay for all labor, materials and equipment required for use in the performance of the Contract, which is incorporated herein by reference.
 2. With respect to the Owner, this obligation shall be null and void if the Contractor:
 - 2.1 Promptly makes payment, directly or indirectly, for all sums due Claimants; and
 - 2.2 Defends, indemnifies and holds harmless the Owner from all claims, demands, liens or suits by any person or entity who furnished labor, materials or equipment for use in the performance of the Contract.
 3. With respect to Claimants, this obligation shall be null and void if the Contractor promptly makes payment, directly or indirectly, for all sums due.
 4. With respect to Claimants, and subject to the provisions of Title 29, Chapter 5 and the provisions of §11-35-3030(2)(c) of the SC Code of Laws, as amended, the Surety's obligation under this Bond shall arise as follows:
 - 4.1 Every person who has furnished labor, material or rental equipment to the Contractor or its subcontractors for the work specified in the Contract, and who has not been paid in full therefore before the expiration of a period of ninety (90) days after the date on which the last of the labor was done or performed by him or material or rental equipment was furnished or supplied by him for which such claim is made, shall have the right to sue on the payment bond for the amount, or the balance thereof, unpaid at the time of institution of such suit and to prosecute such action for the sum or sums justly due him.
 - 4.2 A remote claimant shall have a right of action on the payment bond upon giving written notice by certified or registered mail to the Contractor within ninety (90) days from the date on which such person did or performed the last of the labor or furnished or supplied the last of the material or rental equipment upon which such claim is made.
 - 4.3 Every suit instituted upon a payment bond shall be brought in a court of competent jurisdiction for the county or circuit in which the construction contract was to be performed, but no such suit shall be commenced after the expiration of one year after the day on which the last of the labor was performed or material or rental equipment was supplied by the person bringing suit.
 5. When the Claimant has satisfied the conditions of paragraph 4, the Surety shall promptly and at the Surety's expense take the following actions:
 - 5.1 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.
 - 5.2 Pay or arrange for payment of any undisputed amounts.
 - 5.3 The Surety's failure to discharge its obligations under this paragraph 5 shall not be deemed to constitute a waiver of defenses the Surety or Contractor may have or acquire as to a claim. However, if the Surety fails to discharge its obligations under this paragraph 5, the Surety shall indemnify the Claimant for the reasonable attorney's fees the Claimant incurs to recover any sums found to be due and owing to the Claimant.
 6. Amounts owed by the Owner to the Contractor under the Contract shall be used for the performance of the Contract and to satisfy claims, if any, under any 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 Contract are dedicated to satisfy obligations of the Contractor and the Surety under this Bond, subject to the Owner's prior right to use the funds for the completion of the Work.
 7. The Surety shall not be liable to the Owner, Claimants or others for obligations of the Contractor that are unrelated to the Contract. The Owner shall not be liable for payment of any costs or expenses of any claimant under this bond, and shall have under this Bond no obligations to make payments to, give notices on behalf of, or otherwise have obligations to Claimants under this Bond.
 8. The Surety hereby waives notice of any change, including changes of time, to the Contract or to related Subcontracts, purchase orders and other obligations.
 9. Notice to the Surety, the Owner or the Contractor shall be mailed or delivered to the addresses shown on the signature page. Actual receipt of notice by Surety, the Owner or the contractor, however accomplished, shall be sufficient compliance as of the date received at the address shown on the signature page.
 10. By the Contractor furnishing and the Owner accepting this Bond, they agree that this Bond has been furnished to comply with the statutory requirements of the South Carolina Code of Laws, as amended, and further, that any provision in this Bond conflicting with said statutory requirements shall be deemed deleted herefrom and provisions conforming to such statutory or other legal requirement shall be deemed incorporated herein. The intent is that this Bond shall be construed as a statutory Bond and not as a common law bond.
 11. Upon request of any person or entity appearing to be a potential beneficiary of this bond, the Contractor shall promptly furnish a copy of this Bond or shall permit a copy to be made.
 12. Any dispute, suit, action or proceeding arising out of or relating to this Bond shall be governed by the laws of the State of South Carolina.
- 13. DEFINITIONS**
- 13.1 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 Contract. 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 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 might otherwise be asserted.
 - 13.2 Remote Claimant: A person having a direct contractual relationship with a subcontractor of the Contractor or subcontractor, but no contractual relationship expressed or implied with the Contractor.
 - 13.3 Contract: The agreement between the Owner and the Contractor identified on the signature page, including all Contract Documents and changes thereto.

AIA DOCUMENT

G702, G703 – 1992 Edition

"APPLICATION AND CERTIFICATE FOR PAYMENT"

Note:

The original document is available for viewing at the following location:

Buford Goff & Associates, Inc.
1331 Elmwood Avenue, Suite 200
Columbia, South Carolina 29201
Phone 803-254-6302

Contact Buford Goff & Associates to schedule a time for viewing this document.

SECTION 01 1000 – GENERAL REQUIREMENTS

PART 1 - GENERAL

1.1 MATERIALS AND WORKMANSHIP:

- A. Unless otherwise specified, all materials shall be new, of the best quality consistent with the type and grade specified and of a type and quality suitable for the purpose they are to serve. All employees shall be competent, experienced and skilled in their trades. Workmanship throughout shall be of the first quality equal to the best recognized practice in the field concerned.

1.2 APPROVAL OF SUBSTITUTIONS:

- A. Specific reference in the specifications to any article, device, product, materials, fixture, form or type of construction, etc., by name, make, or catalog number, with or without the words "or equal", shall be interpreted as establishing a standard of quality.
- B. Requests for written approval to substitute materials or equipment considered by the Contractor as equal to those specified shall be submitted for approval in writing ten (10) calendar days prior to bid opening date to the Engineer. Requests shall be accompanied by samples, literature, and information as necessary to fully identify and allow appraisal of the material or equipment. Submittals shall be concise, clear, and brief as possible. Incomplete submittals or submittals requiring lengthy research to ascertain quality will not be considered. No substitutions will be considered within ten (10) days prior to the bid opening.
- C. Approval of the Engineer to use materials or equipment, if granted, will be in the form of a written addendum.
- D. The judgment and decision of the Engineer to approve or reject a request for substitution is final.
- E. Submittals for bidding are not required on items specified by model number or when a manufacturer listed by name can provide equipment with no deviations from the specifications. Submit all other items for approval.
- F. Items approved shall not be construed as authorizing any deviations from the plans and specifications unless such deviations are clearly indicated in the form of a letter that is enclosed with the submittals.
- G. Contractor shall be responsible for verifying all dimensions with available space. If, in the opinion of the engineer, the physical dimensions do not permit the substituted material or equipment to be properly operated, maintained, serviced, or otherwise accessed, or the physical dimension adversely impact other components, a system's ability to be operated, maintained, serviced or otherwise accessed, the material or equipment shall be replaced at the contractor's expense.

1.3 EXAMINATION OF CONDITIONS:

- A. The Contractor, subcontractors and material suppliers shall carefully examine the drawings and specifications and all job conditions and call to the attention of the Engineer any conditions that will interfere with or preclude a first-class and serviceable installation of the product they propose to furnish. The Contractor shall notify the Engineer, in writing, should any conditions exist that would in any way affect a manufacturer's guarantee, warranty or responsibility for proper performance and service of an item.

1.4 FITTING JOB CONDITIONS:

- A. The Contractor, subcontractors and material suppliers shall be responsible for inspecting all job conditions affecting the installation of an item and taking all field measurements required prior to fabrication of an item to insure that the item concerned will integrate properly with all adjacent materials and fit all other conditions as they exist or will exist in the finished building.
- B. Work in connection with the installation of an item shall be coordinated with all other affected work and trades.
- C. Sleeves, anchors and other items that must be embedded in or that otherwise affect other portions of work shall be located and set while such portions of the work are in progress.

1.5 TESTS, CERTIFICATIONS AND APPROVAL BY OTHER AUTHORITIES:

- A. Where tests, certificates or approvals by authorities other than the Engineer are required, the Contractor shall have such tests performed and procure such certification or approvals. The contractor shall forward a minimum of four copies of the results of the test, the certificates, or approvals to the Engineer prior to the proceeding with work involved. Such laboratories and/or authorities as are employed for this purpose shall be competent, with a generally recognized reputation in the field concerned, and shall be subject to approval of the Engineer.

1.6 INCLUSION OF ACCESSORIES:

- A. Unless otherwise specifically mentioned, all anchors, bolts, screws, fittings, fillers, hardware, accessories, trim and other parts required for or in connection with an item of material to make a complete, serviceable, finished and first quality installation shall be furnished and installed as part of the item whether called for by the specifications or not.

1.7 PROTECTION:

- A. All materials shall be shipped and stored and handled in a manner that will afford protection and insure their being in "like new" condition at the time they are incorporated in the work. After installation, they shall be properly protected against damage to insure their being in "like new" condition when the building as a whole is completed and accepted by the Owner.

1.8 INSTALLATION:

- A. All items shall be installed in a workmanlike manner in accordance with the best recognized practice in the field concerned. Manufactured items shall be installed in strict accordance with the manufacturer's printed directions, specifications and recommendations for an installation of highest quality.
- B. All working parts shall be properly adjusted after installation and left in proper working order.
- C. All items in walls exposed to weather or otherwise subjected to flooding or wetting shall be installed so as to shed and not hold water.
- D. Items shall in all cases be installed plumb and true and in proper relation to surrounding materials.

1.9 ANCHORING AND TYING:

- A. All materials, including but not limited to those mentioned below, shall be securely anchored and/or tied together in accordance with the best recognized practice in the field concerned whether shown, specified or not.
- B. Material shall be installed in a permanent manner that will permit expansion, contraction and other minor movements and normal use of the structure without structural features becoming impaired and without any of its parts becoming loose.
- C. Ties and anchors shall be best quality for the purpose.
- D. All wood, steel, concrete or other framing shall be securely anchored and tied together and to supporting or abutting masonry. All veneers, finished and applied items shall be securely anchored and tied to the backing material.

1.10 REFERENCE TO STANDARD SPECIFICATIONS:

- A. When standard specifications such as The American Society for Testing and Materials, Federal Specifications, Department of Commerce (Commercial Standards), American Institute of Steel Construction, or other well known public or trade associations are cited as a standard to govern materials and/or workmanship, such specifications or portions thereof as referred to shall be equally as binding and have the full force and effect as though it was copied into these specifications. Such standards as are mentioned are generally recognized by and available to the trades concerned. The Engineer will, upon request of a bidder or contractor, furnish for inspection a copy of any standard specifications mentioned or direct the bidder or contractor to any easily available copy. Unless otherwise specifically stated, the standard specifications referred to shall be considered as the latest edition and/or revision of such specifications that is in effect on the date of the Invitation for Bids. In case of any conflicts between standard specifications and the written portion of the specifications, the specifications as actually written herein will govern.

1.11 REFERENCES TO MANUFACTURER'S PUBLICATIONS:

- A. Unless otherwise specifically stated, all manufacturer's catalogs, specifications, instructions or other information or literature that are referred to in the specifications shall be considered as the latest edition and/or revision of such publication that is in effect on the date of the Invitation for Bids.

1.12 HAZARDOUS MATERIALS:

A. Existing Conditions:

- 1. In the event the contractor for the project encounters on the site material believed to be asbestos, polychlorinated biphenyl (PCB), lead paints, fuel contaminated soil, or any other material considered hazardous, the contractor shall immediately stop work in the area affected and report the condition to the Engineer in writing by the fastest practical method.
- 2. The contractor shall not resume work until the contractor is advised in writing that the material is not hazardous and/or does not pose a risk to the contractor.

B. New Materials:

- 1. Contractors are hereby advised that the use of the following materials or products containing these materials in any quantity or any form is strictly forbidden, even if the products can be purchased and/or legally installed.
 - a. Asbestos
 - b. PCB
 - c. Lead Solder
 - d. Lead Paint

1.13 EQUIPMENT DELIVERY:

- A. Any Contractor receiving equipment or materials that are to be installed under his Scope of Work shall provide personnel and equipment to unload these materials at the time they arrive on site or make provisions for receiving and unloading the shipment.
- B. Any shipments arriving on site without proper personnel present to receive and unload the shipment will be instructed to return to the shipping terminal. The Contractor shall be responsible for all additional shipping charges.

1.14 ACCIDENT PREVENTION:

- A. Each Contractor shall have an approved written Accident Prevention Program and shall produce it when required by the Engineer.
- B. The Contractor shall hold weekly meetings with all subcontractors to monitor compliance with all safety regulations. These regulations shall be provision of the current editions of the State and Federal laws, including but not limited to, the latest amendments of the

following: Williams-Steagler Occupational Safety and Health Act of 1970, Public Law 91-956, Part 1910 - Occupational Safety & Health Standards, Chapter 17 of Title 29, Code of Federal Regulations, Part 1926 - Safety & Health Code and Federal and State of (South Carolina) Regulations.

1.15 BARRICADES:

- A. The Contractor shall provide all labor and materials necessary to conduct work and protect personnel in accordance with OSHA standards.
- B. The Contractor shall furnish, install, and maintain all necessary temporary barricades at the building floor perimeters and openings and to separate the areas of construction from the building occupants at all times.

1.16 PERSONAL PROPERTY:

- A. Contractor will be held liable for all damage to personal and real property as a result of their negligence to provide protective measures.

1.17 GUARANTEE OF WORK:

- A. The Contractor shall procure and furnish to the Owner all guarantees that are called for by the specifications or that are promised by a manufacturer of an item in his published catalog or literature.
- B. Except as otherwise specified, all work shall be guaranteed by the Contractor against defects resulting from the use of inferior materials, equipment or workmanship for one year from the date of substantial completion.
- C. If, within any guarantee period, repairs or changes are required in connection with guaranteed work which, in the opinion of the Engineer, is rendered necessary as the result of the use of materials, equipment or workmanship which are inferior, defective or not in accordance with the terms of the Contract, the Contractor shall promptly:
 - 1. Correct all defects and place in satisfactory condition all guaranteed work.
 - 2. Repair all damage to the building, site, equipment, or other components which, in the opinion of the Engineer, is the result of the use of materials, equipment, or workmanship which are inferior, defective or not in accordance with the terms of the Contract.
- D. Should the contractor disturb any work guaranteed under another Contract, they shall restore such disturbed work to a condition satisfactory to the Engineer and guarantee such restored work to the same extent as it was guaranteed under such other contract.
- E. If the Contractor, after notice, fails to proceed promptly to comply with the terms of the guarantee, the Owner may have the defects corrected and the Contractor and his surety shall be liable for all expense incurred.
- F. There will be one final inspection of project by the Engineer and Contractors between the 11th and 12th month following final acceptance of the building by the Owner. Inspection will be with Owner. Any and all items found will fall in the years' warranty.

1.18 TESTS:

- A. Any specified laboratory tests of material and finished articles to be incorporated in the work shall be made by bureaus, laboratories, or agencies approved by the Engineer and the reports of such tests shall be submitted to the Engineer. The cost of the testing shall be paid for by the Contractor, unless otherwise specified.
- B. The Contractor shall furnish all sample materials required for these tests and shall deliver same without charge to the testing laboratory or other designated agency when and where directed by them.

1.19 TRANSMITTAL OF DOCUMENTS:

- A. Unless stated otherwise, all information shall flow from subcontractors to prime contractor to Engineer and conversely. Reference to a subcontractor submitting to the Engineer in these specifications is not intended to bypass this routing.

1.20 WORK STATED IN OTHER DIVISIONS OF WORK:

- A. The specifications in each Division are intended to compliment one another. In case of conflict, the most stringent requirement shall apply.

END OF SECTION 01 1000

SECTION 01 1010 - SPECIAL CONDITIONS

PART 1 - GENERAL

1.1 WORK INCLUDED:

- A. The work under this contract includes the furnishing of all labor, material, plant and all items and services of every nature whether particularly mentioned or not that is required to complete the replacement of the existing mechanical systems, installation of new equipment, and controls as indicated.

1.2 RELATED DOCUMENTS:

- A. Attention is directed to Division 1, General Requirements and Instructions to Bidders which are binding in their entirety on this portion of the work and in particular to paragraphs concerning materials, workmanship and substitutions.

1.3 BIDDING

- A. Bids shall be submitted online through the Fort Mill School District Vendor Registry site. Contractor is responsible for registering through the site and using the site to submit their bid prior to the Bid Date.
- B. Technical issues associated with the use of the site shall not be a valid reason for a late bid. Bids received after the cutoff time shall not be accepted.

1.4 OWNER'S SCHEDULE:

- A. Buildings may not be available at all times and on all days depending upon testing, special activities, or unscheduled events.

1.5 SUBSTANTIAL COMPLETION:

- A. Project should be bid based upon a Notice to Proceed being awarded within twenty-one (21) days of bid opening.
- B. If Notice to Proceed is not given by the date indicated above, the contractor shall have ten (10) working days to notify the A/E in writing of any impact to contract cost, if any, to meet the project completion date. If notification is not received within the required time, all parties agree the contract cost is not impacted.
- C. **Project shall be substantially complete by: August 1st 2021**
- D. The contractor shall complete all punchlist items within thirty (30) days of substantial completion.
- E. Any items the contractor does not agree is the responsibility of the contractor shall be identified in writing by the contractor. These items shall be submitted to the A/E within ten (10) days of receipt of the contractor being notified of the item.

- F. Should the contractor fail to complete the punchlist items, the Owner may deduct the following from the contractor's contract amount:
 - 1. Reasonable cost to have work completed by another party.
 - 2. Reasonable cost to have the A/E provide additional review of work.
 - 3. Any other reasonable costs incurred by the Owner as the result of work not being completed.
- 1.6 OSHA STANDARDS:
 - A. OSHA Construction Standards shall be applicable to all construction operations.
- 1.7 CONSTRUCTION SCHEDULE:
 - A. Contractor shall furnish to the Engineer a construction schedule within fourteen (14) days from the date of the "Notice to Proceed."
 - B. Schedule shall include all critical path items, start and completion date of each, and project completion date. Additional detail shall be provided by the Contractor if requested by the Engineer.
 - C. The schedule shall be bar type, computer generated.
- 1.8 SCHEDULE OF VALUES:
 - A. Schedule of values shall include a reasonable breakdown of labor and material for the major categories of work for each trade.
 - B. The schedule of values shall include these line items.
 - 1. One percent (1%) of the total contract value shall be listed for O&M manuals. This item cannot be billed until all O&M's required have been turned in and accepted by the A/E.
 - 2. One percent (1%) of the total contract value shall be listed for Owner training. This item cannot be billed until all training has been completed.
 - 3. Two percent (2%) of the total contract value shall be listed for work related to the A/E punchlist. This item can be billed in full or in part after the contractor has returned all of the A/E's final punchlist report with the status of each item indicated. The Owner reserves the right to withhold full or part payment based upon the effort of the contractor to complete punchlist items in a timely manner.
- 1.9 RETAINAGE:
 - A. Retainage shall be withheld at 5% of the total project contract value.
- 1.10 FINAL PAYMENT:
 - A. Contractor shall furnish to the Engineer the following prior to approval of final certificate of payment.

1. All manufacturers warranties.
2. Information for "As-Built Drawings" from all sections of these specifications.
3. Affidavit that all materials and labor have been paid in full.
4. Instructions to the Owner.
5. Operation and Maintenance Manuals on all equipment.
6. Submittal of punch list with each item initialed and date completed.
7. Additional information as identified in all sections of these specifications and contract drawings.

1.11 CONTRACT DRAWINGS:

- A. Drawings are schematic and are based upon existing documents and engineers' field inspections. Contractor shall field verify locations of all equipment, panels, controls, accessories, wall sections, grades and floor elevations prior to ordering any material or equipment.

1.12 WORK SCHEDULE:

- A. Work may be performed during holidays, weekends, summer break and all other times as coordinated with the district.
- B. No crane work shall be performed while the building is occupied.
- C. Depending upon the nature of the work, utility tie-ins, shutdowns, emergency work, and other work may be required to be done during non-regularly scheduled construction hours.

1.13 PRIME CONTRACTOR:

- A. A contractor may bid as the prime contractor if their work is 40% or more of the total construction amount and they are licensed under SC LLR's classification or subclassifications in Section 40-11-410 (1), (2), or (3). (Note: GC-BD,-HW,-UT).
- B. A contractor may bid as the prime contractor if their work is 40% or more of the total construction amount and they are licensed under SC LLR's classification or subclassification in Sections 40-11-410 (4) and (5).

1.14 SALVAGED MATERIAL:

- A. The Owner will identify any materials, equipment, or building component that they want to retain.
- B. The contractor shall carefully remove items identified by the Owner and deliver them to the Owner's designated facility within 25 miles of the project site.

- C. The contractor shall be responsible for transporting unloading, and setting in place all items.
- D. All other demolished materials shall be removed for the site by the contractor unless specifically designated otherwise.

1.15 STORAGE LAYDOWN AREAS:

- A. There is limited storage and laydown area available on site. These areas which are available will be coordinated with the Engineer and Owner.
- B. Storage and laydown may have to be relocated during the duration of the project to accommodate construction progress at no cost to the Owner.

1.16 PROJECT RESTRICTIONS AND REQUIREMENTS:

- A. No tobacco products permitted on site.
- B. No eating or drinking within the building.
- C. All contractors shall have identification badges worn at all times or shall wear a shirt bearing the contracting company's name and/or logo.

1.17 SITE REPAIR:

- A. Where the site has been excavated or damaged, it shall be refilled with suitable fill dirt and 4" top soil. All excess material shall be removed and disposed of by the contractor.
- B. All fill shall be compacted.
- C. Top soil shall be leveled, slightly sloping away from the building. The soil shall be heavily seeded and watered every other day, for 30 consecutive days. The type of seed shall match existing grass.

1.18 ROOM PREPARATION (EXISTING FACILITIES):

- A. The Owner will be responsible for moving all personal property, computers, electronic equipment, and similar equipment.
- B. The Owner shall be responsible for moving the following:
 - 1. Wrestling mats
- C. Equipment that requires utility connections such as power, water, and waste will be disconnected and utilities properly and safely capped or turned off. After moving equipment back, the contractor shall reconnect utilities.

1.19 ROOF PROTECTION:

- A. The contractor shall take all measures to protect the roof from damage.

- B. The roof shall be protected from damage when transporting materials and equipment to and from the roof.
- C. The roof shall be protected from damage when installing materials and equipment on the roof.
- D. The roof shall be protected during welding, cutting, and other construction tasks.
- E. All scrap materials, screws, fasteners shall be thoroughly cleaned from the roof each day and more frequently if needed to protect the roof from damage.
- F. The contractor shall determine the best method to protect the roof including but not limited to fire blankets, tarps, plywood, heavy mil plastic, etc.
- G. No tools or materials are to be placed directly on the roof without adequate roof protection.
- H. No equipment or materials shall be set directly on the roof. Where materials or equipment must be set on the roof, the roof shall be protected by 1/2" plywood and other materials as necessary to protect the roof.
- I. Any damage to the roof shall be repaired by a roofing contractor certified to work on the type of roof installed. The existing roof warranty shall be maintained.

1.20 CONTRACTOR QUALIFICATIONS:

- A. Within ten (10) days after the Bid Opening, and before award of the Contract, the low Bidder or Bidders will be required to provide qualifications for key project personnel.
- B. Personnel Description:
 - 1. The Project Manager is the person who manages the Project and who has overall project responsibility but is not the person on site running the Project on a daily basis.
 - 2. The Project Superintendent is the person on site who manages the day-to-day operations.
- C. Owner Review and Acceptance:
 - 1. If the Owner is not satisfied with the Project Superintendent's qualifications, the Contractor will be requested to submit qualifications of other persons for those positions.
 - 2. If no Superintendent is acceptable to the Owner, the Owner reserves the right to reject the Contractor's Bid.
- D. Information Required:
 - 1. Prime Contractor:

- a. Project Manager bio
 - b. Project Superintendent bio
 - c. Listing of 3 similar projects in size, complexity, and schedule duration
 - d. References (name and phone) for projects listed above
 - e. Estimate number of workers on job on daily basis
 - f. What trades are subcontracted out
2. HVAC Contractor:
- a. Project Manager bio
 - b. Project Superintendent bio
 - c. Listing of 3 similar projects in size, complexity, and schedule duration
 - d. References (name and phone) for projects listed above
 - e. Estimate number of workers on job on daily basis
 - f. What trades are subcontracted out
3. Electrical Contractor:
- a. Project Manager bio
 - b. Project Superintendent bio
 - c. Listing of 3 similar projects in size, complexity, and schedule duration
 - d. References (name and phone) for projects listed above
 - e. Estimate number of workers on job on daily basis
 - f. What trades are subcontracted out

1.21 SITE DIGGING:

- A. In addition to the requirements of the plans and specifications, the contractor shall be responsible for hiring a utility locator service to identify utilities in the area that is to be dug. The contractor shall also meet with the Owner's maintenance director to discuss any known utilities with the District. In the close proximity to any known or anticipated utilities, the contractor shall hand dig until such utilities are uncovered.

1.22 ADDITIONAL SITE VISITS:

- A. At the prebid conference, additional site visit dates and times will be determined. These additional site visits will be provided by the Owner's representative. Nothing discussed at any visits will modify the contract requirements. Only those items listed in an addendum can change the project requirements.
- 1.23 POWER FOR TEMPORARY HVAC EQUIPMENT (AIR CONDITIONING AND DEHUMIDIFIERS):
- A. It is the contractor's responsibility to provide all temporary power required on the project.
- 1.24 BUILDING HUMIDITY CONTROL:
- A. Contractor shall provide an appropriately sized temporary dehumidifier in all spaces for the entire time that the spaces are without cooling from beginning of demolition until the new system is in full operation. It shall be the contractor's responsibility to maintain the dehumidifiers and humidity levels in the areas of construction for the duration of the project.
- 1.25 GENERAL REQUIREMENTS:
- A. If the contractor observes any conditions that they cannot work safely around, the Owner or Engineer should be notified prior to working in that area.
 - B. The contractor shall take all steps necessary to protect all furnishings from damage at all times during construction.
 - C. The contractor is not to sit or stand on furniture nor place any materials on furniture other than what is required to protect the furniture.
- 1.26 CUTTING AND WELDING:
- A. All cutting, welding, or similar operations creating dust, sparks, smoke, or potential for fire shall be done in accordance with the State of South Carolina Hot Works Procedure.
- 1.27 CONSTRUCTION FENCE:
- A. Provide six (6) ft. tall construction fence around the crane and staging area.
 - B. The fence shall be galvanized and freestanding.
- 1.28 EQUIPMENT INSTALLATION:
- A. No existing units or new units shall be placed directly on the roof.
 - B. Existing units shall be lifted directly off the roof curbs and off the building.
 - C. New units shall be lifted directly on to the new adapter curbs.
- 1.29 EQUIPMENT POWER REQUIREMENTS:
- A. Power for the rooftop units is limited by the existing building power.

- B. All equipment requested by the contractor to be approved for this project must be submitted for prior approval and must clearly indicate the power requirements for each unit.
- C. Requests for prior approval not clearly showing the equipment power requirements will not be considered.

END OF SECTION 01 1010

SECTION 01 1020 - ALTERNATES

PART 1 - GENERAL

1.1 DESCRIPTION:

- A. The Contractor shall state an alternate price to be added to or deducted from the Base Contract Sum if particular alternatives are accepted by the Owner.
- B. The alternates shall be performed within the time frame of the base bid project.
- C. The Owner reserves the right to accept or reject any alternate.
- D. All work required for implementation of an alternate shall be provided. Material and systems shown under the base bid to be reserved or altered shall not be removed or altered if necessary for implementation of the alternate.
- E. The Owner may at any time before final acceptance of a project choose to accept an alternate. The Contractor shall be required to negotiate a fair cost increase (if any is justified) and a fair time extension (if any is justified).

PART 2 - ALTERNATES

2.1 ALTERNATE NO. 1 (Air Handling Unit Warranty):

- A. Base Bid:
 - 1. Provide standard 1 year parts and labor warranty with an extended 4 year compressor parts warranty.
- B. Alternate:
 - 1. Provide a 5 year parts and labor warranty on the air handling units.

END OF SECTION 01 1020

SECTION 01 3100 - CUTTING AND PATCHING

PART 1 - GENERAL

1.1 SCOPE OF WORK:

- A. Provide all cutting and patching indicated on the plans and in these specifications and as required to perform all work necessary to complete the requirements of the project.

PART 2 - PRODUCTS

2.1 MATERIALS:

- A. Use materials that are identical to existing materials except where such materials are prohibited by law or these specifications including, but not limited to, those materials listed in the General Requirements specification. If identical materials are not available or cannot be used for exposed surfaces, use materials that visually match existing adjacent surfaces to fullest extent possible. Use materials whose installed performance will equal or surpass that of existing materials.

PART 3 - EXECUTION

3.1 GENERAL:

- A. The requirements of the structural plans and specifications supersede this specification where a conflict exists.
- B. Do not cut or modify structural elements other than as specifically indicated on the drawings.
- C. Do not cut and patch operating elements or safety related components in manner that would result in reducing their capacity to perform as intended, or result in increased maintenance, or decreased operational life or safety. Obtain written prior approval of cutting and patching for operating elements or safety related systems.
- D. Do not cut and patch construction exposed on exterior or in occupied spaces, in manner that would, in the Engineer's opinion, reduce building's aesthetic qualities, or result in visual evidence of cutting and patching.

3.2 INSPECTION:

- A. Examine existing surfaces before cutting and patching.
- B. If unsafe or unsatisfactory conditions exist, take all necessary measures to make conditions safe and satisfactory for the work to be done. Do not proceed if contractor is unsure of conditions or conditions are not safe and acceptable to the contractor.

- C. Before proceeding, meet at site with all trades affected by this work. Review areas of potential interference and conflict. Coordinate procedures and resolve potential conflicts before proceeding.
- D. Where subsurface conditions or systems are unknown or uncertain, contractor shall take all practical steps to ascertain subsurface conditions or systems. Contractor shall proceed with caution until conditions and systems are known or uncovered.

3.3 PREPARATION:

- A. Provide temporary support of work to be cut.
- B. Protect existing construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of project that might be exposed during cutting and patching operations.
- C. Avoid interference with use of adjoining areas or interruptions of free passage to adjoining areas if these areas are to remain in operation.
- D. Take all precautions necessary to avoid cutting existing pipe, conduit or ductwork which are to remain or to be removed or relocated at a later time.

3.4 PERFORMANCE:

- A. General:
 - 1. Employ skilled workmen to perform cutting and patching.
 - 2. Work shall be done in a timely manner in accordance with the construction schedule and in a time frame to minimize damage, hazard, or vandalism to facility.
- B. Cutting:
 - 1. Cut existing construction using methods least likely to damage elements.
 - 2. In general, where cutting is required use hand or small power tools designed to cut holes and slots neatly to size required with minimum disturbance of adjacent surfaces.
 - 3. To avoid marring existing finished surfaces, cut or drill from exposed or finished side into concealed surfaces.
 - 4. Cut through concrete and masonry using cutting machine such as carborundum saw or diamond core drill.
 - 5. By-pass utility services such as pipe or conduit, before cutting, where lines are indicated to be removed, relocated or abandoned. Cut-off pipe or conduit in walls or partitions to be removed. Cap, valve or plug and seal remaining portion of pipe or conduit.

C. Patching:

1. Patch with durable seams that are as invisible as possible.
2. Where feasible, inspect and test patched areas to demonstrate integrity of installation.
3. Restore exposed finishes of patched areas and extend finish restoration into adjoining construction in manner that will eliminate evidence of patching and refinishing.
4. Patch, repair, replace, or rehang existing ceilings as necessary to provide even plane surface of uniform appearance.

3.5 CLEANING:

- A. Thoroughly clean areas and spaces where cutting and patching is performed or used as access. Remove completely paint, mortar, oils, putty and items of similar nature.

3.6 PENETRATIONS:

- A. All penetrations made by any contractor through walls, ceilings and floors shall be sealed by the Contractor to meet the requirements of all building codes and fire codes applicable to this project.
- B. All sleeves set in concrete, masonry, or other work shall be furnished and installed by the Contractor requiring them in a timely manner so as not to delay the Contractor doing the concrete, masonry or other work. Should the Contractor requiring the sleeves fail to install them in a timely manner they will be required to bear the cost of cutting and patching to install the sleeves.
- C. No penetrations, attachments, or other modifications to load bearing walls, beams, columns or other structural members shall be made without written authorization from the Engineer.

END OF SECTION 01 3100

SECTION 01 3105 - DEMOLITION

PART 1 - GENERAL

1.1 SCOPE OF WORK:

- A. Furnish all labor, materials, tools, and equipment and perform all operations to demolish and remove systems, system components, and building components indicated on the plans and in the specifications and as required to perform all work necessary to complete the requirements of the Project.
- B. Demolition is required for:
 - 1. Portions of existing building indicated on drawings and as required to accommodate new construction.
 - 2. Removal of existing mechanical, electrical, and plumbing equipment, piping, supports, controls and all associated items as indicated on drawings.

1.2 PROJECT CONDITIONS:

- A. Owner may occupy portions of building adjacent to areas of demolition. Conduct demolition work in manner that will minimize disruption of Owner's normal operations.
- B. Owner assumes no responsibility for actual condition of items or structures to be demolished. Conditions existing at time of inspection for bidding purposes will be maintained by Owner insofar as practicable. However, minor variations within structure may occur by Owner's removal and salvage operations prior to start of demolition work.

PART 2 - PRODUCTS (Not Used)

PART 3 – EXECUTION

3.1 GENERAL:

- A. The requirements of the structural plans and specifications shall supersede this specification where a conflict exists.

3.2 PREPARATION:

- A. Provide interior and exterior shoring, bracing, or support to prevent movement, settlement, or collapse of areas to be demolished and adjacent facilities to remain.
- B. Cease operations and notify Owner's Representative and Engineer immediately if safety of structure appears to be endangered. Take precautions to support structure until determination is made for continuing operations.
- C. Provide temporary barricades and other forms of protection to protect personnel from injury due to demolition work.

- D. Provide protective measures as required to provide free and safe passage of personnel to occupied portions of building.
- E. Provide temporary weather protection during interval between demolition and removal of existing construction on exterior surfaces and installation of new construction to ensure that no water leakage or damage occurs to structure or interior areas of existing building.
- F. Provide weatherproof closures for exterior openings resulting from demolition work.
- G. Do not use cutting torches for removal until work area is cleared of flammable materials. At concealed spaces, such as interior of ducts and pipe spaces, verify condition of hidden space before starting flame-cutting operations.

3.3 UTILITIES:

- A. Locate, identify, stub off, and disconnect utility services that are not indicated to remain. Provide bypass connections as necessary to maintain continuity of service to occupied areas of building.
- B. Provide minimum of 72 hours advance notice to Owner if shut down of service is necessary during changeover.
- C. Maintain existing utilities indicated to remain in service and protect them against damage during demolition operations.
- D. Do not interrupt utilities serving occupied or used facilities, except when authorized in writing by authorities having jurisdiction.
- E. Provide temporary services during interruptions to existing utilities, as acceptable to governing authorities.

3.4 DEMOLITION:

- A. Perform demolition work in systematic manner.
- B. Demolish concrete and masonry in small sections. Cut concrete and masonry using power-driven masonry saw or hand tools; do not use power-driven impact tools.
- C. Locate demolition equipment throughout structure and promptly remove debris to avoid imposing excessive loads on supporting walls, floors, or framing.
- D. Provide services for effective air and water pollution controls as required by local authorities having jurisdiction.
- E. For interior slabs on grade, use removal methods that will not crack or structurally disturb adjacent slabs or partitions. Use power saw where possible.
- F. Maintain fire protection systems during selective demolition.
- G. Provide portable fire suppression systems during flame cutting operation.

- H. Use water sprinkling, temporary enclosures, and other methods to limit dust and dirt migration. Comply with governing regulations pertaining to environmental protection. Do not use water when it may create hazardous or objectionable conditions such as flooding and pollution.

3.5 UNFORESEEN CONDITIONS:

- A. If unanticipated mechanical, electrical, or structural elements that conflict with intended function or design are encountered, investigate and measure both nature and extent of conflict.
- B. Submit report to Engineer in written, accurate detail. Pending receipt of directive from Engineer, rearrange demolition schedule as necessary to continue overall job progress without delay.

3.6 DISPOSAL OF DEMOLISHED MATERIALS:

- A. Remove from building site debris, rubbish, and other materials resulting from demolition operations. Transport and legally dispose off site.
- B. If hazardous materials are encountered during demolition operations, comply with applicable regulations, laws, and ordinances concerning removal, handling, and protection against exposure or environmental pollution.
- C. Burning of removed materials is not permitted on project site.
- D. Remove protections at completion of work.

3.7 REPAIR:

- A. Repair demolition performed in excess of that required. Return elements of construction and surfaces to remain to condition existing prior to start operations. Repair adjacent construction or surfaces soiled or damaged by demolition work.

3.8 MASONRY RUBBLE:

- A. Masonry rubble resulting from new work will not be disposed of in the general dumpster. The masonry contractor should make arrangements to have rubble removed from the site by other means. Masonry rubble shall be removed weekly or more frequently as determined by the A/E.

END OF SECTION 01 3105

SECTION 01 3115 - GENERAL CLEANING

PART 1 - GENERAL

1.1 SCOPE OF WORK:

- A. Furnish all labor, materials, tools, and equipment and perform all operations to maintain the buildings and site in a standard of cleanliness as described in this section.

1.2 QUALITY ASSURANCE:

- A. In addition to the standards described in this Section, comply with pertinent requirements of agencies having jurisdiction.

PART 2 - PRODUCTS

2.1 CLEANING MATERIALS AND EQUIPMENT:

- A. Provide required personnel, equipment, and materials needed to maintain the specified standard of cleanliness.
- B. The Prime Contractor is to allow in his bid for provision of a dumpster service for the duration of the project. The Prime Contractor shall allow for emptying as needed.

2.2 OTHER MATERIALS:

- A. Provide other materials, not specifically described, but required for a completed and proper cleaning, as selected by the Contractor subject to the approval of the A/E.

PART 3 - EXECUTION

3.1 GENERAL:

- A. Conduct a daily inspection to verify that the cleaning requirements of this specification are being complied with.
- B. If the contractor fails to maintain the building and site in a clean condition, the Owner, after written notification, will have the cleaning work performed by other forces with the cost incurred by the contractor.

3.2 PROGRESS CLEANING:

- A. General:
 - 1. Retain stored items in an orderly arrangement allowing maximum site and building access, not impeding traffic or drainage, and providing required protection of materials. At no time shall any emergency exit or fire egress be restricted.
 - 2. Do not allow accumulation of scrap, debris, and waste material.

3. At least twice each week, and more often if necessary, completely remove all scrap, debris, and waste material from the job site.
 4. Provide adequate storage for all items awaiting removal from the job site, observing requirements for fire protection and protection of the environment.
 5. All food, food bags and containers, beverage containers and any other organic debris shall be collected and disposed of daily.
- B. Site:
1. Maintain the site in a neat and orderly condition at all times.
 2. Inspect the site and pick up all scrap, debris, and waste material. Remove such items to the place designated for their storage.
- C. Building:
1. Inspect the buildings and pick up all scrap, debris, and waste material. Remove such items to the place designated for their storage.
 2. Prior to the installation of any materials, clean the structures or pertinent portions thereof to the degree of cleanliness recommended by the manufacturer of the succeeding material, using equipment and materials required to achieve the necessary cleanliness.
- 3.3 FINAL CLEANING:
- A. General:
1. Cleaning shall be to the level typically provided by skilled cleaners using commercial quality building maintenance equipment and materials.
 2. Remove from the job site all tools, surplus materials, equipment, scrap, debris, and waste.
 3. Additional requirements may be required elsewhere in these specifications.
- B. Site:
1. Clean all debris from the site accumulated as a result of the contractor's work.
 2. Broom, pressure wash, or steam clean paved areas marred or blemished as a result of the contractor's work.
- C. Buildings:
1. Exterior:
 - a. Visually inspect exterior surfaces and remove traces of soil, waste materials, smudges, and other foreign matter.

- b. Remove all traces of splashed materials from exterior surfaces.
 - c. If necessary to achieve a uniform degree of cleanliness, hose down the exterior of the structure.
 - d. In the event of stubborn stains not removable with water, the Engineer may require light sandblasting, chemical cleaning, or other methods of cleaning at no additional cost to the Owner.
2. Interior:
- a. Visually inspect interior surfaces and remove all traces of soil, waste materials, smudges, and other foreign matter.
 - b. Remove all traces of splashed materials from interior surfaces.
 - c. Remove paint droppings, spots, stains, and dirt from finished surfaces.
3. Glass:
- a. Clean inside and outside dirtied beyond what would normally be expected if construction had not occurred.
- D. Schedule final cleaning as approved by the A/E to enable the Owner to accept a completely clean project.

END OF SECTION 01 3115

SECTION 01 4100 - SUBMITTALS

PART 1 - GENERAL

1.1 GENERAL:

- A. Documents affecting the requirements of this section include, but are not limited to, General Conditions and Supplementary Conditions in Division 1 of these Specifications. Individual requirements for submittals also may be described in other sections of these specifications.
- B. The Contractor may require his subcontractors to provide drawings, diagrams, and similar information for coordination. This information shall remain between the Contractor and his subcontractors and will not be reviewed by the Engineer.

1.2 QUALITY ASSURANCE:

- A. Do not substitute materials, equipment, or methods, etc., unless such substitution has been specifically approved in writing by the Engineer prior to the bid date as set forth hereinafter.
- B. Specific reference in the specifications to any article, device, product, materials, fixture, form or type of construction, etc., by name, make, or catalogue number, with or without the words "or equal" shall be interpreted as establishing a standard of quality and shall not be construed as limiting competition and the Contractor in such cases may, at his option, use any article, device, product, material, fixture, form or type of construction which, in the judgment of the Engineer expressed in writing, is equal to that named. Where quality and other characteristics are very nearly the same, the question of determining equal materials and readily available service sometimes resolves itself to a matter of personal opinion and judgment and in these and all other cases involving the approval of materials, the opinion, judgment, and decision of the Engineer shall be final and bind all parties concerned.
- C. Where the phrase "or equal," "or equal as approved by the Engineer," or similar phrase occurs in the specifications, do not assume that the materials, equipment, or methods will be approved as equal unless the item has been specifically so approved in writing by the Engineer.

1.3 SUBMITTALS:

- A. Make submittals of Shop Drawings, Samples, and other items in accordance with the provisions of this section.
- B. Coordination of submittals:
 - 1. Prior to each submittal, carefully review and coordinate all aspects of each item being submitted.

2. Verify that each item and the submittal for it conform in all respects with the specified requirements.
3. By affixing the Contractor's signature to each submittal, certify that the coordination has been performed

PART 2 - PRODUCTS

2.1 SHOP DRAWINGS:

- A. Shop drawings shall be shown accurately to a scale sufficiently large to show all pertinent aspects of the item.

2.2 MANUFACTURERS LITERATURE:

- A. Where contents of submitted literature from manufacturers includes data not pertinent to the submittal, clearly show which portions of the contents is being submitted for review.
- B. Submit literature in PDF format.

2.3 COLORS AND PATTERNS:

- A. Unless the precise color and pattern is specifically stated, and whenever a choice of color or pattern is available as a standard in the specified products, submit accurate color and pattern charts to the Engineer for selection.

PART 3 - EXECUTION

3.1 IDENTIFICATION OF SUBMITTALS:

- A. Consecutively number all submittals.
 1. When material is resubmitted for any reason, transmit under a new letter of transmittal and with a new transmittal number.
 2. On resubmittals, cite the original submittal number for reference.
- B. Accompany each submittal with a letter of transmittal showing all information required for identification and checking.
- C. On at least the first page of each submittal, and elsewhere as required for positive identification, show the submittal number in which the item was included.
- D. Maintain an accurate submittal log showing current status of all submittals at all times. Make the submittal log available to the Engineer for his review upon request.

3.2 GROUPING OF SUBMITTALS:

- A. Unless otherwise specified, make submittals in groups containing all associated items to assure that information is available for checking each item when it is received.

- B. Partial submittals may be rejected.

3.3 SUBMITTALS:

- A. Unless otherwise approved by the Engineer, submittals shall be submitted within twenty (20) days from the "Notice to Proceed."
- B. Make submittals far enough in advance of scheduled dates for installation to provide time required for reviews, for securing necessary approvals, for possible revisions and resubmittals, and for placing orders and securing delivery.
- C. In scheduling submittals, allow approximately 10 days for review by the Engineer following his receipt of the submittal.

3.4 ENGINEER'S REVIEW:

- A. Review by the Engineer does not relieve the Contractor from responsibility for errors which may exist in the submitted data.
- B. If the submittals are returned to the Contractor and noted to be unacceptable, revise and resubmit, or similarly noted the contractor shall:
 - 1. Make revisions required by the Engineer.
 - 2. If the Contractor considers any required revision to be a change, he shall notify the Engineer in writing prior to proceeding with the change.
 - 3. Make only those revisions directed by the Engineer.
 - 4. Clearly identify the revisions on the submittal so a thorough search of the submittal is not necessary.

END OF SECTION 01 4100

SECTION 01 5100 - PRODUCT HANDLING

PART 1 - GENERAL

1.1 SCOPE OF WORK:

- A. Furnish labor, material, tools, and equipment and perform all operations to handle, load, unload, store, and protect all materials and products used on this Project.

1.2 QUALITY ASSURANCE:

- A. Include within the Contractor's quality assurance program such procedures as are required to assure full protection of work and materials.

1.3 MANUFACTURERS' RECOMMENDATIONS:

- A. Except as otherwise approved by the Engineer, comply with manufacturers' recommendations on product handling, storage, and protection.

1.4 PACKAGING:

- A. Deliver products to the job site in their manufacturer's original container, with labels intact and legible.
- B. Maintain packaged materials with seals unbroken and labels intact until the time of use.
- C. Promptly remove damaged material and unsuitable items from the job site, and promptly replace with material meeting the specified requirements, at no additional cost to the Owner.
- D. The Engineer may reject as non-complying such material and products that do not bear identification satisfactory to the Engineer as to manufacturer, grade, quality, and other pertinent information.

1.5 PROTECTION:

- A. Protect finished surfaces, including jambs and soffits of openings used as passageways, through which equipment and materials are handled.
- B. Maintain finished surfaces clean, unmarred, and suitably protected until accepted by the Owner.

1.6 REPAIRS AND REPLACEMENTS:

- A. In the event of damage, promptly make replacements and repairs to the approval of the Engineer and at no additional cost to the Owner.

END OF SECTION 01 5100

SECTION 01 6100 – INSPECTIONS AND TESTING

PART 1 - GENERAL

1.1 INSPECTIONS:

- A. Inspections by various entities including but not limited to the authority having jurisdiction (AHJ), building inspectors, code officials, special inspectors, architects and engineers may be required on this project.
- B. The contractor shall fully cooperate with the persons performing the inspections by:
 - 1. Providing the appropriate personnel.
 - 2. Providing ladders and other means of access.
 - 3. Providing other assistance as necessary for the persons performing the inspections to complete their inspections in a timely manner.

1.2 TESTING:

- A. Testing by various entities may be required on this project. The contractor shall provide the support required for testing by others similar to that support required for inspections.

1.3 COST FOR INSPECTIONS AND TESTING:

- A. Cost for inspections shall not be the contractor's responsibility unless specifically indicated.
- B. Costs for Chapter 1 and Chapter 17 inspections shall not be the contractor's responsibility.

PART 2 - INSPECTIONS

2.1 GENERAL:

- A. Inspections shall be requested of the Chapter 1 and the Chapter 17 inspectors as required by:
 - 1. Applicable edition of the IBC.
 - 2. This specification section.
 - 3. Additional requirements indicated on plans.

2.2 IBC CHAPTER 1 BUILDING INSPECTION:

- A. HVAC:
 - 1. HVAC rough-in, Chapter 1 inspector, periodically

2. HVAC final inspection, AHJ
 - B. Electrical:
 1. Electrical underground, Chapter 1 inspector, periodically
 2. Electrical rough-in, Chapter 1 inspector, periodically
 3. Electrical final inspection, AHJ
 - C. Fire Resistant Penetrations:
 1. Verification of fire resistant penetrations in accordance with ASTM E2174, Chapter 1 inspector, periodically.
 - D. Energy Efficiency:
 1. Verification of the applicable requirements of ASHRAE 90.1, Chapter 1 inspector, periodically.
 - E. Footings and Foundations:
 1. Footings and foundations, Chapter 1 inspector
 - F. Concrete Slabs:
 1. Concrete slabs, Chapter 1 inspector
 - G. Framing:
 1. Wall framing, Chapter 1 inspector
 - H. Gyp Board:
 1. Gyp Board, Chapter 1 inspector
- 2.3 IBC CHAPTER 17, SPECIAL INSPECTIONS – STEEL:
- A. Material verification of high-strength bolts, nuts and washers:
 1. Identification marking to confirm to ASTM standards specified in the approved construction documents, special inspector, periodically
 2. Manufacturer’s certificate of compliance required, special inspector, periodically.
 - B. Inspection of high-strength bolting:
 1. Bearing-type connections, special inspector, periodically
 2. Slip-critical connections, special inspector, periodically

- C. Material verification of structural steel:
 - 1. Identification markings to conform to ASTM standards specified in the approved construction document, special inspector, periodically
 - 2. Manufacturer's certified mill test reports, special inspector, periodically
- D. Material verification of the weld filler materials:
 - 1. Identification markings to conform to AWS specification in the approved construction documents, special inspector, periodically
 - 2. Manufacturer's certificate of compliance required, special inspector, periodically
- E. Inspection of welding:
 - 1. Structural steel – complete and partial penetration groove welds, special inspector, continuous
 - 2. Structural steel – multipass fillet welds, special inspector, continuous
 - 3. Structural steel – single-pass fillet welds $> 5/16''$, special inspector, continuous
 - 4. Structural steel – single-pass fillet welds $\leq 5/16''$, special inspector, periodically
 - 5. Structural steel – floor and deck welds, special inspector, periodically
 - 6. Reinforcing steel – verification of weldability of reinforcing steel other than ASTM A 706, special inspector, periodically
 - 7. Reinforcing steel-resisting flexural and axial forces in intermediate and special moment frames and boundary elements of special reinforced concrete shear walls and shear reinforcement, special inspector, continuous
 - 8. Reinforcing steel – shear reinforcement, special inspector, continuous
 - 9. Reinforcing steel – other reinforcing steel, special inspector, periodically
- F. Inspection of steel frame joint details for compliance with approved construction documents:
 - 1. Details such as bracing and stiffening, special inspector, periodically
 - 2. Member locations, special inspector, periodically
 - 3. Application of joint details at each connection, special inspector, periodically
- G. Seismic:
 - 1. Inspection of structural welding in accordance with AISC Seismic Provisions, special inspector, continuous
 - 2. Ultrasonic test of discontinuities behind an adjacent to welds with base metal thicker than 1.5 inches where subject to through-thickness weld shrinkage strains, special inspector, continuous

2.4 IBC CHAPTER 17 SPECIAL INSPECTIONS – GENERAL:

- A. Excavation and Fill
- B. Soils and Foundation
- C. Structural Masonry
- D. Seismic

PART 3 – EXECUTION

3.1 INSPECTION SCHEDULE:

- A. The contractor shall notify the Chapter 1 and Chapter 17 inspectors not less than 48 hours prior to the time of the requested inspection.

END OF SECTION 01 6100

SECTION 01 7100 - DOCUMENTATION AND CLOSEOUT

PART 1 - GENERAL

1.1 SCOPE OF WORK:

- A. Furnish all labor, materials, tools and equipment and perform all operations in connection with the project documentation and closeout.

1.2 RELATED DOCUMENTS:

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

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 GENERAL:

- A. All reports, forms, and manuals shall be submitted to the A/E in triplicate unless additional copies are noted.
- B. Report, forms, and manuals are to be submitted as soon as possible, but no later than thirty (30) days after the earliest date they can be prepared.

3.2 OWNER TRAINING:

- A. The contractor shall schedule the training on equipment and systems at least twenty-one (21) days before training is to take place. The contractor shall provide multiple dates and times for the training to allow the Owner to coordinate the schedules of their staff to be trained.
- B. The contractor shall provide all training aids, manuals, etc. for the Owner's staff at the training classes. These are in addition to whatever is required for the Operations and Maintenance manuals. The contractor shall coordinate the number required with the Owner but shall include a maximum of eight (8) sets for the training class.
- C. The person providing the training shall be thoroughly knowledgeable in the subject matter.

3.3 PROJECT JOB DRAWINGS AND AS-BUILT DRAWINGS:

- A. Keep a record set of drawings on the job and, as construction progresses, shall show the actual installed location of all items, material, and equipment on the project job drawings.
- B. At the time of final inspection, one corrected set of prints shall be delivered to the A/E. All drawing costs to be by the Contractor.

- C. As built drawings shall have the information transferred from the project job drawings including all addendum, supplemental instructions, change orders, and similar information.
- D. Qualified draftsmen shall perform this task.

3.4 FIELD REPORTS AND FINAL INSPECTION REPORTS:

- A. The A/E will review the Contractor's work periodically throughout the project. A report will be submitted to the Contractor.
- B. The reports shall be responded to within ten days of receipt by the Contractor. Each item shall be addressed with comments written on the inspection report if possible. Contractor's response shall address the status of each item and all discrepancies.

3.5 ACCEPTANCE:

- A. Upon notification by the Contractor and after completion of Operation and Maintenance Instructions, the A/E will visit the project for a demonstration of the building system and an inspection of the completed work.
- B. Items which do not comply with the Contract Documents or which function incorrectly will be listed. The list will be provided by the A/E to the Contractor for correction of the installed work.
- C. After all corrections have been made, the Contractor shall notify the A/E who will recheck the systems for compliance of all items listed.

PART 4 - STANDARD FORMS

4.1 GENERAL:

- A. All forms shall be completely filled out by the Contractor prior to acceptance of the project by the A/E.

4.2 GENERAL CONSTRUCTION CLOSEOUT LIST:

GENERAL CONSTRUCTION CLOSEOUT DOCUMENT PROJECT: <u>FMSD Fort Mill High School HVAC Renovations</u> BGA PROJECT NO.: <u>20051</u>			
DOCUMENT	DATE REVIEWED	DATE RETURNED	COMMENTS
General Construction O&M Manuals (3 sets plus CD) Vol. 1			
General Construction O&M Manual (3 sets plus CD) Vol. 2			
General Construction marked- up As-Builts (1 set red lined)			
Asbestos Free Letter (1)			
Release of Lien (subs greater than 2% contract value)			
Punchlist dated _____			
Punchlist dated _____			
Punchlist dated _____			
Final Pay Application			

GENERAL CONSTRUCTION CLOSEOUT DOCUMENT (Continued)

PROJECT: FMSD Fort Mill High School HVAC Renovations
BGA PROJECT NO.: 20051

DOCUMENT	DATE REVIEWED	DATE RETURNED	COMMENTS
Contractors Project Insurance Letter (2)			
ACORD Certificate of Insurance (3)			
AIA G704 – Substantial Completion or SE 550			
AIA G706 – Contractor’s Affidavit of Debts and Claims			
AIA G706A – Contractor’s Affidavit of Release of Liens			
AIA G707 – Consent of Surety Company to Final Payment			
AIA G715 – Supplemental Attachment for ACORD Certificate of Insurance			
SE 560 Certificate of Final Completion			
SE 585 Certificate of Occupancy/Use			

NOTE: Not all closeout documents may be listed. See other sections of specifications for additional requirements.

- (1) Letter on contractor’s letterhead stating “To my knowledge, no asbestos materials were used on this project.”
- (2) Letter on contractor’s letterhead stating “This is to certify that, as the acting representative of (xxx Company), I am unaware of any reason that the completed project insurance will not be renewed to cover the period required by the contract documents.”
- (3) Provide current certificate of Liability Insurance.

END OF SECTION 01 7100

SECTION 07 2000 - SEALANTS AND CAULKING

PART 1 - GENERAL

1.1 SCOPE OF WORK:

- A. Furnish all labor, materials, tools, and equipment and perform all operations to seal and caulk joints where shown on the plans as required to provide a positive barrier against passage of moisture and passage of air.

1.2 QUALITY ASSURANCE:

- A. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of this work.

PART 2 - PRODUCTS

2.1 SEALANTS:

- A. Provide the following materials manufactured by Sonneborn Building Products:

MATERIAL

LOCATION OF USE:

- | | | |
|----|-------------------------|---|
| 1. | Sonolastic NP1 | Throughout the Work, except where other sealant is specified, where anticipated joint movement will be 25% or less. |
| 2. | Sonolastic Omniseal | Throughout the Work, except where other sealant is specified, where anticipated joint movement will be 50% or less. |
| 3. | Polyethylene Backer Rod | Where required to prevent 3-point adhesion |

- B. For other services, provide products especially formulated for the proposed use and approved in advance by the Engineer.

- C. Colors:

- 1. Colors for each exposed sealant installation will be selected by the Engineer from standard colors normally available from the specified manufacturer.
- 2. In concealed installations, any color may be used.

2.2 PRIMERS:

- A. Use only those primers which have been tested for durability on the surfaces to be sealed and are specifically recommended for this installation by the manufacturer of the sealant used.

2.3 BACKUP MATERIALS:

- A. Use only those backup materials, specifically recommended for this installation by the manufacturer of the sealant used, which are non-absorbent, and non-staining.

2.4 MASKING TAPE:

- A. For masking around joints, provide an appropriate masking tape which will effectively prevent application of sealant on surfaces not scheduled to receive it, and which is removable without damage to substrate.

2.5 WARRANTY:

- A. Provide all required installation and a single-source written warranty providing that the system will be free from defects of workmanship or materials in the joint system for a period of three years.

2.6 OTHER MATERIALS:

- A. Provide other materials, not specifically described, but required for a complete and proper installation, as selected by the Contractor subject to the approval of the Engineer.

PART 3 - EXECUTION

3.1 SURFACE CONDITIONS:

- A. Examine the areas and conditions under which work will be performed. Correct conditions detrimental to timely and proper completion of the Work. Do not proceed until unsatisfactory conditions are corrected.

3.2 PREPARATION:

- A. Concrete, masonry, ceramic tile, and stone surfaces:
 - 1. Install only on surfaces which are dry, sound, and well brushed, wiping free from dust.
 - 2. At open joints, remove dust by mechanically blown compressed air if so required.
 - 3. To remove oil and grease, use sandblasting or wire brushing.
 - 4. Where surfaces have been treated, remove the surface treatment by sandblasting or wire brushing.

5. Remove latency and mortar from joint cavities.

B. Aluminum surfaces:

1. Aluminum surfaces in contact with sealant:

- a. Remove temporary protective coatings, dirt, oil, and grease.
- b. When masking tape is used for protective cover, remove the tape just prior to applying the sealant.

3.3 INSTALLATION OF BACKUP MATERIAL:

A. When using backup of tube or rod stock, avoid lengthwise stretching of the material. Do not twist or braid tube or rod backup stock.

B. Installation tool:

1. For installation of backup material, provide a blunt-surfaced tool of wood or plastic, having shoulders designed to ride on the adjacent finished surface and a protrusion of the required dimensions to assure uniform depth of backup material below the sealant.
2. Do not, under any circumstance, use a screwdriver or similar tool for this purpose.
3. Using the approved tool, smoothly and uniformly place the backup material to the depth indicated on the Drawings or otherwise required, compressing the backup material 25% to 50% and securing a positive fit.

3.4 PRIMING:

A. Use only the primer approved by the Engineer for the particular installation, applying in strict accordance with the manufacturer's recommendations.

3.5 BOND BREAKER INSTALLATION:

A. Provide an approved bond breaker where recommended by the sealant manufacturer, and where directed by the Engineer, adhering strictly to the manufacturers recommendations.

3.6 INSTALLATION OF SEALANTS:

A. Prior to start of installation in each joint, verify the joint type according to details on the Drawings, or as otherwise directed by the Engineer, and verify that the required proportion of width to depth of joint has been secured.

B. Equipment:

1. Apply sealant under pressure with power-actuated or manually-operated hand gun, or by other appropriate means.

2. Use guns with nozzle of proper size, providing sufficient pressure to completely fill the joints as designed.
- C. Thoroughly and completely mask joints where the appearance of primer or sealant on adjacent surfaces would be objectionable.
 - D. Install the sealant in strict accordance with manufacturer's recommendations, filling joints to the recommended depth.
 - E. Tool joints to the profile shown on the Drawings, or as otherwise recommended by the manufacturer if not shown on the Drawings.
 - F. Cleaning up:
 1. Remove masking tape immediately after tooling joints.
 2. Clean adjacent surfaces free from sealant as the installation progresses, using solvent or cleaning agent recommended by the manufacturer of the sealant used.
 3. Upon completion of this work, promptly remove from the job site all debris, empty containers, and surplus material.

END OF SECTION 07 2000

SECTION 09 3000 - PAINTING

PART 1 - GENERAL

1.1 SCOPE OF WORK:

- A. Furnish all labor, material, tools, and equipment and perform all operations to prepare and paint or otherwise finish all surfaces required to be painted or similarly finished on this project.

1.2 SUBMITTALS:

- A. Product Data: Manufacturer's technical information, label analysis, and application instructions for each material proposed for use.
- B. Paint Color Schedule: Prior to requesting inspection for Substantial Completion, submit schedule indicating all paint manufacturers, product numbers, and colors for all painted surfaces.

1.3 QUALITY ASSURANCE:

- A. Provide manufacturer's best quality trade paint material of various coating types specified. Paint material containers without manufacturer's product identification will not be acceptable.

1.4 DELIVERY, STORAGE, AND HANDLING:

- A. Deliver materials to job site in manufacturer's original, unopened packages and containers bearing manufacturer's name and label and the following information:
 - 1. Product name or title of material
 - 2. Product description (generic classification or binder type)
 - 3. Manufacturer's stock number and date of manufacture
 - 4. Contents by volume, for pigment and vehicle constituents.
 - 5. Thinning instructions
 - 6. Application instructions
 - 7. Color name and number
- B. Store materials not in use in tightly covered containers in well-ventilated area at minimum ambient temperature of 45 deg F (7 deg C). Maintain containers used in storage in clean condition, free of foreign materials and residue.

- C. Protect from freezing. Keep storage area neat and orderly. Remove oily rags and waste daily. Take necessary measures to ensure that workers and work areas are protected from fire and health hazards resulting from handling, mixing, and application.

1.5 JOB CONDITIONS:

- A. Apply water-based paints only when temperature of surfaces to be painted and surrounding air temperatures are between 50 deg F and 90 deg F.
- B. Apply solvent-thinned paints only when temperature of surfaces and surrounding air temperatures are between 45 deg F and 95 deg F.
- C. Do not apply paint in snow, rain, fog, or mist, when relative humidity exceeds 85 percent, at temperatures less than 5 deg F above dew point, or to damp or wet surfaces.

1.6 MANUFACTURERS:

- A. The following manufacturers are acceptable for the specific products listed:
 - 1. Devoe and Reynolds Co. (Devoe)
 - 2. Duron Paints and Wallcoverings (Duron)
 - 3. The Glidden Company (Glidden)
 - 4. Benjamin Moore and Co. (Moore)
 - 5. PPG Industries, Pittsburgh Paints (PPG)
 - 6. The Sherwin-Williams company (S-W)

PART 2 - PRODUCTS

2.1 MASONRY BLOCK FILLER:

- A. High-Performance Latex Block Filler: Heavy-duty latex block fillers used for filling open textured interior and exterior concrete masonry block before application of top coats:
 - 1. Devoe: 52901 Bloxfil Acrylic Latex Block Filler
 - 2. Duron: Block Kote Acrylic Latex Block Filler, 16-005
 - 3. Glidden: 18674 Ultra-Hide Acrylic Latex Block Filler
 - 4. Moore: Moorcraft Block Filler #145
 - 5. PPG: 6-7 Latex Masonry Block Filler
 - 6. S-W: Heavy-Duty Block Filler B42W46

2.2 PRIMERS:

- A. Interior Flat Latex-Based Paint: Flat latex paint used as primer over concrete and masonry under alkyd semigloss enamel:
1. Devoe: 36XX Wonder-Tones Latex Flat Wall Paint
 2. Duron: Duron Deluxe Flat Latex, 38 Series
 3. Glidden: 5300 Ultra-Hide Flat Wall Paint
 4. Moore: Moore's Latex Quick-Dry Prime Seal #201
 5. PPG: 80 Line Wallhide Flat Latex Paint
 6. S-W: Pro-Mar 200 Latex Flat B30W200
- B. Latex-Based Interior White Primer: Latex-based primer coating used on interior gypsum drywall under alkyd semigloss enamel:
1. Devoe: 50801 Wonder-Tones Latex Primer and Sealer
 2. Duron: Drywall Primer Vinyl Latex Sealer, 18-004
 3. Glidden: 5019 PVA Primer
 4. Moore: Moore's Latex Quick-Dry Prime Seal #201
 5. PPG: 6-2 Quick-Dry Latex Primer Sealer
 6. S-W: Pro-Mar 200 Latex Wall Primer B28W200
- C. Synthetic, Rust-Inhibiting Primer: Quick-drying, rust-inhibiting primer for priming ferrous metal on exterior under full-gloss alkyd enamel and on interior under alkyd semigloss enamel:
1. Devoe: 14920 Bar-Ox Quick Dry Metal Primer, Red
 2. Duron: Dura Clad Damp Proof Red Oxide Metal Primer, 33-250
 3. Glidden: 5210 Glid-Guard Universal Fast-Dry Metal Primer
 4. Moore: Ironclad Retardo Rust-Inhibitive Paint #163
 5. PPG: 6-208 Red Inhibitive Metal Primer
 6. S-W: Kem Kromik Metal Primer B50N2/B50W1

2.3 UNDERCOAT MATERIALS:

- A. Interior Enamel Undercoat: Ready-mixed enamel for use on interior as an undercoat over a primer on concrete, concrete masonry, and ferrous and zinc-coated metal under semigloss alkyd enamel:
1. Devoe: 8801 Velour Alkyd Enamel Undercoat
 2. Duron: Alkyd Enamel Undercoater, 04-005
 3. Glidden: 4200 Spred Ultra Semi-Gloss Enamel
 4. Moore: Moore's Alkyd Enamel Underbody #217
 5. PPG: 6-6 Speedhide Quick-Dry Enamel Undercoater
 6. S-W: Pro-Mar 200 Latex Wall Primer B28W200

2.4 EXTERIOR FINISH PAINT MATERIAL:

- A. Alkyd Gloss enamel: Weather-resistant high-gloss enamel for use over primed, zinc-coated (galvanized) metal and aluminum surfaces:
1. Devoe: 70XX Mirrolac Interior/Exterior Alkyd Gloss Enamel
 2. Duron: Dura Clad Alkyd Gloss Enamel, 12 Series
 3. Glidden: 4500-Line Glid-Guard Industrial Enamel
 4. Moore: Impervo High-Gloss Enamel #133
 5. PPG: 54 Line Quick-Dry Enamel
 6. S-W: Metalastic II Enamel B-53 Series

2.5 INTERIOR FINISH PAINT MATERIAL:

- A. Interior Semigloss Odorless Alkyd Enamel: Low-odor, semigloss, alkyd enamel for use over primer and undercoat on concrete, masonry (including concrete masonry block), and both ferrous and zinc-coated (galvanized) metal surfaces and over primer on gypsum drywall:
1. Devoe: 26XX Velour Alkyd Semigloss Enamel
 2. Duron: Wall Kote Alkyd Semi-Gloss Enamel, 48 Series
 3. Glidden: 4600 Spred Ultra Semigloss Enamel
 4. Moore: Moore's Satin Impervo Enamel #235
 5. PPG: 27 Line Wallhide Semigloss Enamel

6. S-W: Classic 99 Semigloss Enamel A40 Series

PART 3 - EXECUTION

3.1 ITEMS TO BE PAINTED:

A. General:

1. In addition to the items identified in other areas of these specifications, the materials, components, system, and other building components identified in these specifications shall be painted.
2. Paints shall be applied to surfaces that have been prepared in strict accordance with the manufacturer's requirements. The preparation shall include all work required to get the surface ready for priming and finish painting.
3. At no time shall a coat exceed the manufacturer's recommendations for thickness.
4. Painting of surfaces which are concealed or in equipment rooms shall not be required unless specifically noted otherwise.
5. Where surface is new and would typically have been painted in new construction, based upon the existing installation, the surface shall be painted.
6. If the new surface is noted to be finished to match existing as one similar notation, the new surface shall be finished, texture and color, to match existing texture and color.
7. Unless noted otherwise, colors to be selected by Owner. Colors may vary from space to space or within a space but no intricate color pattern will be required.

B. Building components to be painted:

1. All exposed patches, masonry or otherwise.
2. All new steel supports.
3. All building components left bare or otherwise not matching existing as the result of the work required by this contract.

C. HVAC:

1. As indicated on the drawings.

D. Shop or factory painted equipment:

1. All equipment finishes scraped, abraded, or otherwise damaged in shipping, handling, or installation shall be cleaned, primed, and painted to match shop or factory paint.

E. Items subject to rusting:

1. Unless specifically stated otherwise, all steel, iron, or other ferrous metal, not galvanized, plated, or shop or factory painted shall be painted with an industrial quality rust inhibitive metallic primer. This includes but is not limited to materials installed:
 - a. Outdoors
 - b. Exposed to ambient conditions

3.2 EXAMINATION:

- A. Examine substrates and conditions under which painting will be performed for compliance with requirements for application of paint. Do not begin paint application until unsatisfactory conditions have been corrected. Start of painting will be construed as Applicator's acceptance of surfaces and conditions within particular area.

3.3 PREPARATION - GENERAL:

- A. Remove hardware and hardware accessories, plates, machined surfaces, lighting fixtures, and similar items in place that are not to be painted, or provide surface-applied protection prior to surface preparation and painting. Remove these items if necessary for complete painting of items and adjacent surfaces. Following completion of painting operations in each space or area, have items reinstalled by workers skilled in trades involved.
- B. Clean and prepare surfaces to be painted and repainted in accordance with the PDCA Specification Manual published by Painting and Decorating Contractors of America for each substrate condition and as specified herein.
 1. To remove mildew on impervious surfaces, scrub affected areas with mildewicide or solution of 50 percent household bleach to 50 percent water by volume. Retreat as required to remove mildew. Rinse thoroughly with water to remove any surface residue. Allow surface to dry (masonry and concrete -17 or less moisture content as determined by moisture meter) before proceeding with further preparation or painting.
 2. Provide barrier coats over incompatible primers or remove and reprime. Notify Architect in writing of problems with using specified finish-coat material with substrate primed by others.
- C. Carefully mix and prepare paint materials in accordance with manufacturer's directions.
 1. Maintain containers used in mixing and application of paint in clean condition, free of foreign materials and residue.
 2. Stir material before application to produce mixture of uniform density; stir as required during application. Do not stir surface film into material.
 3. Use only thinners approved by paint manufacturer, and only within recommended limits.

- D. Tint each undercoat lighter shade to facilitate identification of each coat where multiple coats of same material are applied. Tint undercoats to match color of finish coat, but provide sufficient differences in shade of undercoats to distinguish each separate coat.

3.4 PREPARATION - CEMENTITIOUS MATERIAL:

- A. Prepare concrete and concrete masonry block surfaces to be painted. Remove efflorescence, chalk, dust, dirt, grease, oils, and release agents.
- B. Apply block filler to unfilled existing CMU surfaces to be repainted.
- C. Determine alkalinity and moisture content of surfaces by performing appropriate tests. If surfaces are sufficiently alkaline to cause blistering and burning of finish paint, correct this condition before application. Do not paint surfaces where moisture content exceeds that permitted in manufacturer's painted directions.

3.5 PREPARATION - FERROUS METALS:

- A. Ferrous Metals: Clean nongalvanized ferrous-metal surfaces that have not been shop coated; remove oil, grease, dirt, loose mill scale, and other foreign substances. Use solvent or mechanical cleaning methods that comply with recommendations of SSPC.
- B. Touch up bare areas and shop-applied prime coats that have been damaged. Wire-brush, clean with solvents recommended by paint manufacturer, and touch primer matching shop coat.

3.6 PREPARATION - GALVANIZED SURFACES:

- A. Clean galvanized surfaces with non-petroleum-based solvents so that surface is free of oil and surface contaminants. Remove pretreatment from galvanized sheet metal fabricated from coil stock by mechanical methods.

3.7 APPLICATION:

- A. Apply paint in accordance with manufacturer's directions. Use applicators and techniques best suited for substrate and type of material being applied.
- B. Do not paint over dirt, rust, scale, grease, moisture, scuffed surfaces, or conditions detrimental to formation of durable paint film.
 - 1. Provide finish coats that are compatible with primers used.
 - 2. The number of coats and film thickness required is same regardless of application method. Do not apply succeeding coats until previous coat has cured as recommended by manufacturer. Sand between applications where sanding is required to produce even smooth surface in accordance with manufacturer's directions.
 - 3. Apply additional coats when undercoats, stains, or other conditions show through final coat of paint until paint film is of uniform finish, color, and appearance.

- Give special attention to ensure that surfaces, including edges, corners, crevices, welds, and exposed fasteners, receive dry film thickness equivalent to that of flat surfaces.
4. The term "exposed surfaces" includes areas visible when permanent or built-in fixtures, grilles, and similar components are in place. Extend coatings in these areas as required to maintain system integrity and provide desired protection.
 5. Sand lightly between each succeeding enamel or varnish coat.
 6. Omit primer on metal surfaces that have been shop-primed and touch-up painted.
- C. Apply first coat to surfaces that have been cleaned or otherwise prepared for painting as soon as practicable after preparation and before subsequent surface deterioration.
1. Allow sufficient time between successive coats to permit proper drying. Do not recoat until paint has dried to where it feels firm and does not deform or feel sticky under moderate thumb pressure and where application of another coat of paint does not cause lifting or loss of adhesion of undercoat.
- D. Apply materials at not less than manufacturer's recommended spreading rate. Provide total dry film thickness of entire system as recommended by manufacturer.
- E. Apply block fillers to concrete masonry block at rate to ensure complete coverage with pores filled.
- F. Before application of finish coats, apply prime coat as recommended by manufacturer to materials that have not been prime coated by others. Recoat primed and sealed surfaces where evidence of suction spots or unsealed areas in first coat appears, to assure finish coat with no burn through or other defects due to insufficient sealing.
- G. Completely cover to provide opaque, smooth surface of uniform finish, color, appearance, and coverage. Cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness, or other surface imperfections will not be acceptable.
- H. Match approved samples for color, texture, and coverage. Remove, refinish, or repaint work not in compliance with specified requirements.
- 3.8 FIELD QUALITY CONTROL:
- A. Owner reserves right to engage services of independent testing laboratory to sample paint material being used. Samples of material delivered to project may be taken, identified, sealed, and certified in presence of Contractor. Testing laboratory may perform appropriate tests as required by Owner.
 - B. If test results show material being used does not comply with specified requirements, Contractor may be directed to stop painting, remove noncomplying paint, pay for testing, repaint surfaces coated with rejected paint, and remove rejected paint from previously painted surfaces.

3.9 CLEANING:

- A. At end of each work day, remove empty cans, rags, rubbish, and other discarded paint materials from site.
- B. Upon completion of painting, clean glass and paint-spattered surfaces. Remove spattered paint by washing and scraping, using care not to scratch or damage adjacent finished surfaces.

3.10 PROTECTION:

- A. Protect work of other trades, whether to be painted or not, against damage by painting. Correct damage by cleaning, repairing or replacing, and repainting, as acceptable to Architect.
- B. Provide "wet paint" signs to protect newly painted finishes. Remove temporary protective wrappings provided by others for protection of their work after completion of painting operations. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

3.11 EXTERIOR PAINT SCHEDULE:

- A. Ferrous Metal: Primer is not required on shop-primed items.
 - 1. Full-Gloss Alkyd Enamel: 2 finish coats over primer.
 - a. Primer: Synthetic Rust-Inhibitive Primer
 - b. First Coat: Alkyd Glass Enamel
 - c. Second Coat: Alkyd Glass Enamel

3.12 INTERIOR PAINT SCHEDULE:

- A. Concrete Masonry Units:
 - 1. Semigloss Alkyd Enamel Finish: 2 coats over filled surface with dry film thickness not less than 3.5 mils, excluding filler coat.
 - a. Block Filler: High-Performance Latex Block Filler
 - b. Undercoat: Interior Enamel Undercoat.
 - c. Finish Coat: Interior Semigloss Odorless Alkyd Enamel
- B. Gypsum Drywall Systems:
 - 1. Odorless Semigloss Alkyd Enamel Finish: 3 coats with total dry film thickness not less than 2.5 mils.
 - a. Primer: Interior Latex-Based White Primer

- b. First Coat: Interior Semigloss Odorless Alkyd Enamel
 - c. Second Coat: Interior Semigloss Odorless Alkyd Enamel
- C. Ferrous Metal:
- 1. Semigloss Enamel Finish: 2 coats over primer with total dry film thickness not less than 2.5 mils.
 - a. Primer: Synthetic Rust-Inhibiting Primer
 - b. Undercoat: Interior Enamel Undercoat
 - c. Finish Coat: Interior Semigloss Odorless Alkyd Enamel
- D. Zinc-Coated Metal:
- 1. Semigloss Finish: 2 coats over primer, with total dry film thickness not less than 2.5 mils.
 - a. Pretreatment: Solvent wipe
 - b. Primer: Galvanized Metal Primer
 - c. Undercoat: Interior Enamel Undercoat
 - d. Finish Coat: Interior Semigloss Odorless Alkyd Enamel

END OF SECTION 09 3000

SECTION 23 0501 - GENERAL HVAC REQUIREMENTS

PART 1 - GENERAL

1.1 SCOPE OF WORK:

- A. The Heating, Ventilation, and Air Conditioning (HVAC) work shall include, but not be limited to, the following:
 - 1. Heating systems
 - 2. Air Conditioning
 - 3. Air Distribution
 - 4. Controls and Instrumentation
 - 5. Balancing of Air Systems

1.2 RELATED DOCUMENTS:

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 specification sections, apply to this section.
- B. All sections of Division 23 specifications apply to this section.

1.3 DELINEATION OF WORK:

- A. Provide all necessary coordination of information to installers who are performing work to accommodate Division 23 installations.
- B. Where the Division 23 installer is required to install items which they do not purchase, they shall include for such items:
 - 1. The coordination of their delivery.
 - 2. Their unloading from delivery trucks driven in to any designated point on the property line at grade level.
 - 3. Their safe handling and field storage up to the time of permanent placement in the project.
 - 4. The correction of any damage, defacement or corrosion to which they may have been subjected.
 - 5. Their field assembly and internal connection as may be necessary for their proper operation.

6. Their 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 systems including the purchase and installation of all terminating fittings necessary to adapt and connect them to the building systems.
- C. Items which are to be installed by the Division 23 installer but not purchased as part of the work of Division 23 shall be carefully examined upon delivery to the project. The Division 23 installer shall provide all work necessary to properly install these items.
 - D. If any items have been received in such condition that their installation will require additional work beyond the project scope of the work, the A/E shall be notified in writing within 10 working days of the date of delivery of the items. Any claims beyond 10 days will not be considered by the A/E.

1.4 QUALITY ASSURANCE:

- A. All equipment and materials required for installation under these specifications shall be new and without blemish or defect. All equipment shall bear labels attesting to Underwriters Laboratories approval where subject to Underwriters Laboratories label service. Where no specific indication as to the type or quality of material or equipment is indicated, a first-class standard article shall be furnished. All manufacturers of equipment and materials pertinent to these items shall have been engaged in the manufacture of said equipment a minimum of three (3) years and, if so directed by the Engineer, be able to furnish proof of their ability to deliver this equipment by submitting affidavits supporting their claim.
- B. Each major component of equipment shall have the manufacturer's name, address, model number and rating on a plate securely affixed in a conspicuous place. The nameplate of a distributing agent will not be acceptable. ASME Code Ratings, UL label, or other data which is die-stamped into the surface of the equipment shall be stamped in a location easily visible. Performance as delineated in schedules and in the specifications shall be interpreted as minimum performance.
- C. All equipment of one type (such as fans, pumps, valves, grilles, etc.) shall be the products of one manufacturer unless specifically stated otherwise.
- D. Where the specifications do not list a specific model number for a manufacturer, the construction of a product shall be equal to those models specifically listed.
- E. All materials with a manufacturers listed shelf life shall be used at least six months prior to the expiration of the materials' shelf life.

1.5 REQUIREMENTS OF REGULATORY AGENCIES:

- A. Submit all items necessary to obtain all required permits to the appropriate Regulatory Agencies, obtain all required permits, and pay all required fees.

- B. Where Codes and Standards are referenced, they shall be the date stated in these specifications or on the drawings. If none stated, they shall be the latest edition.
- C. All work shall conform to the following Building Codes:
 - 1. International Building Codes
 - 2. National Fire Protection Association
- D. All work shall conform to all federal, state, and local ordinances.
- E. Where applicable, all fixtures, equipment, and materials shall be as approved or listed by the following:
 - 1. Factory Mutual Laboratories (FM)
 - 2. Underwriters Laboratories, Inc. (UL)
- F. All fuel fired equipment shall meet the requirements of the insurers and agencies listed and also meet the owner's insurer requirements.

1.6 STANDARDS AND PROCEDURES

- A. All work shall meet or exceed the standards and procedures of the following:
 - 1. ADC: Air Diffusion Council
 - 2. AGA: American Gas Association
 - 3. AMCA: Air Moving and Conditioning Association, Inc.
 - 4. ANSI: American National Standards Institute
 - 5. ASHRAE: American Society of Heating, Refrigerating and Air Conditioning Engineers
 - 6. ASME: American Society of Mechanical Engineers
 - 7. ASTM: American Society of Testing and Materials
 - 8. IBR: Institute of Boiler and Radiator Manufacturers
 - 9. MSS: Manufacturers Standardization Society
 - 10. NBBPVI: National Board of Boiler and Pressure Vessel Inspectors
 - 11. NEMA: National Electrical Manufacturer's Association
 - 12. OSHA: Occupational Safety & Health Administration

13. SMACNA: Sheet Metal and Air Conditioning Contractors National Association, Inc.
14. IRM: Improved Risk Mutuals

1.7 APPROVAL OF SUBSTITUTIONS:

- A. Specific reference in the specifications to any article, device, product, materials, fixture, form or type of construction, etc., by name, make, or catalog number, with or without the words "or equal", shall be interpreted as establishing a standard of quality and shall not be construed as limiting competition. The Contractor in such cases may, at his option, use any article, device, product, material, fixture, form or type of construction which, in the judgment of the A/E expressed in writing, is equal to that named. Where quality and other characteristics are very nearly the same, the question of determining equal materials and readily available service sometimes resolves itself to a matter of personal opinion and judgment and in these and all other cases involving the approval of materials, the opinion, judgment and decision of the A/E shall be final and bind all parties concerned.
- B. Requests for written approval to substitute materials or equipment considered by the Contractor as equal to those specified shall be submitted for approval in writing ten (10) calendar days prior to bid opening date to the A/E. Requests shall be accompanied by samples, literature, and information as necessary to fully identify and allow appraisal of the material or equipment. Submittals shall be concise, clear, and brief as possible. Incomplete submittals or submittals requiring lengthy research to ascertain quality will not be considered.
- C. Approval of the A/E to use materials or equipment, if granted, will be in the form of a written addendum. Approved substitutions may be used at the Contractor's option. No substitutions will be allowed if substitutions are requested later than ten (10) days prior to bid opening date.
- D. Items approved shall not be construed as authorizing any deviations from the plans and specifications unless such deviations are clearly indicated in the form of a letter that is enclosed with the submittals. The Contractor shall be responsible for verifying all dimensions with available space. If, in the opinion of the A/E, the physical dimensions do not permit the substituted material or equipment to be properly operated, maintained, serviced, or otherwise accessed, or the physical dimension adversely impact other components, a system's ability to be operated, maintained, serviced or otherwise accessed, the material or equipment shall be replaced at the Contractor's expense.

1.8 VERIFICATION OF DIMENSIONS AND LOCATIONS:

- A. The Contractor shall visit the facility and become thoroughly familiar with all details of the work, working conditions, dimensions and clearances.
- B. Notify the A/E of any discrepancy between actual conditions and conditions indicated on the contract documents that could cause changes, other than minor ones, to the installation of any systems or equipment.

1.9 EQUIPMENT CONNECTIONS:

- A. The contract documents may indicate specific electrical, duct, and piping connection locations to equipment. Each manufacturer approved for bidding may have different connection arrangements. The Contractor is responsible for the modifications to and the extension of connecting components as required for the equipment provided.
- B. The Contractor shall bear all costs for required changes in connection to equipment.

1.10 ROOFTOP EQUIPMENT LOCATIONS:

- A. Rooftop equipment shall not be located within ten (10) feet of the roof edge. Notify the A/E in writing of any discrepancy on the plans and the ten (10) foot requirement prior to roughing-in equipment.
- B. All roof mounted equipment shall be located so as to provide for clearance all around and above each unit equal to or greater than that recommended by the unit manufacturer's suggested services and operating clearances. Notify the A/E in writing of any circumstances that would prevent proper clearances from being provided prior to roughing-in equipment.

1.11 WORKMANSHIP:

- A. Workmen shall be thoroughly experienced and fully capable of installing the work. Work shall be in accordance with the best standard practice of the trade. Work that is not of good quality will require removal and reinstallation at no additional expense to Owner.
- B. All material and equipment to be installed in accordance with manufacturer's printed recommendations using recommended accessories. Retain a copy on job site and submit others for approval when required.

1.12 GUARANTEES AND WARRANTIES:

- A. General:
 - 1. Furnish to the A/E a guarantee form, included in these specifications, signed by the Contractor and Owner agreeing to the start and end dates of all systems and equipment under warranty.
 - 2. All defective materials or inferior workmanship shall be replaced or repaired as directed by the Owner's representative during the guarantee period.
- B. Equipment Warranties:
 - 1. Equipment shall be warranted by the equipment manufacturer. Where labor is included in the warranty, the manufacturer, at their option, may permit the contractor to provide the required repairs on the equipment unless specified otherwise.
 - 2. The equipment manufacturer shall include a written guarantee with the closeout documentation.

C. Duration Period:

1. For work not otherwise specified, the duration shall be one year from substantial completion including all parts, labor, and other charges.
2. The Contractor is responsible for purchasing from the equipment manufacturers any additional warranties to ensure that the equipment is warranted by the manufacturer through the duration period specified.

D. Extended Warranties:

1. Warranty periods shall be extended where specifically stated in these specifications.
2. The extended warranties shall meet the requirements of the base warranty unless specifically noted otherwise.
3. The extended warranty time listed is time in addition to the base warranty period.
4. The following systems or equipment shall be extended warranties:
 - a. The environmental control system shall have a one year extended warranty.
 - b. The building automation system shall have a one year extended warranty.
 - c. Variable frequency drives shall have a one year extended warranty.
 - d. All air conditioning compressors shall be provided with an extended 4-year warranty, including parts and delivery charges. Centrifugal and rotary compressors shall include motor, impeller or screw, and drive train.

E. Non-Warranted Items:

1. Non durable replaceable items such as air filter media do not require replacement after the date of acceptance.

F. Warranty Repair:

1. Repair shall take place as soon as possible but not later than the following:
 - a. Items not essential for facility operation - 7 days.
 - b. Items that have a small impact on facility operation - 2 days.
 - c. Items that have a significant impact on the facility operation - immediately begin repairs or work necessary to minimize operational impact to Owner.

2. The determination of the impact on the facility is solely that of the Owner and A/E.
3. Where life safety issues are impacted, the contractor shall take all steps necessary to ensure the facility can continue to function in a safe manner.
4. If repairs cannot be made in the required time period, temporary systems shall be installed until repairs can be completed.
5. All costs associated with warranty work shall be borne by the contractor.

1.13 EXISTING FACILITIES:

- A. The location of duct, pipe, fixtures, equipment and appurtenances for existing facilities are shown on plans to indicate the extent of work required. Exact condition shall be field verified by the contractor.
- B. Work shall be performed above existing ceilings except where removal of existing ceilings is specifically identified. Where working above existing ceilings, remove existing tile/grid and reinstall existing tile/grid as necessary. Any damaged tile/grid shall be replaced at the contractor's expense.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 PRIOR CONDITIONS:

- A. Prior to the installation of any equipment or system component, the Contractor shall review any prior work that has been completed to accommodate the equipment or system component to be installed.
- B. If the prior work does not make a proper installation of any equipment or system component possible, notify the A/E prior to installation of any equipment or system component.

3.2 INSTALLATION:

- A. Install all equipment and appurtenances in strict accordance with the manufacturer's recommendations and the manufacturer's shop drawings.
- B. If any equipment cannot be installed in accordance with Codes, contract documents, manufacturer's recommendations and accepted practices, notify the A/E in writing prior to installation of equipment.
- C. If any system component cannot be installed in accordance with Codes, contract documents and accepted practices, notify the A/E in writing prior to installation of the system component.

3.3 PROTECTION OF SYSTEMS AND EQUIPMENT:

- A. Protect all materials and equipment from damage during storage at the Site and throughout the construction period. In the event of damage prior to final inspections, repair or replace damaged items as determined by the A/E, at no cost to the Owner.
- B. Store equipment on elevated supports and cover them on all sides with securely fastened waterproof coverings. All equipment openings shall be securely sealed.
- C. Piping shall be protected by storing it on elevated supports and capping the ends.
- D. During construction, all open ends of pipe, etc. which could collect construction debris shall be properly capped.

3.4 CLEANING OF SYSTEMS AND EQUIPMENT:

- A. All equipment and systems shall be cleaned of all extraneous materials to leave equipment and system finish in a new condition.
- B. Where equipment and systems cannot be properly cleaned, take all measures necessary to replace or repair equipment and systems to bring back to a "like new" condition. All costs shall be borne by the Contractor.
- C. All extraneous materials shall be removed on the site on a regular basis to provide access to all work as well as a safe working environment.

3.5 SUPPORT OF SYSTEMS:

- A. Hanging duct, piping, or equipment from un-reinforced metal decks (i.e., metal roof deck w/o concrete), wood decks, etc. is not permitted.
- B. The following methods of support are not permitted:
 - 1. Wire hangers unless specifically indicated
 - 2. Perforated straps
 - 3. Vinyl or plastic straps

END OF SECTION 23 0501

SECTION 23 0502 - COMMON HVAC MATERIALS

PART 1 - GENERAL

1.1 SCOPE OF WORK:

A. General:

1. Furnish all labor, materials, tools, and equipment and perform all operations in connection with the installation of the mechanical systems where shown on the drawings and specified hereinafter.

B. Description:

1. Rooftop curbs shall include all supports for rooftop equipment, pipe, duct, air handling equipment and accessories.

1.2 RELATED DOCUMENTS:

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 specification sections, apply to this section.
- B. All sections of Division 23 specifications apply to this section.

1.3 QUALITY ASSURANCE:

- A. All work shall meet or exceed the standards and procedures (latest edition) of the following:

1. AISC Steel Handbook

- B. All work shall be applicable by mechanics normally employed in the trade. All work shall be installed in accordance with the manufacturer's recommendations.

C. Manufacturers:

1. The following caulking manufacturers are acceptable:

- a. TREMCO
- b. Sonneborn - Contech
- c. W. R. Meadows

2. The following acoustical sealant (gypboard) manufacturers are acceptable:

- a. USG
- b. Approved equal

PART 2 - PRODUCTS

2.1 PRODUCT REFERENCES:

- A. Unless specifically indicated otherwise, the following products or product accessories shall be provided with the indicated equipment.
 - 1. Filters shall be provided on all air systems to protect heat transfer components from outside air, building exhaust air or other airstreams that could foul heat transfer surfaces and elsewhere as indicated. Refer to Particulate Air Filtration specification.

2.2 FLASHING:

- A. General:
 - 1. Provide flashing and counter flashing on all pipes, ducts, flues, conduits, and other mechanical system components which penetrate exterior walls or roofs.
 - 2. Flashing sizes where shown are minimum sizes but in no case shall they be less than size required by roofing manufacturer.
- B. HVAC Ducts:
 - 1. See detail on plans.
 - 2. Flashing of duct shall be fabricated from 20 gauge stainless steel sheets.

2.3 HVAC ROOF CURBS:

- A. Required Locations:
 - 1. Provide roof curb for all rooftop mechanical systems or components including, but not limited to, the following:
 - a. Rooftop units
 - b. Elsewhere as indicated
- B. Height:
 - 1. Curbs shall be height indicated, 18 inches high, or 8 inches above top of finished roof, whichever is greater.
 - 2. Curb shall be sloped as required to maintain a level surface for the equipment.
- C. Curb Construction:
 - 1. Curb shall be manufactured specifically for the roof type on which it is to be installed.

2. Curb shall be continuously welded.
3. Curb shall have 1-1/2 inch internal rigid insulation with 1/8 inch gasket between top of curb and equipment.
4. Curbs shall be galvanized.
5. Curbs shall be minimum 18 gauge.
6. Provide an angle on bottom of air handler curbs all around for attachment of sound barrier material.
7. Height of curb shall be coordinated with sound attenuator sizes where sound attenuators are required.
8. Where indicated on the drawings, curbs shall be provided with a service platform that is supported off of the curb.

D. Adapter Roof Curbs:

1. Provide an adapter curb on top of existing roof curb where required.
2. Provide 1/8 inch gasket between top of existing curb and new curb and between the new unit and adapter curb.
3. Blanked off section of adapter curb, if any, shall be sloped 1/8" per foot away from unit.
4. Curb shall have 1-1/2" internal elastomeric or rigid insulation and be structurally designed with cross bracing when required.
5. Adapter curbs shall be designed to allow the supply and return connections of the new units to transition to the existing supply and return connections.

2.4 CURB DESIGN:

- A. Curb shall meet or exceed the greater of the seismic requirements and wind load requirements for this project. If no wind loads are indicated on mechanical or structural plans, the supplier shall assume 130 MPH wind load.
- B. Design shall be reviewed by a registered professional engineer licensed in the state in which the project is located. The engineer's seal and signature shall be indicated on the submittals.
- C. The design shall include but not be limited to:
 1. Weight of load
 2. Type of load (point load, center load, end reaction, etc.)
 3. Safety factor (minimum of 2)

4. Curb support bearing (beam, joist, concrete roof, etc.)
5. Platform load and attachment

2.5 SERVICE PLATFORM DESIGN:

- A. Platform shall be factory designed and fitted.
- B. Platform shall meet or exceed the greater of the seismic requirements and wind load requirements for this project.
- C. Design shall be reviewed by a registered professional engineer licensed in the state in which the project is located. The engineer's seal and signature shall be indicated on the submittals.
- D. Main Base Frame:
 1. Frames shall be fully welded and all welds shall be coated with Zinc-Rich Primer: SSPC-Paint 20 Type II or equal. Base frame shall have ¼" thick angle frame support for tread plates.
 2. Welded mounting cups shall be provided for handrails.
 3. Pre-punched mounting holes and water weep holes shall be located around the perimeter of the entire base.
 4. System shall be broken into bolt on sections not to exceed 10 feet in length to allow easy installation.
 5. Base frames shall have fully adjustable braces for leveling. Braces shall mount to the curb to eliminate roof penetrations. No contact shall be made with the roof.
 6. Frame shall be hot dipped galvanized.
- E. Tread Plates:
 1. 14ga (min.) steel double broke and box folded to create a rigid walking surface.
 2. Tread plate shall be factory punched and formed to create a non-slip surface.
 3. Tread plates shall be removable.
 4. Tread plate edges shall be coated with Zinc-Rich Primer: SSPC-Paint 20 Type II or equal.
- F. Railing:
 1. 14ga galvanized 1.625" diameter tubing with 42" tall top rail, 21" tall midrail and 4" tall toe kick to meet OSHA standards.

2. Handrails shall be removable.
3. Railing shall be hot dipped galvanized.

2.6 HOUSEKEEPING PADS:

A. General:

1. Housekeeping pads shall be constructed of concrete and shall meet the requirements of the Concrete specifications.
2. Concrete shall develop a minimum strength 3000 psi at 28 days or as specified in the concrete specification, whichever requirement is greater.
3. Housekeeping pads shall extend six inches past equipment and supports in all direction.

B. Pads (exterior):

1. All equipment installed on grade and on the exterior of buildings shall be provided with a reinforced concrete housekeeping pad.
2. Pad shall be minimum six inches thick and four inches above finished grade.

2.7 DRAINS:

A. General:

1. Drain shall be full size of connections, size indicated on drawings, or 3/4" minimum, whichever is largest.

B. Equipment and Miscellaneous Drains:

1. Provide drains with deep seal p-trap for all equipment provided with drain connections, where drain connections are indicated on the drawings, and when drains required for proper operation of a system.

2.8 EQUIPMENT AND MISCELLANEOUS VENTS, RELIEFS, AND OVERFLOWS:

- A. Provide vents, reliefs, and overflows for all equipment provided with these connections, where indicated on plans, and when needed for proper system operation.
- B. Vent, relief, and overflows shall be run full size of connection or size indicated on drawings, whichever is larger.

2.9 FASTENERS, ANCHORS, AND ACCESSORIES:

- A. Unless indicated otherwise, all fasteners, anchors, and accessories shall be metallic and manufactured in the United States.
- B. Materials provided shall be considered industry standard for commercial or industrial use.

- C. All materials shall be installed in accordance with the manufacturer's recommendations for the intent use and application.
- D. Materials installed outdoors, in attics, in crawl spaces, in tunnels and other areas exposed to ambient temperature or humidity shall be stainless steel or hot dipped galvanized.
- E. Unless otherwise specified or required by the manufacturer, bolts shall meet or exceed the following strengths:
 - 1. Proof Load: 74 ksi
 - 2. Yield Strength: 81 ksi
 - 3. Tensile Strength: 105 ksi

2.10 SEALANT:

- A. Exterior joint sealant shall be polyurethane base, multi-component; self-leveling type for application in vertical joints; capable of withstanding movement of up to 50% of joint width and satisfactorily handled throughout temperature of 4 to 27 degrees C.; uniform, homogeneous, and free from lumps, skins and coarse particles when mixed; Shore "A" hardness of minimum 15 and maximum 50; non-staining; non-bleeding.
- B. Color shall be approved by A/E.

2.11 ACOUSTICAL SEALANT (GYPBOARD):

- A. General:
 - 1. Acoustical sealant shall be provided at penetrations of all non-rated assemblies.
 - 2. Product shall be latex based and bond with porous and non-porous materials.
 - 3. Product shall be permanently resilient.
- B. Properties:
 - 1. Flame spread: 0
 - 2. Smoke spread: 0
 - 3. Viscosity: 250K - 400K CPS
- C. Manufacturer shall be:
 - 1. USG Sheetrock Brand Acoustical Sealant

2.12 EXTRA FAN SHEAVE AND BELTS:

- A. Provide one extra fan sheave and one extra belt set for each belt driven fan.

- B. The sheaves and belts shall be similar to the original supplied sheaves and belts and shall be selected by the sheave manufacturer.
- C. The sheaves shall not be selected where the fan operates at a speed exceeding the fan's maximum RPM or the motor's amperage rating.
- D. The sheave for fans controlled by a variable frequency drive shall be selected so that the fan can operate as close to maximum RPM as long as motor maximum FLA's are not exceeded.

2.13 VOC's (ADHESIVES, SEALANTS, AND SEALANT PRIMERS):

- A. All adhesives, sealants, and sealant primers shall meet the latest requirements of LEED or Green Globes or the following, whichever has the lower values:
 - 1. Substrate Applications:
 - a. Metal to Metal - 30 g/L
 - 2. Specialty Applications:
 - a. PVC welding – 510 g/L
 - b. CPVC welding – 450 g/L
 - c. ABJ welding – 325 g/L
 - d. Plastic cement welding – 250 g/L
 - e. Adhesive primer for plastic – 550 g/L
 - f. Sheet applied rubber lining – 850 G/L
 - g. Contact adhesive – 80 g/L
 - 3. Insulation:
 - a. Duct - 50 g/L
 - b. Piping - 50 g/L
- B. The VOC limits are g/L less water.
- C. Adhesives, sealants, and sealant primers shall comply with the South Coast Air Quality Management District (SCAQMD) Rule #1168.

PART 3 - EXECUTION

3.1 ROOF CURBS AND SERVICE PLATFORMS:

- A. Submit shop drawings with structural engineering calculations for wind and platform design.
- B. Curbs and platforms shall be installed to maintain a level surface plus or minus 1/4 inch for length of curb.
- C. Field verify the size of an existing curb prior to fabricating adapter curb.
- D. Field verify the slope of an existing curb prior to fabricating the adapter curb.
- E. Provide curb seal or gasket on all equipment curbs.

3.2 EQUIPMENT STORAGE:

- A. Facilities for storing materials and equipment shall be provided by the Contractor.
- B. All equipment and materials shall be protected from ambient conditions including freezing and exposure to sunlight when these conditions could affect the product.
- C. All stored items shall be elevated off slab or grade.

3.3 HOUSEKEEPING PADS:

- A. All exposed surfaces shall be steel troweled smooth with beveled edges.
- B. Pad shall be level within 1/16 inch for the length and width of the pad.
- C. Provide all required foundation bolts, washers, sleeves, plates, templates, etc., for mechanical equipment. Foundation bolts shall be embedded in concrete, set in place before concrete is poured and securely held in place with templates.
- D. Furnish shop drawings showing all required hanger bolts and other appurtenances necessary for the proper installation of this equipment. All such work shall be shown in detail on the shop drawings, showing the complete details of all foundations including necessary concrete and steel work, fasteners and vibration isolation devices.
- E. Set all equipment on their foundations and shim level with steel shims and grout up under base for uniform bearing.
- F. Equipment shall be fastened to housekeeping pads as required by seismic design.
- G. Housekeeping pad shall be anchored to the structural slab as required by seismic design or as indicated by structural or mechanical details, whichever requirement is greater.

3.4 ACCESS DOORS IN FINISHED CONSTRUCTION:

- A. Provide a schedule with location and type to the installing contractor.
- B. Coordinate required location of all access panels with installing contractor.

3.5 DRAINS:

A. General:

1. All horizontal gravity drain piping shall be installed with a uniform grade of not less than 1/8" per foot of fall in direction of flow except as noted otherwise.

B. Equipment and Miscellaneous Drains:

1. Run drain to roof drain or storm drain if not indicated otherwise on plans.

3.6 EQUIPMENT AND MISCELLANEOUS VENTS, RELIEFS, AND OVERFLOWS:

- A. Run vents and reliefs to location indicated on plans or, if none indicated, to a location where they can discharge safely without presenting a hazard to personnel. Terminate with appropriate fitting.

- B. Run overflow similar to drain.

3.7 EXTERIOR SEALANT:

- A. Submit color charts to A/E.

3.8 EQUIPMENT PENETRATIONS:

- A. Seal all openings into equipment resulting from installation of equipment such as conduit and flex.

3.9 EQUIPMENT INSTALLATION:

- A. Repair all insulation damaged during installation of equipment.

3.10 EXTRA FAN SHEAVE AND BELTS:

A. Installation:

1. Install second sheave and belts when required for the fan to meet the specified performance.

3.11 EQUIPMENT ATTACHMENT:

- A. Equipment shall be secured to the building or structure. Where equipment is provided with a method of attachment, that method shall be used to attach the equipment. Where equipment is not provided with a method of attachment, the contractor shall add gussets, angles, or similar material to the unit without affecting the performance or warranty of the equipment, which shall be used to attach the equipment.

END OF SECTION 23 0502

SECTION 23 0503 - DEMOLITION, PATCHING AND REPAIR

PART 1 - GENERAL

1.1 SCOPE OF WORK:

A. General:

1. Furnish all labor, materials, tools and equipment and perform all operations in connection with the demolition of all mechanical equipment, piping, duct, and appurtenances where indicated or shown on the drawings and specified hereinafter.
2. Furnish all labor, materials, tools and equipment and perform all operations in connection with the patching and repair of building structure, finishes and building assemblies as specified hereinafter.
3. All existing utilities, controls, etc. shall be reconnected to new systems as required to maintain the same functions as existed prior to new work.

B. Descriptions:

1. Cut openings thru the existing building walls, roof, floors, and finishes to accommodate the installation of Division 23 equipment, controls, piping, and appurtenances.
2. Remove and dispose of existing HVAC equipment, piping, and appurtenances.
3. Patch and repair all building finishes, structural components, or other appurtenances that are removed or damaged as a result of the performance of this contract. Patch and repair work shall include finishes, components, substructure and materials required for the installation of such work in accordance with standard practices.
4. All penetrations thru exterior walls, floors, and roof systems shall be sealed watertight.
5. Patched and repaired work shall be finished to match existing or adjacent construction and conditions.

1.2 RELATED DOCUMENTS:

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 specification sections, apply to this section.
- B. All sections of Division 23 specifications apply to this section.

PART 2 - EXECUTION

2.1 GENERAL:

- A. Post tensioned slabs, beams, columns and other load bearing structures shall not be drilled, cut, or otherwise modified without written approval by structural engineer.

2.2 PROTECTION:

- A. Provide barricades and take all other precautionary measures necessary to protect personnel and property.
- B. The Contractor shall be responsible for any damages to adjacent areas to the construction area.
- C. Areas not included in the scope of work, areas where work is minimal, and, in the case of a phased contract, areas which remain inactive for long periods shall be protected from the area in which the work is being performed by a slab to slab barrier acceptable to engineer and local authorities.
- D. Protect the roof at all times. Provide planking, plywood, supports, and other materials and means to ensure damage is not incurred.
- E. At no time shall required means of egress be blocked by equipment materials, permanent or temporary barriers.

2.3 COORDINATION:

- A. All demolition work which will interrupt building utilities or cause the disruption of the normal environment in areas of the building not within the scope of this project will be performed at other than the Owner's normal working hours.

2.4 PENETRATIONS:

- A. All round penetrations shall be core drilled. All other penetrations shall be saw cut. Openings shall not be larger than required for proper installation of pipe or duct.

2.5 MATERIAL REMOVAL:

- A. The Owner shall retain first right of refusal on all existing equipment, piping, and appurtenances which are to be removed as a result of this contract.
- B. Coordinate demolition work with Owner using extreme care not to damage existing equipment which Owner elects to retain.
- C. Remove Owner retained equipment from existing location and store equipment at a location on the site where specified by Owner.
- D. All material, equipment, supports, and appurtenances not required as the result of demolition to or renovation of the building systems shall be removed from the project site and disposed of properly unless retained by Owner.

END OF SECTION 23 0503

SECTION 23 0510 - DOCUMENTATION AND CLOSEOUT

PART 1 - GENERAL

1.1 SCOPE OF WORK:

- A. Furnish all labor, materials, tools and equipment and perform all operations in connection with the project documentation and closeout.

1.2 RELATED DOCUMENTS:

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 specification sections, apply to this section.
- B. All sections of Division 23 specifications apply to this section.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 GENERAL:

- A. All reports, forms, and manuals shall be submitted to the A/E in triplicate unless additional copies are noted.
- B. Report, forms, and manuals are to be submitted as soon as possible, but no later than thirty (30) days after the earliest date they can be prepared.

3.2 OWNER TRAINING:

- A. The contractor shall schedule the training on equipment and systems at least 21 days before training is to take place. The contractor shall provide multiple dates and times for the training to allow the Owner to coordinate the schedules of their staff to be trained.
- B. The contractor shall provide all training aids, manuals, etc. for the Owner's staff at the training classes. These are in addition to whatever is required for the Operations and Maintenance manuals. The contractor shall coordinate the number required with the Owner but shall include a maximum of 8 sets for the training class.
- C. The person providing the training shall be thoroughly knowledgeable in the subject matter.

3.3 PROJECT JOB DRAWINGS AND AS-BUILT DRAWINGS:

- A. Keep a record set of drawings on the job and, as construction progresses, shall show the actual installed location of all items, material, and equipment on the project job drawings.
- B. At the time of final inspection, one corrected set of prints shall be delivered to the A/E. All drawing costs to be by the Contractor.

- C. As built drawings shall have the information transferred from the project job drawings including all addendum, supplemental instructions, change orders, and similar information.
- D. Qualified draftsmen shall perform this task.

3.4 OPERATING AND MAINTENANCE MANUAL:

- A. Compile and bind three (3) sets of all manufacturer's instructions and descriptive literature on all items of equipment furnished under this work. Additionally, provide this information on a CD in PDF format.
- B. Binder shall be hard cover, three-ring notebook, embossed with the name of the project, 11" x 8-1/2" with heavy duty rings. Maximum binder size shall be 2-1/2". Use multiple binders as necessary.
- C. The spine of the binder shall be titled "HVAC Operating and Maintenance Manual, Volume No. X," with the name of the project and the date under the title.
- D. The Operating and Maintenance Manual shall include the following:
 - 1. Cover sheet in each binder listing the architect, engineer, and all contractors. List addresses and contact information.
 - 2. List name, address and phone number of organization responsible for warranty work, if other than Contractor, and the specific work for which he is responsible.
 - 3. List name, address and phone number of the nearest sales and the nearest service organization for each product.
 - 4. Schedules of all equipment including identification tag numbers shown on plans cross referenced to field applied identification tag numbers.
 - 5. Performance Curves: For fans and similar equipment at the operating conditions.
 - 6. Lubrication Schedule: Indicating type and frequency of lubrication required.
 - 7. List of Spare Parts: Recommended for normal service requirements. Each piece of equipment shall have this list clearly marked or attached to this submittal.
 - 8. Parts List: Identifying the various parts of the equipment for repair and replacement purposes.
 - 9. Instruction Books: May be standard booklets but shall be clearly marked to indicate applicable equipment and characteristics.
 - 10. Wiring Diagrams: Generalized diagrams are not acceptable, submittal shall be specifically prepared for this Project.
 - 11. Automatic Controls: Diagrams and functional descriptions.

12. All factory test reports where factory tests specified.
 13. All start-up reports for all equipment.
 14. Test and balance report.
 15. Filter size list for each piece of equipment. Identify filter type, size, efficiency, and equipment tag.
 16. Ceiling marker schedule.
- E. The following diagrams, schematics, and lists shall be provided:
1. Automatic control diagrams
 2. Sequences of operation
- F. When the test and balance report is over 50 pages, they shall be provided in a separate manual.

3.5 ENGINEERING FIELD REPORTS AND FINAL INSPECTION REPORTS:

- A. The A/E will review the Contractor's work periodically throughout the project. A report will be submitted to the Contractor.
- B. The reports shall be responded to within ten days of receipt by the Contractor. Each item shall be addressed with comments written on the inspection report if possible. Contractor's response shall address the status of each item and all discrepancies.

3.6 OPERATION AND MAINTENANCE INSTRUCTIONS:

- A. After all final tests and adjustments have been completed, the Owner's Representatives shall be instructed in all details of operation and maintenance for the systems installed.
- B. Instruction periods shall be as designated by the Owner and shall not necessarily be consecutive.
- C. Fifty percent of instructions shall be in a formal classroom setting.
- D. Instruction shall be provided as follows:
 1. Equipment: Trained factory representative
 2. System: Competent employee of the Contractor

3.7 CONTROLS OPERATION AND MAINTENANCE INSTRUCTIONS:

- A. Upon completion of Operation and Maintenance instructions, the Owner's representative shall be instructed in all details of operation and maintenance for the controls installed.

- B. Controls Operation and Maintenance Instruction shall include the entire control system including control sequences that are inherent to equipment provided by the Equipment Manufacturer including economizer cycles, burner operation, low ambient operation, freezestats and similar sequences. Provide sufficient personnel equipment, walkie-talkies, gauges, and other accessories for this work.
- C. Instruction periods shall be as designated by the Owner and shall not necessarily be consecutive.
- D. Fifty percent of instructions shall be in a formal classroom setting.
- E. Instruction shall be provided as follows:
 - 1. Controls System: Competent employee of the controls installer

3.8 ACCEPTANCE:

- A. Upon notification by the Contractor and after completion of Operation and Maintenance Instructions, the A/E will visit the project for a demonstration of the building system and an inspection of the completed work.
- B. Items which do not comply with the Contract Documents or which function incorrectly will be listed. The list will be provided by the A/E to the Contractor for correction of the installed work.
- C. After all corrections have been made, the Contractor shall notify the A/E who will recheck the systems for compliance of all items listed.

PART 4 - STANDARD FORMS

4.1 GENERAL:

- A. All forms shall be completely filled out by the Contractor prior to acceptance of the project by the A/E.

4.2 HVAC CLOSEOUT LIST:

HVAC CLOSEOUT DOCUMENT PROJECT: <u>FMSD Fort Mill High School</u> BGA PROJECT NO.: <u>20051</u>		
DOCUMENT	DATE REVIEWED	COMMENTS
Preliminary Test and Balance (Airside)		
Test & Balance (Airside)		
HVAC O&M Manuals (3 sets plus CD)		
As installed Control Drawings		
HVAC marked-up As-Builts (1 set red lined)		
Equipment Start-Up Reports		
Filter List		
Punchlist dated _____		
Punchlist dated _____		
Punchlist dated _____		
Walk-Through with Owner		
NOTE: Not all closeout documents may be listed. See other sections of specifications for additional requirements.		

4.3 HVAC INSTRUCTIONS TO OWNER:

HVAC INSTRUCTIONS TO OWNER PROJECT: <u>FMSD Fort Mill High School</u> BGA PROJECT NO.: <u>20051</u>					
INSTRUCTIONS	DATE/TIME SCHEDULED	MINIMUM SPECIFIED HOURS	ESTIMATED HOURS OF INSTRUCTION	PERSONS ATTENDING	COPY OF SIGN-IN LIST SENT TO BGA
Air Handler VFD's					
Controls					
Packaged Units					
HVAC General					
Bipolar Ionization					
<p>NOTE: Not all instructions may be listed. See other sections of specifications for additional requirements. Up to 8 sets of training material required. Provide per number of persons indicated. Where no minimum specified hours indicated, training shall be provided as necessary for technician to provide the Owner a good understanding of the operation, function, and maintenance requirements of the equipment or system installed.</p>					

4.5 INSTRUCTIONS TO OWNER:

OWNER INSTRUCTIONS SIGN-IN SHEET PROJECT: <u>FMSD Fort Mill High School</u> BGA PROJECT NO.: <u>20051</u>				
SYSTEM/EQUIPMENT:	DATE	TIME		LOCATION:
		START	FINISH	
INSTRUCTORS (PRINT NAME AND SIGN) 1. _____ 2. _____				
ATTENDEES (PRINT NAME AND SIGN) 1. _____ 2. _____ 3. _____ 4. _____ 5. _____ 6. _____ 7. _____ 8. _____				
WRITTEN MATERIALS PROVIDED TO ALL ATTENDEES: _____ YES _____ NO INSTRUCTIONS IN CLASSROOM: _____ YES _____ NO INSTRUCTIONS IN FIELD: _____ YES _____ NO				

END OF SECTION 23 0510

SECTION 23 0511 - SUBMITTALS

PART 1 - GENERAL

1.1 GENERAL:

- A. Refer to Division 1 specification for information and shop drawings and submittals requirements. When conflicts exist, the more stringent requirements shall apply.

1.2 RELATED DOCUMENTS:

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 specification sections, apply to this section.
- B. All sections of Division 23 specifications apply to this section.

1.3 PREPARATION OF SUBMITTALS:

- A. Before preparing submittals, consult all contract drawings and specifications in detail, obtain manufacturer's recommended installation instructions, and have shop drawings prepared based on specific equipment and material intended for installation. Obtain all drawings and submittals from other trades as necessary to coordinate submittals.
- B. Sign all shop drawings indicating conformance with contract documents before submitting to the A/E.

1.4 SUBMITTALS:

A. General:

1. Submittals are required on all items of equipment and materials.
2. Submittals shall include but not be limited to:
 - a. All requirements of Division 1.
 - b. Complete information pertaining to appurtenances and accessories.
 - c. Information properly marked with service or function identification as related to the project.
 - d. Where the submittal consists of catalog sheets displaying other items which are not applicable, the proper features shall be clearly identified.
 - e. External connections properly marked, as related to the specific use intended, on standard factory assembly and field installation drawings.
 - f. All performance characteristics and physical characteristics.
 - g. Wiring and control diagram.

1.7 EQUIPMENT DIMENSIONS AND WEIGHTS:

- A. The contract documents may indicate specific equipment dimensions. The Contractor is responsible for verification of the dimensions for the equipment submitted prior to submitting shop drawings. Equipment larger than the equipment indicated on the contract documents may not be acceptable by the A/E's.
- B. The contract documents may indicate specific equipment weights. The Contractor is responsible for verification of the weight of the equipment submitted prior to submitting shop drawings. Equipment weighing more than the equipment indicated on the contract documents may not be acceptable to the A/E.
- C. Equipment shall not exceed maximum weight indicated on the schedules. If the equipment weight exceeds that indicated on the schedule, even where the manufacturer is an approved manufacturer, that equipment can not be bid on for this project.
- D. If equipment is not acceptable to the A/E due to dimensions or weights exceeding those indicated on contract documents, the Contractor shall accept all responsibility and costs for providing equipment that meets the dimension and weight requirements of the contract documents.

1.8 ELECTRICAL CHARACTERISTICS:

- A. Electrical characteristics for mechanical equipment are generally indicated on the mechanical documents. The electrical documents generally indicate power and wiring requirements to each piece of mechanical equipment.
- B. It shall be the mechanical installer's responsibility to verify prior to submitting shop drawings that the equipment submitted meets the electrical requirements of both the mechanical and electrical documents. If there is a discrepancy, the contractor shall bring the discrepancy to the A/E's attention prior to submitting shop drawings.
- C. If the discrepancy is brought to the A/E's attention prior to ordering the mechanical equipment or electrical materials associated with that equipment, the A/E will issue additional instructions to the Contractor.
- D. If the discrepancy is not brought to the A/E's attention prior to ordering the mechanical equipment and electrical materials (i.e. Contractor does not verify electrical requirements), the Contractor shall be responsible for all costs except those that would have been incurred if the discrepancy was determined prior to ordering the mechanical equipment and electrical materials.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 PRODUCT SUBMITTALS:

- A. The following list may be used as a checklist for the contractor and A/E. All products may not be listed.

3.2 TEST AND REPORT SUBMITTALS:

- A. The following list may be used as a checklist for the Contractor and A/E. All tests may not be listed.
 - 1. Duct air loss test
 - 2. System start-up
 - 3. Test and Balance Agency Construction report

3.3 CONTROL SUBMITTAL:

- A. Control submittals shall include the following:
 - 1. All information necessary for a clear representative of the system to be provided.
 - 2. All control components.
 - 3. Graphical representative of all systems to be controlled.
 - 4. I/O summary sheets.
 - 5. Floor plan indicating panels.
 - 6. Sequence of operation. All devices referenced in the sequence shall be indicated on graphic representation.
 - 7. Large scale (75% reduction maximum) of all control panel faces.
 - 8. Wiring diagrams including interface with equipment (terminal strip, contactor, etc.).
- B. All drawing submittals shall be CADD generated drawings.
- C. Submit a floor plan locating all thermostats, sensors, lighting override switches, and control panels. Contractor must receive approval in writing before roughing in controls.

3.4 COORDINATION DRAWING SUBMITTAL:

- A. This section may not include all drawings required. See specific specifications for additional requirements. All drawings shall be drawn (1/8") (1/4") = 1'0" minimum. Each system shall be represented by a different color.
- B. Review structural and architectural drawings to determine method of attachment or support of pipe, duct, and equipment to slabs, walls, and other structural elements.
- C. Coordination Drawings:
 - 1. Provide dimensional coordination drawings of the following:

- a. Building elements:
 - 1) Walls
 - 2) Casework (built-in)
 - 3) Ceiling
 - 4) Structure (floor and roof system)
- b. Mechanical elements:
 - 1) Duct
 - 2) HVAC equipment (with required clearances)
- c. Other system elements:
 - 1) Lights
 - 2) Conduit 1-1/2" and above
 - 3) Gas piping
2. Drawings shall have the following line weights:
 - a. Building elements and lights – light
 - b. Duct, piping, conduit – medium
 - c. Equipment – heavy
3. Each system shall be provided with a different color line.
4. All non-essential text, symbols, objects, etc. (not necessary for systems coordination) shall be omitted from the coordination drawings.
5. Submit drawings for all units.
6. Drawings shall be submitted in color.
- D. Provide dimensional drawings in plan with all site utilities shown of the following:
 1. Size and location of all underground piping under mechanical equipment yards.
- E. Provide dimensional drawings on a plan indicating the following:
 1. Size and location of all rooftop equipment, equipment weights, and roof penetrations.
 2. Size and location of all concrete housekeeping pads.

3. Size and location of all prestressed tee penetrations.
- F. When Division 23 equipment is to be installed on supports provided by installers other than Division 23, the Division 23 installer shall provide:
 1. Size, orientation, weights, and connection locations for all equipment to be installed. Information shall include all seismic components, point loads, elevations, etc.
 2. Location and required size and elevation of all pipe and duct supports.
 - G. See duct specifications for additional duct drawings required.
 - H. Provide coordination drawings of all duct shown to be installed above inaccessible ceilings such as gypboard ceilings. Drawings shall show areas of inaccessible ceilings, duct, dampers, control sensors and components, airflow stations, valves, and other components which require access.
- 3.5 SHOP DRAWING SUBMITTAL COVER SHEET:
- A. A separate cover sheet shall be submitted with each product type (i.e., valves can be submitted together, etc.)

3.6 SHOP DRAWING SUBMITTAL COVER SHEET
(Provide one page for each group of shop drawings.)

PROJECT NAME: **Fort Mill High School HVAC Renovations** BGA FILE NO. **20051**

PRODUCT: _____ BGA SHOP DWG. NO. _____

NOTE TO CONTRACTOR

1. All shop drawing comments by Buford Goff & Associates shall be complied with or the shop drawings shall be declared rejected.
2. If this form is not completed and signed by the Contractor and items 1 to 8 below are not answered YES or N/A, the shop drawings shall be declared rejected.
3. Dampers, grilles, valves, etc., are reviewed for characteristics but not for size and quantity. It is the Contractor's responsibility to verify sizes and quantity.

SHOP DRAWING SUBMITTAL (Contractor to complete this section)

1. Does the submittal comply with the contract documents? Yes No
If no, list all deviations on an attached page.
2. Have the electrical characteristics (i.e., volt/phase/amps, MOP, MCA, and connection location) been reviewed with the electrical schedules and the electrical circuit sizing meet the requirements of that equipment? Yes No N/A
3. Is product an approved manufacturer listed in the specifications or addendum? Yes No N/A
4. Does the product submitted meet the manufacturer's recommended service clearance for the space in which it is to be installed? Yes No N/A
5. Have the control components of the product been reviewed and do they meet with the requirements of the controls contractor? Yes No N/A
6. Have the equipment connections been reviewed (size and locations) and has the Contractor included all provisions to make the required connections? Yes No N/A
7. Has the seismic engineer reviewed and approved the method of connecting seismic restraints to equipment? Yes No N/A
8. Is the equipment within the weight limitations specified, if any? Yes No N/A

BGA'S SHOP DRAWING STAMP (Engineer to complete this section)

Checking is only for general conformance with the design concept of the project and general compliance with the information given in the Contract Documents. Contractor is responsible for specific compliance with the information given in the Contract Documents; dimensions which shall be confirmed and correlated at the job site; fabrication processes and techniques of construction; coordination of his work with that of all other trades, and the safe and satisfactory performance of his work.

- Reviewed Reviewed as Noted Revise and Resubmit Revise and Resubmit Items Listed
 See attached for additional comments Reject

Comments: _____

_____ Reviewer: _____ Date: _____

END OF SECTION 23 0511

SECTION 23 0523.03 - GAS VALVES FOR HVAC SYSTEMS

PART 1 - GENERAL

1.1 SCOPE OF WORK:

A. General:

1. Furnish all labor, materials, tools and equipment and perform all operations in connection with the installation of valves and appurtenances where shown on the drawings and specified hereinafter.

1.2 RELATED DOCUMENTS:

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 specification sections, apply to this section.
- B. All sections of Division 23 specifications apply to this section. In addition, refer to these specification sections:
 1. Section 23 2113 - HVAC Piping (General)

1.3 QUALITY ASSURANCE:

A. Codes and Standards:

1. All valves shall meet or exceed the following federal and ANSI standards (latest edition).

ANSI B1.1	Unified screw thread standard (thread tolerance)
ANSI B2.1	Pipe thread taper
ANSI B16.1	Cast iron pipe flanges and flanged fittings (Class 125 and 250)
ANSI B16.10	Face-to-face and end-to-end dimensions (ferrous valves)
ANSI B16.18	Valve and fitting solder ends
ANSI B 16.34	
MSS SP-25	Standard markings for valves, fittings, flanges, and unions
MSS SP-78	Gray iron plug valves, Flanged and Threaded Ends
MSS SP110	Ball valves Threaded, Socket Welding, Solder Joint, Grooved and Flared Ends
MSS SP-110	Bronze, brass, and carbon steel ball valves
WW-V35	Ball valves
2. All valve materials shall meet or exceed the following ASTM standards (latest edition):

- ASTM B-16.33 (Gas valves)
- ASTM B-16.34 Materials standard
3. All gas ball valves shall meet or exceed the following standards (latest edition).
- | | |
|--------------|---|
| CGA CR91 | Indoor use, (32 deg. F to 125 deg. F, 5 psi) |
| CGA 9.1 | Appliance valves, (32 deg. F to 300 deg. F, 1/2 psi) |
| ANSI Z.21-15 | Appliance valves, (32 deg. F to 300 deg. F, 1/2 psi) |
| CAN/CGA | Appliance and equipment valves, (32 deg. F to 300 deg. F, 125 psi.) |
| UL 125 | Ammonia and LP gas, (600 psi) |
4. All work shall meet or exceed the standards and procedures (latest editions) of the following:
- a. API 602 - Material Thickness
 - b. API 607
 - c. API 608
 - d. API 609
 - e. Gas Regulator. ANSI Z21.80.
- B. All valves furnished under this section shall be new, first quality of approved manufacturer, and shall be tight at the specified test pressure.
- C. Valve manufacturer and pressure rating shall be cast on side of valve body.
- D. Manufacturers:
- 1. The following gas valve manufacturers are acceptable:
 - a. Rockwell
 - b. Nordstrom
 - c. Walworth
 - d. Powell
 - e. Crane
 - f. Resun

2. The following gas pressure regulators are acceptable:
 - a. American Meter Co.
 - b. Maxitrol Co.
 - c. Pietro Fiorentini Gas Governors
 - d. Sensus

PART 2 - PRODUCTS

2.1 VALVES:

A. General:

1. Leave packing for all valves in good condition, replacing as necessary at completion of work. Packing shall be of approved non-asbestos material suitable for required service.
2. The pressure-temperature rating of valves shall be not less than the design criteria applicable to all components of the system.
3. All valves used only for shut-off shall be the size of the line in which it is installed unless noted otherwise.

2.2 GAS VALVES:

A. General:

1. Gas valves with bronze trim are for non-corrosive gas only. Valves used with corrosive gas shall be suitable for application.

B. Ball valves:

1. General:

- a. Ball valves shall have brass body, chrome plated brass ball, brass trim, teflon stem packing and ball seat, blow-out proof stem, adjustable stem packing gland, and vinyl coated zinc coated steel handle with SWP of 150 psi and CWP of 600 psi.

2. Ball valves used for (2 psig and less):

- a. Valves, 1/4" to 3", shall be full port, 2 piece, threaded end.
 - 1) Hammond 8909

2.3 GAS PRESSURE REGULATORS:

A. General:

1. Gas regulators shall be provided at all locations where main and branch line gas pressures exceed the allowable unit or appliance inlet gas pressure.
 2. All regulators shall be factory assembled.
- B. 2 PSIG Inlet and Less:
1. Regulator shall include full capacity internal relief and vent.
- C. Greater than 2 PSIG Inlet:
1. Regulator shall include full capacity internal relief, over-pressure shutoff, under-pressure shutoff, and vent.
- D. Accessories:
1. Bug proof vent with stainless steel screen.

PART 3 - EXECUTION

3.1 VALVES (INSTALLATION):

- A. All valves in horizontal lines shall be installed with the stem upright and within 15 degrees of vertical where possible.
- B. Threaded valves shall have a union installed adjacent to those valves.

END OF SECTION 23 0523.03

SECTION 23 0529 - HANGERS AND SUPPORTS FOR HVAC PIPING

PART 1 - GENERAL

1.1 SCOPE OF WORK:

A. General:

1. Furnish all labor, materials, tools and equipment and perform all operations in connection with the installation of supports and anchors on all piping and appurtenances where shown on the drawings and specified hereinafter.

1.2 RELATED DOCUMENTS:

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 specification sections, apply to this section.
- B. All sections of Division 23 specifications apply to this section. In addition, refer to these specification sections:
 1. Section 23 0548 – Sound, Vibration, and Seismic Control for HVAC
 2. Section 23 2113 - HVAC Piping (General)

1.3 QUALITY ASSURANCE:

- A. Products not otherwise specified in these documents shall be furnished by the listed manufacturers and installed in accordance with the manufacturers recommendation.
- B. Products used shall be consistent with industry practice for use in commercial or industrial installation.
- C. Codes and Standards:
 1. All work shall meet or exceed the standards and procedures of the following as referenced (latest editions):
 - a. ANSI B31.3 - Pressure Piping
 - b. Factory Mutual
 - c. International Building Codes
 - d. Manufacturer's Standardization Society Documents, MSS-SP-58, MSS-SP-69
 - e. Pipe Fabrication Institute, Standard ES-26
 - f. AISC Specification for the Design, Fabrication, and Erection of Structural Steel Buildings

D. Manufacturers:

1. The following surface mounted pipe support manufacturers are acceptable:
 - a. Mifab
 - b. MIRO
 - c. Approved Equal
2. The following channel support manufacturers are acceptable:
 - a. Erico Eristrut
 - b. Unistrut
 - c. Approved Equal

PART 2 - PRODUCTS

2.1 GENERAL:

- A. It shall be the Contractor's responsibility to provide an adequate pipe support system in accordance with recognized engineering practices using, where possible, standard, commercially available hangers, support, guides, anchors and accessories.
- B. Model numbers are indicated for products not exposed to ambient conditions. The products exposed to ambient conditions shall be a similar product but with the material or finish specified for products exposed to ambient conditions.
- C. Materials shall be selected to prevent electrolysis and minimize corrosion for the environment in which the product is to be installed.
- D. Hanger shall be sized for insulation to run through hanger, support, clamp, or guide.

2.2 SAFETY FACTOR:

- A. All attachments, rods, and accessories selected based on weight load shall be selected for a two times safety factor minimum.

2.3 SEISMIC RESTRAINTS:

- A. Where seismic restraints of components is required, attachments shall be per the requirements of the Vibration and Seismic Controls specifications.

2.4 PRODUCTS EXPOSED TO AMBIENT CONDITIONS:

A. Materials:

1. The material for all accessories including, but not limited to, rods, bolts, fasteners, inserts, saddles, supports, anchors, clamps, auxiliary steel, and

accessories shall be stainless steel or hot dipped galvanized unless specifically noted otherwise.

2.5 PIPE HANGER SPACING:

A. General:

1. The maximum spacing for pipe hangers and supports shall not exceed those stated in these specifications or the hanger manufacturer's recommendations, whichever is less.
2. Where concentrated loads of valves, fittings, etc. occur, closer spacing will be necessary and shall be based on the weight to be supported and the maximum recommended loads for the hanger components.
3. Hangers shall be provided within 12" of each change of direction, at each valve, and at equipment connections.
4. Pipe not listed shall meet the spacing requirements of the manufacturer.

B. Steel (Std. Weight):

<u>Size</u>	<u>Max. Span Ft.</u>
All sizes	10

2.6 AUXILIARY SUPPORTS, FASTENERS, AND ACCESSORIES:

- A. Provide all auxiliary supports, anchors, and fasteners necessary for the installation of piping, equipment, and accessories.
- B. Supports shall include angles, channels, flat steel, rods, bolts and appurtenances.
- C. Special supports shall be provided where standard hanger, supports, or attachments cannot be used. This includes, but is not limited to, use of trapeze supports, suspending supports from other supports (where acceptable to manufacturers, etc.).

2.7 CHANNEL SUPPORTS:

A. General:

1. Channel supports shall be utilized wherever practical and whenever a channel support provides a cleaner installation than individual attachments to the structure.

B. Construction:

1. Channel supports shall be 12 gauge minimum and dimensions as necessary to meet project conditions.

2. Channels in conditioned spaces or in plenums above conditioned spaces shall be pregalvanized or powder coated carbon steel.
 3. Channels exposed to ambient conditions shall be hot dipped galvanized after fabrication, aluminum, stainless steel, PVC coated, or epoxy coated.
 4. Channels shall have holes, slots, knockouts, etc. as required by the Contractor.
- C. Clamps and Accessories:
1. Clamps, accessories, fasteners, etc. shall generally be the same materials as the channel supports unless indicated otherwise.

2.8 SURFACE MOUNTED PIPE SUPPORTS:

- A. Rubber Support:
1. Support shall be constructed of UV resistant rubber.
 2. Attached to the base are two threaded rods with a 14 gauge channel support (or self-lubricating rollers as required by the installation. If rollers are required, a pipe guide shall be provided.)
 3. The support height shall be adjustable.
 4. The support shall be suitable for a minimum load of 150 lbs.
 5. The channel support shall be (galvanized) (stainless steel).
 6. The threaded rod shall be (zinc plated) (stainless steel).
- B. Polycarbonate Support:
1. Support shall be constructed of UV resistant polycarbonate.
 2. Attached to the base are two threaded rods with self-lubricating rollers with a pipe guide.
 3. The support height shall be adjustable.
 4. The support shall be suitable for a minimum load of 150lbs.
 5. Metal components shall be stainless steel or HDG.
 6. A UV resistant rubber support pad shall be provided.
- C. Basis of design rubber support manufacturers shall be:
1. Mifab CE

D. Basis of design polycarbonate support manufacturers shall be:

1. MIRO

PART 3 - EXECUTION

3.1 INSTALLATION:

- A. Provide all steel and concrete required for support and anchoring of pipes other than shown on structural or architectural drawings.
- B. Contractor shall bear all responsibility for materials and workmanship as described in this section, and shall make sure that all hangers and supports are properly and permanently connected to building structure.
- C. All pipe supports shall be designed to avoid interferences with other piping, hangers, electrical conduits and supports, building structures and equipment.
- D. Guide points for expansion joints shall be located and constructed wherever required or shown on drawings and at each side of an expansion joint or loop, to permit only free axial movement in piping systems. Guides shall be securely anchored to structure.
- E. Provide hanger rod nuts on both sides of clevis and trapeze hangers.

3.2 SUBMITTAL:

- A. Manufacturer shall be responsible for reviewing all plans, specifications, and existing conditions to determine the types, quantities, and accessories required to provide a complete system of pipe support.
- B. Submit shop drawings for each product to be used and indicate where the product is to be installed (i.e., steam piping in tunnel, chilled water pipe in crawl space, etc.).

3.3 AUXILIARY SUPPORTS, ANCHORS, AND FASTENERS:

- A. Supports attaching to steel structure shall be by bolting or clamping without penetrating structural member. Welding is not permitted without written permission.
- B. All fasteners shall be provided which resist loosening from vibration.

3.4 SURFACE MOUNTED PIPE SUPPORT:

- A. When installed on a roof, provide a heavy bed of roofing tar or mastic acceptable to the roofing contractor to set the supports on.
- B. Adjust pipe support for gravity flow of condensate drain lines.

END OF SECTION 23 0529

SECTION 23 0548 – SOUND, VIBRATION, AND SEISMIC CONTROL FOR HVAC

PART 1 - GENERAL

1.1 SCOPE OF WORK:

A. General:

1. Furnish all labor, materials, tools and equipment and perform all operations in connection with the installation of mechanical sound, vibration, and seismic control required on all mechanical equipment, systems, and appurtenances where shown on the drawings and specified hereinafter.

- B. All foundations and supports of Division 23 equipment shall be furnished and installed by Division 23 installer except where specifically noted otherwise.

1.2 RELATED DOCUMENTS:

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 specification sections, apply to this section.

- B. All sections of Division 23 specifications apply to this section.

1.3 QUALITY ASSURANCE:

A. Codes and Standards:

1. All seismic equipment and design shall comply with all local codes and ordinances and meet or exceed the standards and procedures (latest editions) of the following:

- a. International Building Codes
- b. SMACNA Seismic Restraint Manual
- c. ASHRAE
- d. ASTM E 488 (Anchor locations)

- B. Mechanical sound, vibration and seismic control equipment shall be sized and provided by manufacturer only. Seismic bracing shall be a factory manufactured item listed in the manufacturers catalog for the intended use.

C. Manufacturer:

1. The following sound, vibration, and seismic control (except flexible pipe connectors) manufacturers are acceptable:

- a. Mason Industries
- b. Vibration Mountings and Controls, Inc.

- c. Vibro-Acoustics Corporation
2. The following acoustical barrier manufacturers are acceptable:
 - a. Kinetics
 - b. Acoustiblok
 - c. Aerosonics
 - d. Sound Seal
3. The following duct silencer manufacturers are acceptable:
 - a. Price
 - b. United Sheet Metal
 - c. Vibro-Acoustics Corporation
4. The following grille silencer manufacturers are acceptable:
 - a. Price
 - b. Ruskin

PART 2 - PRODUCTS

2.1 GENERAL:

- A. All equipment and piping shall be mounted on or suspended from approved foundations and supports as specified herein and as shown on the drawings.
- B. The vibration isolation systems shall be guaranteed to have the deflection recommended by the manufacturer for the specific application but no less than shown on the schedule. Mounting sizes shall be determined by the mounting manufacturer and mountings shall be installed in accordance with the manufacturer's instructions.
- C. The installed vibration isolation system for slab or roof supported equipment shall have a maximum lateral motion under equipment start-up or shut down conditions of 1/4 inch. Motions in excess of this amount shall be restrained by approved spring type mountings.
- D. Components not exposed to ambient:
 1. Steel components shall be powder coated. All nuts, bolts, and washers shall be zinc-electroplated. Structural steel bases shall be thoroughly cleaned of welding slag and primed with zinc-chromate or metal etching primer.
- E. Components exposed to ambient or inside air handlers:
 1. All components shall be PVC coated steel, hot-dip galvanized, stainless steel, or heresite coated.

2.2 VIBRATION ISOLATORS:

A. General:

1. Where steel spring isolation systems are required, the mounting assemblies shall:
 - a. Utilize bare springs with the spring diameter not less than 0.8 of the compressed height of the spring at rated load.
 - b. Springs shall have minimum additional travel to solid equal to 50 percent of rated deflection.
2. Each spring isolator shall be designed and installed so that the ends of the spring remain parallel during and after the specified minimum deflection to solid height.
3. All spring-flex mountings shall be completely stable beyond rated load and have an additional 30% capacity (minimum), and horizontal and vertical spring constants shall be equal ($k_x/k_y=1$).
4. Vibration isolation equipment submittal drawings shall include the following information:
 - a. Isolation mounting deflections.
 - b. Spring diameters, compressed spring heights at rated load; solid spring heights, where spring isolation mountings are used.
 - c. Equipment operating speed.
 - d. Clearly outlined procedures for installing and adjusting isolators.
5. Isolators for equipment installed outdoors shall be designed to provide adequate restraint due to normal wind conditions and to withstand design wind loads or 30#/sq. ft., whichever is greater, applied to any exposed surface of the isolated equipment.
6. Neoprene shall be bridge bearing type.
7. Mounts shall have holes in baseplate for anchoring to structure.
8. All baseplates shall be sized to meet manufacturer's maximum published seismic restraint rating.

B. Specification type "B" (Seismic Mounts):

1. Freestanding spring type isolators with ductile iron housing. Isolators shall include leveling bolts which shall be rigidly bolted to equipment. Mounting shall be designed to resist seismic forces in all directions.
2. Basis of design manufacturer shall be:
 - a. Mason Industries type SSLFH.

- C. Specification type "C" (Seismic Mounts with Limit Stops):
1. Freestanding spring type isolators with ductile iron housing. The housing shall include vertical limit stops to prevent spring extension when weight is removed. A minimum clearance of 1/2" 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 operations. Isolators shall include leveling bolts which shall be rigidly bolted to equipment.
 2. Basis of design manufacturer shall be:
 - a. Mason Industries type SLRSO.
- D. Specification type "X" (Thrust Restraints):
1. Horizontal thrust restraints shall consist of a spring element in series with a neoprene pad as described in Specification type "B" with the same deflection as specified for the mountings or hangers. The spring element shall be contained within a steel frame and designed so it can be preset for thrust at the factory and adjusted in the field to allow for a maximum of 1/4" movement at start and stop. The assembly shall be furnished with one rod and angle brackets for attachment to both the equipment and ductwork or the equipment and the structure. Horizontal restraints shall be attached at the centerline of thrust and symmetrically on either side of the unit.
 2. Basis of design manufacturer shall be:
 - a. Mason Industries, Inc. type WB.
- E. Specification type "Q" (Waffle Pads):
1. One layer of 3/4" thick neoprene pad consisting of 2" square modules.
 2. Pads shall have a minimum load deflection of 10%.
 3. Pads up to 36 sq. inches shall have a 1/4" thick bearing plate. Larger pads shall have a 3/8" thick bearing plate.
 4. Bearing plates shall be stainless steel and shall have an appropriately sized hole for mounting.
 5. Basis of design manufacturer shall be:
 - a. Mason Industries, Inc. Model Super WMH.

2.3 VIBRATION ISOLATOR SCHEDULE:

- A. General:
1. Deflection shown is a minimum value. Higher values may be required by seismic design.

- B. Fans mounted in Air Handlers:
 - 1. Type (B) (C) mount, deflections 2.0"
 - 2. Type G base (less than 4" TSP)
 - 3. Type X thrust restraint

2.4 DUCT SILENCERS

- A. Rectangular duct silencers shall have outer casings of not less than 22 gauge galvanized steel. Seams shall be lock formed and mastic filled. The internal baffles (splitters) shall be not less than 24 gauge galvanized perforated steel having an open area of about 30%. The nosings shall be full radius or airfoil shape.
- B. The sound absorbing media shall be not less than 4.5 pcf glass/mineral fiber packed under 5% compression. The fiberfill shall be incombustible, mildew resistant and vermin proof. The sound absorbing material shall be protected from erosion.
- C. If the silencer is installed in a location exposed to water or weather, the fill shall be completely encapsulated in mylar bagging. The mylar bagging shall not degrade the acoustical performance of the silencer.
- D. If the silencer is supplied in modular sections, the silencer shall meet or exceed the specification for single module silencers with respect to insertion loss, pressure drop, regenerated noise and air leakage.

2.5 GRILLE SILENCERS

- A. General:
 - 1. Furnish and install grille silencers of the size, configuration, air volume, and air flow direction as described on the plans and schedules.
- B. Performance:
 - 1. Silencer performance characteristics, including insertion loss and pressure drop, shall be attained through testing in accordance with ASTM Standard E477.
 - 2. Laboratory performance verification in the manufacturer's test facility may be requested, in which case a comparative test report shall be made available to the engineer.
- C. Construction:
 - 1. Air transfer 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.
 - 2. Grille silencers shall be constructed of:
 - a. 24-gauge solid galvanized steel casing

- b. 24-gauge perforated galvanized steel liner
- c. Absorptive acoustic fiberglass.
- 3. Acoustic media:
 - a. Acoustic media shall be shot-free inorganic glass fiber with long, resilient fibers, bonded with thermosetting resin.
 - b. Glass fiber shall be packed with a minimum of 10% compression to eliminate voids and settling.
- 4. Fire-Performance Characteristics:
 - a. Air transfer silencer assemblies, including acoustic media fill, sealants, and acoustical spacers shall have combustion rating equal to or less than shown below when tested according to ASTM E84, NFPA 255 or UL 723:
 - 1) Flame-spread index not exceeding 25
 - 2) Smoke-developed index not exceeding 50

2.6 ACOUSTICAL BARRIERS:

- A. Type 2 - Acoustical Barrier Type:
 - 1. Barrier is suitable for below rooftop equipment curb.
 - 2. Acoustical barrier shall be a 2.0 lb. per square foot, reinforced material. Tensile strength shall be 510 lbs. per in. Material shall be waterproof.
 - 3. Sound transmission loss shall be STC 32.
 - 4. Basis of design Type 2 manufacturer shall be:
 - a. Acoustiblok
- B. Systems requiring Type 2 acoustical barriers:
 - 1. Provide a minimum sound transmission lost of STC 48 (type 2) in the rooftop unit curb and pipe chase for the following rooftop units:
 - a. All rooftop units on this project.

2.7 SEISMIC DESIGN:

- A. General:
 - 1. Specifications and plans shall indicate minimum requirements and general intent. The actual requirements shall be determined by the contractor's seismic system

engineer but those requirements shall not be less than indicated on the plans and in these specifications.

2. The seismic engineer shall be a professional engineer registered in the state in which the facility is to be constructed and whose principal area of practice is in seismic engineering and related fields. The engineer shall be in the full time employment of the company submitting the product. The seismic engineer shall be responsible for:
 - a. Submittals (drawings and calculations)
 - b. Seismic Quality Assurance Plan
 - c. Certificates of Compliance
3. Where pipes, ducts, conduit, and similar systems cross the seismic isolation interface between two seismically isolated structures, the pipes, ducts, conduit, and similar systems shall have flexible connections to accommodate the seismic displacement of the structures. Typically, this will include flexible connections on one side of the interface.
4. The following mechanical components, except ceiling mounted mechanical components, shall be exempt from seismic design:
 - a. All components in seismic design category A and B.
 - b. All components in seismic design category C where $I_p = 1.0$.
 - c. All components in seismic design category D, E, or F:
 - 1) 20# or less
 - 2) For distribution systems 5#/LF or less
 - 3) Flexible connections between component and duct, piping, and conduit
 - 4) Components mounted 4 ft. or less above floor weighing 400# or less, and $I_p = 1.0$

B. Duct Systems:

1. Seismic restraints are required for all ducts unless specifically indicated otherwise.
2. The following duct shall be exempt from seismic design:
 - a. Duct with an $I_p = 1.0$ and with a cross-sectional area of less than 6.0 SF.
 - b. Duct with an $I_p = 1.0$ and installed 12 inches or less from the point of connection to the supporting structure above to top of duct (excluding

insulation or any other coverings) for full length of duct run (duct run is up to change of direction of more than 2 times duct width in degrees).

C. Components in Duct Systems:

1. Components and equipment installed in the duct system having flexible duct connections at one or more ends and weighing 20 pounds or less may be considered part of the duct system.
2. Components and equipment installed in the duct system having no flexible duct connection and weighing 75 pounds or less may be considered part of the duct system.
3. Connections to components and equipment in the duct system (i.e., hydronic or steam coils, electrical conduit, central conduit, etc.) shall accommodate differential movement utilizing type of flexible connection indicated on drawings or elsewhere in the specifications. If none indicated, flexible connection may be:
 - a. Flexible connector
 - b. Swing joints
 - c. Multiple elbows
4. All components and equipment greater than 20 pounds with flexible duct connectors or greater than 75 pounds shall be independently supported and seismically restrained independently of the duct system.

D. Piping Systems:

1. Seismic restraints are required for all pipes unless specifically indicated otherwise.
2. Seismic restraints are not required for the following pipe provided the pipe is installed where it is protected from impact or will avoid the impact of larger pipe or equipment:
 - a. Pipes are supported by clevis or roller hangers and installed 12 inches or less from the point of connection to the supporting structure above to the top of the pipe (excluding insulation or any other coverings).
 - b. Pipes are supported by trapeze or roller support and are installed 12 inches or less from the point of the supporting structure above to the top of the trapeze or part of the roller support supporting the pipe.
 - c. High deformity piping in Seismic Design Category D, E, or F, $I_p = 1.5$, and nominal pipe size 1 inch or less. Total weight, if on a trapeze, must be 10# or less.
 - d. High deformity piping in Seismic Design Category C, $I_p = 1.5$, and a nominal pipe size of 2 inches or less.

- e. High deformity piping in Seismic Design Category D, E, or F, I_p equal to 1.0, and nominal pipe size 3 inches or less.
3. Other piping systems shall meet or exceed the requirements of the IBC and the listed standard (whichever is greater):
 - a. Refrigeration Piping - ASME B31.5
 - b. LP Gas - ASME B31.4
 - c. Natural Gas - ASME B31.4
 - d. Fuel Oil - ASME B31.4
- E. Importance Factor (I_p):
 1. Life safety components of the systems shall have an importance factor of $I_p = 1.5$ and shall include, but not be limited to:
 - a. Smoke control systems (ducts, dampers, fans, controls, etc.)
 - b. Fire protection system (sprinkler, controls interface, etc.)
 - c. Isolation room ventilation
 - d. Laboratory exhaust systems including fans, air distribution, and valves.
 - e. Laboratory supply systems including fans, air distribution, and valves.
 - f. Heating systems serving hospitals, nursing homes, correctional institutions, and all other types of institutionally restrained facilities or where persons are non-ambulatory.
 2. Importance factor for the following equipment shall be $I_p = 1.5$:
 - a. Equipment with gas furnaces
 3. Importance factor for mechanical components shall be $I_p = 1.0$ unless indicated otherwise.

2.8 WIND LOAD DESIGN:

- A. General:
 1. Specifications and plans shall indicate minimum requirements and general intent. The actual requirements shall be determined by the contractor's structural engineer but those requirements shall not be less than indicated on the plans and in these specifications.
 2. The structural engineer shall be a professional engineer registered in the state in which the facility is to be constructed. The structural engineer shall be responsible for:

- a. Submittals (drawings and calculations)
3. All equipment located outdoors shall be designed to meet or exceed the requirements of the current IBC wind load requirements.
4. Calculations shall be based on the ASCE determined design pressure, exposure class, building height, and building type.
- B. All rooftop curbs shall be anchored sufficiently to the roofing members to withstand the IBC wind load requirements.
- C. All outdoor equipment located on equipment pads shall be anchored to the equipment pads to withstand the IBC wind load requirements. Equipment pads shall be designed to withstand these requirements.
- D. Where additional bracing or tie downs are required, they shall be provided at no additional cost to the Owner.
- E. Coordinate the restraints required for wind loading with the seismic and vibration requirements indicated on the drawings and specifications.

2.9 ANCHORAGE TO BUILDING STRUCTURE:

- A. General:
 1. Anchorage to the building structure shall meet the latest requirements of:
 - a. International Building Code (Chapter 19)
 - b. ASCE Standard 7-05 (Chapter 13)
 - c. American Concrete Institute (ACI) 318
 2. Requirements of this section of specifications are minimum requirements. When other requirements are indicated, the greater requirement shall be met or exceeded.
- B. Anchorage in Concrete or Masonry:
 1. Calculation of anchorage forces shall be provided by the seismic engineer for all installations in Seismic Design Category C, D, E, and F.
 2. The following anchorage and attachments are not permitted:
 - a. Power driven fasteners for tension load applications in Category D, E, and F unless specifically approved for this application.
 - b. Friction clips.

2.10 VIBRATION AND SEISMIC ACCESSORIES:

- A. Provide all necessary brackets, bolts, fasteners, predrilled bases, oversized bases, accessory components and materials to install systems in accordance with manufacturer's requirements.

2.11 OUTDOOR EQUIPMENT:

- A. Roof Mounted Equipment:
 - 1. Equipment shall be direct anchored if design permits unless isolation is required.
 - 2. Curbs and equipment supports shall be attached to building structure.
- B. Slab Mounted Equipment (outdoor):
 - 1. Equipment shall be direct anchored if design permits unless isolation bases are required.
 - 2. If no other isolation is indicated for outdoor equipment, 3/4" neoprene waffle pads shall be provided.

PART 3 - EXECUTION

3.1 GENERAL:

- A. If the equipment to be mounted or restrained is not furnished with integral structural frames and external mounting lugs (both of suitable strength and rigidity), approved members shall be installed in the field which shall provide means of attaching required vibration and seismic devices.
- B. The members include, but not limited to the following: gussets, rails, brackets, angles, channels and similar components. These members should be sized by the vibration and seismic vendor to provide an acceptable installation.
- C. All field installed components shall be neatly installed and be of materials and/or finish suitable for the installation.

3.2 SUBMITTALS (VIBRATION ISOLATION):

- A. The manufacturer shall submit drawings indicating location and type of all vibration isolation components provided.
- B. A schedule shall show capacity and load of each component at each location.
- C. Design shall be based upon actual installation and not contract drawing schematics.

3.3 SUBMITTALS (SEISMIC LOAD):

- A. Seismic Restraints:
 - 1. Submit drawings showing seismic loading, location of bracing, and types and sizes of bracing assemblies. The level of detail and information provided shall be similar to those included in the "SMACNA Seismic Restraint Manual."

2. Submit seismic protection ratings in three principle axes certified by an independent laboratory.
 3. Submit calculations for shear, pull-up, primary overturning, and secondary overturning.
 4. Submit drawings indicating auxiliary supports and method of attachment.
 5. Submit drawings indicating size and type of attachment (i.e., welding, bolting, etc.) to:
 - a. Roof curbs and equipment supports to building structure.
 - b. Attachment of equipment to roof curbs and equipment supports.
 - c. Attachment of equipment to adapter curb and adapter curb to the existing curb.
 - d. Attachment of equipment to housekeeping pads or slab.
 6. Submittals for seismic snubbers shall also include detailed drawings of steel sole plates and all anchorage to building structure including welding, bolting, and other methods of attachment. Submittal shall clearly indicate location of attachment and structural members.
- B. Attachments and Connections:
1. Submit drawing indicating type of connection (i.e., clamp, eye bolt, swivel, etc.) to:
 - a. Beams
 - b. Joists
 - c. Structure members
 2. Submit drawings indicating type of attachment (welding, bolting, etc.) to:
 - a. Structural members
 - b. Components or equipment
- C. Calculations shall be submitted and signed by a licensed professional engineer in the state where the project is located.
- 3.4 SUBMITTALS (WIND LOAD):
- A. Submit drawings and calculations showing wind loading, location of anchors, ties and bracing, and types and sizes of restraints.
 - B. Submit drawings showing auxiliary supports and method of attachment.

- C. Submit drawings and calculations showing the attachment of equipment to curbs.
- D. Submit drawings and calculations showing the attachment of curbs to the structure members.
- E. Submit drawings and calculations showing the attachment of equipment to adapter curb and adapter curbs to existing curbs.

3.5 ACOUSTICAL BARRIERS INSTALLATION:

- B. Below rooftop curb:
 - 1. Seal to inside of roof curb and to all penetrations to completely isolate rooftop equipment.

3.6 DUCT SILENCERS:

- A. Duct silencers shall be furnished and installed as shown on the mechanical drawings and as called for in the silencer schedule.
- B. The insertion loss of the duct silencers shall be not less than the values shown in the schedules.
- C. The insertion loss shall be substantiated by submitting NVLAP accredited laboratory test data.
- D. The pressure drop across the duct silencers shall not exceed the values scheduled on the drawings.
- E. The self-noise of the duct silencers shall be not more than the following values at an air velocity of 1000 fpm in the direction of sound propagation.

Octave-Band Self-Noise Power Levels in dB at the following frequencies

<u>Face Area</u>	<u>63 Hz</u>	<u>125 Hz</u>	<u>250 Hz</u>
2 sq. ft	38	26	30
4 sq. ft	41	29	33
6 sq. ft	44	32	36
8 sq. ft	47	35	39

3.7 SUPERVISION:

- A. The manufacturer, or his qualified representative, shall be responsible for providing such supervision as may be necessary to assure correct installation and adjustment of the isolators. Upon completion of the installation and after the system is put into operation, the manufacturer, or his representative, shall make a final inspection and submit his report to the A/E in writing certifying the correctness of installation and compliance with approved submittal data.

3.8 INSTALLATION:

- A. Where field conditions, construction schedule, or construction progress require that isolators be installed after the equipment or systems are installed, provide temporary supports until that time when isolators can properly be installed.

3.9 EXISTING CURBS:

- A. After the existing unit is removed from the existing curb, the seismic engineer shall determine the best method to secure the existing curb to the existing building structure to meet the HVAC system's seismic requirements.

END OF SECTION 23 0548

SECTION 23 0553 - IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SCOPE OF WORK:

A. General:

1. Furnish all labor, materials, tools and equipment and perform all operations in connection with the installation of mechanical identification on all mechanical equipment, systems, and appurtenances where shown on the drawings and specified hereinafter.

1.2 RELATED DOCUMENTS:

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 specification sections, apply to this section.
- B. All sections of Division 23 specifications apply to this section.

1.3 QUALITY ASSURANCE:

A. Codes and Standards:

1. All work furnished and installed shall comply with all local codes and ordinances and shall meet or exceed the standards and procedures (latest editions) of the following:
 - a. ANSI A13.1 for the identification of piping systems.
 - b. ANSI/NEMA Standard Z535.1.

B. Manufacturer:

1. The following band, tag, nameplate, and identification marker manufacturers are acceptable:
 - a. Seton Name Plate Corporation
 - b. T&B/Westline Products
 - c. Brady
 - d. MSI
 - e. Brimar

PART 2 - PRODUCTS

2.1 NAMEPLATES:

A. General:

1. Nameplates shall be black plastic with white engraved lettering.

2. All information shall be provided on a single nameplate per device if practical.
 3. Nameplates shall have screw holes and screws for mounting unless screws would damage the intended use of the product to which it is attached (i.e., NEMA4 panel, etc.). In that case, provide stick-on nameplates.
 4. Nameplates shall be 1/16" thick.
- B. Size:
1. Three-quarter inch (3/4") high nameplate when located on ceiling grid.
 2. Two inch (2") high nameplate when located on outdoor HVAC equipment.
 3. Three-quarter inch (3/4") high nameplate when located on control devices such as switches, sensors, etc.
 4. Size as indicated on plans or detail.

2.2 SWITCHES, THERMOSTATS, AND OTHER SIMILAR DEVICES:

- A. Devices to be identified include:
1. Fan controls
 2. Flat plate sensors
 3. Thermostats, humidity sensors, and CO2 sensors
 4. Similar equipment
- B. Nameplate shall include (example):
1. Equipment description: HV #1, etc.
 2. Switch position as required: Summer/Winter, On/Off, etc.

2.3 MECHANICAL EQUIPMENT:

- A. Devices to be identified include all mechanical equipment.
- B. Nameplate shall include (example):
1. Equipment description: EF #1, etc.
 2. Owner's identification number

PART 3 - EXECUTION

3.1 NAMEPLATES:

- A. Submit listing of all nameplates with associated information to A/E for approval before fabrication.
- B. Coordinate method of attachment and location of nameplate with contractor who is responsible for the installation of the device (i.e., control panel, air handler, etc.).

END OF SECTION 23 0553

SECTION 23 0592 - SYSTEM START-UP

PART 1 - GENERAL

1.1 SCOPE OF WORK:

A. General:

1. Furnish all labor, materials, tools and equipment and perform all operations in connection with the start-up of all building mechanical systems where shown on the drawings and specified hereinafter.

B. Description:

1. These systems shall include:
 - a. Air systems (heating, ventilating, air conditioning, exhaust and recirculation)

1.2 RELATED DOCUMENTS:

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 specification sections, apply to this section.
- B. All sections of Division 23 specifications apply to this section. In addition, refer to these specification sections:
 1. Section 23 0593 - Testing, Adjusting, and Balancing for HVAC

1.3 QUALITY ASSURANCE:

A. Codes and standards:

1. All work shall meet or exceed the standards and procedures of the following (latest edition):
 - a. AABC National Standards
 - b. SMACNA

B. Start-up of equipment shall be by manufacturer's representative unless noted otherwise.

C. Tests, in addition to those specified herein, required to prove code compliance, to meet insurance requirements, and to verify proper installation by the A/E, owner, or authorities having jurisdiction shall be provided by the Contractor.

D. All tests, instruments, and procedures shall be in accordance with the AABC National Standards and system test and balance specifications.

PART 2 - PRODUCTS

2.1 GENERAL:

- A. All concealed work must remain uncovered until required tests have been completed. Sections of the system may be tested prior to concealing as outlined hereinafter.
- B. The Owner and the A/E shall be notified in writing a minimum of three working days prior to any tests being performed.
- C. Local, state and federal authorities having jurisdiction shall be notified in writing with sufficient time to schedule inspection as required by the authority.
- D. In no case shall a system be started or operated in such a manner that the system or component pressure or temperature ratings, or the pressure or temperature to which a system or component has been tested, be exceeded.

2.2 START-UP:

- A. Systems shall be started up by the Contractor except as required in specific portions of the mechanical specifications.
- B. The following systems shall be started up by a factory certified technician:
 - 1. Heating and air conditioning equipment
 - 2. Variable frequency drives
 - 3. Bipolar ionization

2.3 AIR DISTRIBUTION SYSTEMS:

- A. General:
 - 1. Cleaning and leakage testing are not required for existing duct systems unless indicated otherwise.
- B. Cleaning of Duct System:
 - 1. Upon completion of duct and before installation of any outlets, the contractor shall clean entire duct system of all rubbish, plaster, dirt, etc.
- C. Leakage Tests for systems 2 inch w.g. and less:
 - 1. Verify, by use of air monitoring devices and pitot tube traverse, that the total air quantities measured at all outlets and the air quantity handled by the fan differ by no more than $\pm 5\%$.
 - 2. Where leakage is determined to exceed 5% in accordance with the above testing procedure, the Contractor shall locate and repair the duct to reduce the leakage to acceptable levels.

3. Where excessive leakage is noted at any location, whether the entire system meets the 5% leakage rate or not, the Contractor shall repair the duct to minimize the leakage at the location identified.
4. Leakage includes all connected components of the system.
5. Leakage tests shall be repeated until the duct is proven to be within the limits of leakage specified herein.

2.4 SYSTEM START-UP:

A. General:

1. System shall be started and checked to ensure safe and proper operation.
2. Minimum requirements are listed for each system and are in addition to manufacturer start-up requirements and the requirements stated in the specific sections of the specifications.
3. Temperature control systems installed complete and operable.
4. Proper thermal overload protection in place for electrical equipment.

B. Air Systems:

1. Verify proper fan rotation.
2. Verify full load amps are below nameplate amps.
3. Verify control dampers operating.
4. Verify balance dampers and fire and smoke dampers are open.
5. Remove all duct restrictions.
6. Verify clean filters are installed.
7. Verify access doors are closed and duct end caps are in place.
8. All outlets shall be installed and connected.

2.5 SYSTEM PRESSURES:

- A. Observe the start-up of systems to verify that no dangerous conditions exist as the result of high (supply) or low (return/exhaust) pressure. If excessive pressures are observed, report the observed condition and shut down or modify system operation to avoid damage.

PART 3- EXECUTION

3.1 SUBMITTALS:

- A. Submit to the A/E all test results including a minimum of the following information:
 - 1. System tested
 - 2. Location of test
 - 3. Date, time, and ambient temperature at test startup and completion
 - 4. Persons present for test
 - 5. Duration of test
 - 6. Test equipment
 - 7. Test results
- B. Partial system may be done at the Contractor's option except tests shall be completed:
 - 1. For each phase designated by contract documents
 - 2. In accordance with building contracts schedule for completion
 - 3. As required to turn over portions of the system for the Owner's use
- C. Reports shall include but not be limited to:
 - 1. Tests during construction
 - 2. Manufacturer's factory test reports
 - 3. Equipment start-up reports
- D. Reports shall be submitted within ten days of test completion.

3.2 ENGINEER REVIEW:

- A. The A/E shall, at his discretion, recheck any or all of the test work. Provide ample number of technicians and test equipment to perform the tests required.
- B. All systems not accepted shall be retested.
- C. Systems shall be retested and rechecked until accepted by all parties.

3.3 DUCT LEAKAGE:

- A. Where leakage is determined to exceed the allowable rate, locate and repair the duct to reduce the leakage to acceptable levels.

END OF SECTION 23 0592

SECTION 23 0593 - TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 - GENERAL

1.1 SCOPE OF WORK:

A. General:

1. Furnish all labor, materials, tools, and equipment and perform all operations in connection with the testing and balancing of all mechanical systems where shown on the drawings and specified hereinafter.

B. Description:

1. Systems shall include all equipment, operators, controls, accessories, and appurtenances.
2. These systems shall include:
 - a. Air systems (heating, ventilating, air conditioning, exhaust and recirculation distribution systems)
 - b. Vibration isolation systems
3. Air inlets and outlets shall include:
 - a. Exhaust
 - b. Relief
 - c. Outside Air
 - d. Supply
 - e. Return

1.2 RELATED DOCUMENTS:

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 specification sections, apply to this section.
- B. All sections of Division 23 specifications apply to this section. In addition, refer to these specification sections:
 1. Section 23 0592 - System Start-Up

1.3 QUALITY ASSURANCE:

- A. Codes and Standards:

1. All work shall meet or exceed the standards and procedures of the following (latest editions):
 - a. AABC National Standards
 - b. NEBB Standards
2. Testing and balancing shall be performed by an agency certified by the AABC or NEBB.
3. All technicians shall have a minimum of three years testing and balancing. Each test and adjustment shall be under the direct supervision of a qualified technician.
4. Testing and balancing shall be performed by one agency.

PART 2 - PRODUCTS

2.1 GENERAL BALANCING PROCEDURES:

- A. All recorded data shall represent a true, actually measured, or observed condition.
- B. Any abnormal conditions in the mechanical systems or conditions which prevent total system balance, as observed by the Test and Balance Agency, shall be reported as soon as possible to the A/E.
- C. If, for any reason, a system cannot be properly balanced, it shall be reported to the A/E by the Test and Balance Agency as soon as observed.
- D. Should additional balancing devices be required, the Test and Balance Agency shall bring it to the attention of the Contractor as quickly as possible.
- E. The Test and Balance Agency shall leave all system components in proper working order including:
 1. Replace belt guards.
 2. Close access doors.
 3. Close doors to electrical switch boxes.
 4. Restore thermostats to specified settings.
- F. The Test and Balance Agency shall permanently mark the settings of all valves, dampers, and other adjustment devices in a manner that will allow the settings to be restored. If a balancing device is provided with a memory stop, it shall be set and locked.
- G. Systems shall be tested in each specified mode of operation. See equipment Sequence of Operation.

2.2 INSTRUMENTS:

- A. All Test and Balance work shall be performed using the required instrumentation to obtain proper measurements.
- B. Instruments shall be properly maintained and transported in such a manner as to provide protection against damage due to vibration, impact, moisture or any other condition that may render them inaccurate.
- C. Instruments shall have been calibrated within a period of six months prior to starting the project.
- D. Proof of calibration shall be maintained with the instruments.
- E. Instruments shall be calibrated upon completion of the work when required by the client to prove reliability.

2.3 AIR SYSTEMS:

- A. General Requirements:
 - 1. Total system balance shall not begin until the Test and Balance Agency has verified that start-up procedures have been performed and filters have been changed.
 - 2. The Test and Balance Agency shall measure the amperes of all fan motors before total system balance is started and shall take proper steps to correct and report any overloads.
 - 3. The Test and Balance Agency shall not continue total system balance if any conditions are observed that are hazardous to the air system. This shall be reported and corrected before proceeding further.
 - 4. The Test and Balance Agency shall verify all outlets for compliance with design requirements and shall report any variations before starting total system balance.
 - 5. If during total system balance, the Test and Balance agency detects any inlet or outlet conditions that will not allow proper balancing to be performed, the A/E shall be notified immediately.
 - 6. Reports shall indicate airflow measured at unit and inlet and outlet totals.
- B. Air Outlets:
 - 1. The systems shall be balanced so that the total supply air quantity to each space shall be within -5% to +5% of the design amount.
 - 2. The pattern for all adjustable outlets shall be adjusted for proper distribution to minimize drafts.
 - 3. Outlet dampers shall not be used to provide proper branch airflow to space.

4. The test and balance contractor shall indicate on the test and balance report that the grilles provide the proper directional throw where direction throws are indicated.
- C. Air Inlets:
1. Inlets on systems shall be adjusted to the required quantities with a tolerance of $\pm 5\%$.
 2. At completion of total system balance, at least one inlet of every branch shall be fully open and at least one branch balancing damper in the system shall be fully open.
 3. Return air inlets installed in ceilings where the space above the ceiling is used as a return air plenum are to be fully opened and are not to be measured or adjusted except where a specific airflow is indicated.
- D. Zone Dampers:
1. Dampers installed in main trunks and branches and dampers required for system control shall be balanced within -5% to +5% of the design amount.
- E. Filters:
1. Under final balanced conditions, the Test and Balance Agency shall measure and record static pressure entering and leaving each filter bank.
- F. Fans:
1. The Test and Balance Agency shall set the fan RPM to provide design total CFM and the required static pressure to operate the system.
 2. If proper airflow is not achieved, the Contractor shall change the belts and drives. The new drives shall be calculated by the Test and Balance Agency. The Test and Balance Agency shall reset the fan RPM to provide design total CFM.
 3. Fan speed shall not exceed the maximum allowable RPM as established by the fan manufacturer.
 4. The final setting of fan RPM shall not result in overloading the fan motor in any mode of operation. Dampers shall be modulated, and the amperes of the supply fan motor shall be measured to ensure that no motor overload can occur. The amperes shall be measured in the full cooling, heating, dehumidification, and economizer modes to determine the maximum brake horsepower.
 5. After total system balancing, the following values shall be recorded:
 - a. Fan RPM
 - b. Motor voltage and amperes
 - c. Entering static pressure

- d. Leaving static pressure
- 6. Final RPM of the constant volume supply fan shall be set to supply the required CFM with filters artificially restricted to simulate 100% loading. The Test and Balance Agency shall verify that the fan motor will not be overloaded when the system is operating with unrestricted, clean filters in place.
- 7. When applicable, final supply fan settings shall be based on rated wet cooling coil resistance.
- 8. Final RPM of the supply fan in systems having mixed air dampers shall be set to provide required CFM with the system in a logical non-modulating mode; for example, minimum outside air.
- G. Coils:
 - 1. Under final balanced conditions, the Test and Balance Agency shall measure and record static pressure entering and leaving each coil bank.
- H. Other Devices:
 - 1. Under final balanced conditions, the Test and Balance Agency shall measure and record static pressures entering and leaving other devices including:
 - a. Soundtraps
- I. Mixed Air Control:
 - 1. The Test and Balance Agency shall observe or test mixed air plenums for possible stratification. If freeze-up or other serious problems are likely, the condition shall be reported to the Architect/Engineer at once.
 - 2. The Test and Balance Agency shall set the minimum outside air quantity to the required value. If this airflow quantity cannot be properly measured, the Temperature Method as specified in the AABC National Standards shall be utilized.
- J. Static Pressure Readings:
 - 1. Static pressure leaving the fan shall be taken as far downstream from the fan as is practical, but shall be upstream of any restrictions in the duct (such as duct turns).
 - 2. No reading shall be taken directly at the fan outlet or through the flexible connection.
 - 3. Static pressure entering a fan shall be measured in the inlet duct upstream of any flexible connection and downstream of any duct restrictions.

2.4 TEMPERATURE CONTROL SYSTEM:

- A. In the process of Total System Balance, the Test and Balance Agency shall:

1. Work with the temperature control contractor to ensure the most effective total system operation within the design limitations, and to obtain mutual understanding to intended control performance.
2. Verify that all control devices are properly connected.
3. Verify that all dampers and other controlled devices are operated by the intended controller.
4. Verify that all dampers are in the position indicated by the controller (open, closed, or modulating).
5. Verify the integrity of valves and dampers in terms of tightness of close-off and of full-open position. This includes dampers in multizone units, mixing boxes and VAV terminals.
6. Check that all valves are properly installed in the piping system in relation to direction of flow and location.
7. Check the calibration of all controllers.
8. Verify the proper application of all normally open and normally closed valves.
9. Check the locations of all thermostats and humidistats for potential erratic operation from outside influences such as sunlight, drafts, or cold walls.
10. Check the locations of all sensors to determine whether their position will allow them to sense only the intended temperatures or pressures of the media.
11. Check that the sequence of operation for any control mode is in accordance with approved shop drawings. Verify that no simultaneous heating and cooling occurs except where specified. Observe that heating cannot take place at VAV reheat terminals until the unit is at minimum CFM.
12. Verify that all controller set points meet the design intent.
13. Check all dampers for free travel.
14. Verify the operation of all interlocked systems.
15. Perform all system verification to assure the safety of the system and its components.

2.5 EXISTING SYSTEMS:

A. General:

1. All hydronic and air systems which are to remain but are modified in any manner or are listed to be tested shall be tested before demolition begins.
2. The test and balance contractor shall utilize an ultrasonic meter to measure existing water flows where existing water flows are to be measured. If there are

proper flow measuring devices installed, the test and balance contractor may use the installed devices.

3. Where ultrasonic meters are used on existing insulated systems, the contractor shall remove insulation as needed and repair insulation and finish to match existing when testing is completed.

B. Balancing Requirements

1. The A/E shall provide direction on any changes to be made to the existing equipment's air balance. After renovation work is completed, the existing equipment shall be rebalanced or, if no changes are required, equipment shall be retested.

C. Locations shall include, but not be limited to, the following:

1. Equipment and airflows indicated on the plans.
2. Air flow at points where new duct ties in.

D. Reports:

1. A test and balance report shall be submitted before demolition and after renovation is completed for all systems which are required to be measured.

2.6 TEMPERATURE MEASUREMENT:

A. General:

1. Air and water temperatures at hydronic coils must be taken in the same relative timeframe. For example, when measuring coil entering and leaving air temperatures, the coil entering and leaving water temperature must be taken in close timeframe to the measurement of the air.
2. Where outside air temperature is a variable affecting other readings (such as a mixed air temperature), the outside air reading shall be given at the time of the mixed air reading.

B. Air Temperatures:

1. Provide entering and leaving air temperatures for each cooling coil, heating coil, energy recovery and heat transfer device.
2. Temperatures shall be measured in heating, cooling, dehumidification, and neutral modes of operation.

PART 3 - EXECUTION

3.1 SUBMITTALS:

- A. The Contractor shall submit to the A/E the following information within thirty days after the award of the contract:
 - 1. The name of the Test and Balance Agency.
 - 2. Name and registration number of the certified testing technician.
- B. The Contractor shall submit to the A/E the following information within ninety days after the award of the contract.
 - 1. Detailed testing procedures including list of instruments, task performed, model and serial number and date last calibrated.
 - 2. Agenda including schedule of work with approximate duration of each phase, approximate date of field inspections, and required start date to meet scheduled completion date.
 - 3. Report forms.
- C. An approved copy of each submittal must be received by the Test and Balance Agency before work is begun.
- D. If complete submittals are not received by the A/E within the specified times, the A/E reserves the right to select the Test and Balance Agency with any additional costs incurred by the Contractor.

3.2 REPORT SUBMITTALS:

- A. Provide a preliminary typed report for engineers' review.
- B. After receiving engineers' review comments and address issues, submit three copies of the Test and Balance report. Report shall have systems, subsystems, and individual readings in a sequential format.
- C. Reports shall be submitted after all modifications required by these specifications to balance system (i.e. replace impellers, belts, drives, dampers) have been made. Reports will not be accepted with comments such as damper missing, new drive required, etc.

3.3 DRAWING SUBMITTALS:

- A. Test and Balance Agency shall submit plans indicating:
 - 1. All traverse locations referencing values shown in reports.
 - 2. Locations of all required sound and vibration measurements.

3.4 COORDINATION OF WORK:

- A. Test and Balance Agency shall not begin work on a system until system is started as required in SYSTEM START-UP specifications.

3.5 CONTRACTOR REVIEWS AND INSPECTIONS:

- A. The Test and Balance Agency shall perform one pre-construction plan check and submit comments to A/E.
- B. The Test and Balance Agency shall perform construction inspections at the following stages of each construction phase and submit comments to A/E:
 - 1. 50% completion
 - 2. 90% completion

3.6 BELTS, DRIVES, IMPELLERS AND DAMPERS:

- A. If it is determined by the Test and Balance Agency that drive changes are required, the Contractor shall change belt and drive.
- B. Drives for constant volume air handlers shall be selected for a minimum of 100% filter loading.
- C. Drives for variable volume air handlers shall be selected for a minimum of 100% filter loading.
- D. If it is determined by the Test and Balance Agency that impeller changes are required, the Contractor shall change impellers.
- E. If it is determined by the Test and Balance Agency that additional balance dampers are required, the Contractor shall install additional dampers.
- F. The Test and Balance Agency shall rebalance system after changes have been made.

3.7 ENGINEER REVIEW:

- A. The A/E shall, at their discretion, recheck any or all of the test and balance work within 120 days of receipt of report. The Test and Balance Agency shall provide ample number of technicians and test equipment to perform the tests required.
- B. Upon completion of the A/E's recheck, the testing and balancing report, or portions thereof, shall be accepted or rejected. All parts not accepted shall be retested and rebalanced.
- C. Systems shall be tested, rebalanced and rechecked until accepted by all parties.

3.8 EXISTING SYSTEMS:

- A. Pre-demolition test report shall be submitted before demolition begins.
- B. Balance systems as directed by A/E after renovation work is completed and provide renovation test report.

3.9 MOTOR CAPACITY:

- A. At no time shall the motor exceed full load amps. Motor shall load into service factor only if written permission is received from the engineer.

END OF SECTION 23 0593

SECTION 23 0700 - HVAC INSULATION

PART 1 - GENERAL

1.1 SCOPE OF WORK:

A. General:

1. Furnish all labor, materials, tools and equipment and perform all operations in connection with the installation of insulation required for thermal and acoustical installation on all mechanical equipment, piping, ductwork, and appurtenances where shown on the drawings and specified hereinafter under applicable sections of this specification.

1.2 RELATED DOCUMENTS:

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 specification sections, apply to this section.
- B. All sections of Division 23 specifications apply to this section. In addition, refer to these specification sections:
 1. Section 23 0713 - Duct Insulation
 2. Section 23 0716 - HVAC Equipment Insulation
 3. Section 23 0719 - HVAC Piping Insulation

1.3 QUALITY ASSURANCE:

A. Flame and Smoke Spread Ratings:

1. All insulation materials must have a maximum 25/50 flame/smoke rating as tested by ASTM E-84, NFPA 255 and UL 723 except where specifically noted otherwise.
2. Flame/smoke rating shall be a minimum of 25/250 in equipment rooms where the room is not used as a plenum.
3. Flame/smoke rating shall be a minimum of 25/250 in tunnels, crawl spaces, and outdoors.

B. Insulation thickness shall equal those recommended by ASHRAE 90.1 or as scheduled, whichever is greater. Surface temperatures shall be below 140 degrees F.

C. Accessories such as adhesives, mastics, cements, and tapes for fittings shall have the same component rating as listed above.

D. All products or their shipping cartons shall bear a label indicating that flame and smoke ratings do not exceed requirements. Treatment of jackets or facing to impart flame and smoke safety shall be permanent. The use of water soluble treatments is prohibited.

- E. Installation and materials shall meet the requirements of the International Building Codes.
- F. All insulation work shall be applied by mechanics normally employed in the trade. All insulation shall be installed in accordance with the manufacturer's recommendations.
- G. All insulation furnished under this Division of the specifications shall be the product of one manufacturer except for special applications.
- H. Manufacturers:
 - 1. The following manufacturers of sealants, adhesives, and mastics shall be:
 - a. Foster
 - b. Childers
 - c. Mon-Eco

PART 2 – PRODUCTS

2.1 MASTICS, SEALANTS, AND ADHESIVES:

- A. General:
 - 1. Materials shall be as recommended by the insulation manufacturer.
 - 2. Products shall be applied as recommended by the manufacturer for that specific application.
 - 3. The number of coats and thicknesses shall meet or exceed the manufacturer's recommendation or as indicated in these specifications or on the plans, whichever is greatest (coats and thickness).
 - 4. Materials shall meet LEED requirements for low emitting products.
- B. Finish:
 - 1. When material is applied where it is to be painted, the material shall be coated, if necessary, to allow the material to be properly painted without use of special paints or primers.

PART 3 - EXECUTION

3.1 GENERAL:

- A. All insulation materials shall be delivered and stored in manufacturer's container and kept free from dirt, water, chemical and mechanical damage.
- B. Insulation shall be applied by experienced workmen in a workmanlike manner.

- C. Insulation shall not be applied until all pressure testing has been completed, inspected and released for insulation application.
- D. Surfaces to be insulated shall be clean and dry.
- E. All insulation joints shall be butted firmly together and all jackets and tapes shall be smoothly and securely installed.
- F. Insulation shall be run continuously through walls, ceiling openings, and sleeves except where fire stop or firesafing materials are required.
- G. Items that are factory insulated shall not receive additional insulation where not otherwise specified.

3.2 INSTALLATION:

- A. General:
 - 1. Insulation on cold surfaces where vapor barrier jackets are used shall be applied with a continuous, unbroken vapor seal.
 - 2. Insulation on equipment that must be opened periodically for inspection, cleaning, and repair must be constructed so insulation can be removed and replaced without damage.

END OF SECTION 23 0700

SECTION 23 0713 - DUCT INSULATION

PART 1 - GENERAL

1.1 SCOPE OF WORK:

A. General:

1. Furnish all labor, materials, tools and equipment and perform all operations in connection with the installation of insulation required for thermal and acoustical installation on all sheet metal duct and appurtenances where shown on the drawings and specified hereinafter.

1.2 RELATED DOCUMENTS:

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 specification sections, apply to this section.
- B. All sections of Division 23 specifications apply to this section. In addition, refer to these specification sections:
 1. Section 23 0700 - HVAC Insulation

1.3 QUALITY ASSURANCE:

A. Codes and Standards:

1. Federal Specification HH-I-558C Mineral Fiber Boards, Blankets and Pipe Covering
2. ASTM C553 Standard Specification for Mineral Fiber Blanket Insulation for Commercial and Industrial Applications
3. ASTM C547 Standard Specification for Mineral Fiber Performed Pipe Insulation
4. ASTM G12 Standard Specification, Mineral Fiber Block and Board Thermal Insulation
5. ASTM C1136 Barrier Material, Vapor (Jacket Only)
6. ASTM C916 Liner Adhesive
7. ASTM G21, G22 Fungi and Bacteria Resistant Tests
8. ASTM C1071, Standard Specification for Fibrous Glass Duct Lining Insulation (Thermal and Sound Absorbing Material)
9. UL 723 Duct Tape

- B. Duct wrap shall not exceed 25% compression.

C. Manufacturers:

1. The following fiberglass duct insulation manufacturers are acceptable.
 - a. Owens/Corning
 - b. Certainteed
 - c. Knauf
 - d. Johns Manville
2. The following elastomeric duct insulation manufacturers are acceptable:
 - a. Armacell
 - b. K-Flex
 - c. Aeroflex
 - d. Nomaco

PART 2 - PRODUCTS

2.1 GENERAL:

- A. Duct insulation shall comply with the requirements of International Energy Conservation Code or these specifications, whichever is greater.
- B. If no other specific direction is provided, the spaces for duct insulation are defined as follows:
 1. Concealed:
 - a. Above ceiling.
 - b. In mezzanines.
 - c. In mechanical rooms.
 - d. Other spaces not generally considered regularly occupied spaces.
 2. Exposed:
 - a. Indoor locations generally considered regularly occupied spaces and where duct can be visible to occupants.
 3. Outdoor:
 - a. Exposed to ambient conditions including sunlight and weather.

4. Unconditioned spaces:
 - a. Exposed to ambient temperatures but not to sunlight and weather. Typical spaces may be attics, crawl spaces, utility tunnels, chases open to the exterior, etc.
5. Return air plenum:
 - a. A space is only considered a return air plenum if the unducted air returning from a space or above the ceiling of the space is from the same air handler supplying that space.

2.2 TYPES OF FIBERGLASS INSULATION:

A. Fiberglass Duct Wrap:

1. Blanket type insulation composed of glass fibers bonded with a thermosetting resin and faced with an FSK vapor retarder. The facing shall be a glass scrim reinforced laminate of aluminum foil and kraft paper bonded with a fire retardant adhesive.
2. Insulation shall be 1.00 lb./CF density, .28K @ 75 degrees F and a facing vapor transmission of .02 perms max.
3. Basis of design insulation shall be:
 - a. Owens Corning Type 100

2.3 TYPES OF ELASTOMERIC INSULATION:

A. Elastomeric Duct Insulation:

1. Insulation is a flexible elastomeric thermal insulation.
2. Insulation shall be .27 K value @ 75 degrees F, water vapor transmission of less than 0.08, water absorption of less than 0.2% (by volume) and shall not support microbial growth.
3. Basis of design insulation shall be:
 - a. K-Flex LS sheet

B. Elastomeric Duct Insulation (Indoor Exposed):

1. Insulation is a flexible elastomeric thermal insulation with white PVC sheet laminated to a mylar film.
2. Cladding shall be .12 mm thick and suitable for field painting.

3. Insulation shall be .27 K value @ 75 degrees F, water vapor transmission of less than 0.08, water absorption of less than 0.2% (by volume) and shall not support microbial growth.
4. Basis of design insulation shall be:
 - a. K-Flex WT Clad

2.4 MINIMUM THERMAL VALUES REQUIRED FOR INSULATION (UP TO 9000 CDD50 AND UP TO 9000 HDD 65, CLIMATE ZONE 3):

A. General:

1. This section is intended to indicate minimum as installed "R" values.
2. Where specific duct insulation thicknesses are indicated elsewhere in this specification or on the plans, the greater thickness or insulating value shall be provided.
3. If no other requirements are indicated and an R-0 is indicated, no insulation is required.

B. Supply Duct:

1. Outdoor: R-8 as installed

C. Return Duct:

1. Outdoor: R-8 as installed

D. Outside Air Duct:

1. See requirements for supply duct.

2.5 APPLICATION OF FIBERGLASS DUCT WRAP:

A. Fiberglass duct wrap shall be provided for all ducts and plenums required to be insulated in the following locations:

1. Concealed ducts
2. Exposed ducts in occupied spaces

2.6 APPLICATION OF ELASTOMERIC INSULATION:

A. Outdoor duct:

1. Provide elastomeric insulation on the following systems:
 - a. As indicated on the drawings.

2. Two layers are required. The layer adjacent to the duct shall be 1" elastomeric insulation (without jacket). The second (outer layer) shall be 3/4" elastomeric insulation specified for outdoor applications (i.e., with aluminum foil).

B. Louver Blank-Off Panel:

1. Provide elastomeric insulation on all louvers specified with a blank-off panel.
2. One layer is required. The layer shall be 3/4" elastomeric insulation specified for indoor application (i.e., with PVC sheet).

2.7 TAPE FOR FIBERGLASS DUCT INSULATION:

- A. Tape shall be pressure sensitive joint sealing tape specifically made for the specific application in which it is used.
- B. Tape shall be 3" wide minimum and shall match the insulation finish.

2.8 DUAL WALL DUCT:

- A. No additional insulation is required.

2.9 ALUMINUM JACKETING:

- A. General:
 1. Provide a complete system of aluminum jacketing for the following duct systems.
 - a. As indicated on the drawings.
 2. Jacket thickness shall be .024" minimum.
 3. Jacketing shall be provided on all sides of the duct.

2.10 LOUVER BLANK-OFF PANELS:

- A. Provide 3/4" elastomeric insulation.

PART 3 - EXECUTION

3.1 INSTALLATION OF FIBERGLASS INSULATION:

- A. Fiberglass Duct Wrap Insulation:
 1. Duct wrap insulation seams shall be stapled 6" on center with outward clinching staples. All seams are to be sealed with pressure sensitive tape matching the facing.
 2. Where rectangular ducts are 24" in width or greater, duct wrap insulation shall be additionally secured to the bottom of the duct with mechanical fasteners such as

pins and speed clip washers, spaced 18" on center (max.) to prevent sagging of insulation.

B. Tape and Mastic Installation:

1. After the pressure sensitive tape is applied, a coat of mastic shall be applied to the tape overlapping the insulation by 2" minimum.
2. Tape and mastic shall also be applied to all tears, rips, punctures, penetrations, mechanical fasteners, access doors, and all other locations as necessary to ensure a continuous vapor tight system.
3. Mastic must also be applied to any factory applied tape such as on factory insulated supply grilles, etc.

3.2 INSTALLATION OF ELASTOMERIC INSULATION:

- A. Insulation shall be adhered to the sheet metal with 100% coverage of adhesive.
- B. Provide 4" wide tape to match finish of elastomeric insulation.

3.3 ALUMINUM JACKETING:

- A. When installed outdoors jacketing shall be sloped to prevent water from standing on the ductwork.
- B. Whenever possible locate seams on the bottom side of the ductwork.

END OF SECTION 23 0713

SECTION 23 0900 - INSTRUMENTATION AND CONTROLS FOR HVAC (GENERAL)

PART 1 - GENERAL

1.1 SCOPE OF WORK:

A. General:

1. Furnish all labor, materials, tools and equipment and perform all operations in connection with the installation of the building environmental controls shown on the drawings and specified hereinafter.

B. Description:

1. Control and instrumentation work shall include:
 - a. Temperature control
 - b. Humidity control
 - c. Airflow control
 - d. Equipment interlock and controls
 - e. Wiring for automatic controls

1.2 RELATED DOCUMENTS:

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 specification sections, apply to this section.
- B. All sections of Division 23 specifications apply to this section. In addition, refer to these specification sections:
 1. Section 23 0900.01 - Controls for HVAC (Dampers and Valves)
 2. Section 23 0904 - Building Automation System
 3. Section 23 0905 - Smoke Devices and Systems

1.3 QUALITY ASSURANCE:

A. Codes and Standards:

1. All environmental controls shall comply with all local codes and ordinances, and meet or exceed the following standards:
 - a. Underwriters Laboratories
 - b. NEMA Standards

- c. National Electric Code
 - d. Scientific Apparatus Makers Associates Standard PMC 20.1 for Process Measurement and Control Terminology
 - e. Scientific Apparatus Makers Associates Standard PMC 20.2 for Process Control Performance
 - f. NFPA 90A
 - g. NFPA 72E Standard for Automatic Fire Detector
- B. Control circuit wiring shall meet NFPA Standard 70, Article 725, for remote control, low energy power, low voltage power and signal circuits.
- C. All control equipment shall be the product of one manufacturer whenever practical.
- D. Manufacturers:
- 1. The following Building Environmental Controls Contractors are acceptable:
 - a. United Automation Corporation, Charlotte, NC
 - 2. The following steel control guard manufacturers are acceptable:
 - a. VPI
 - b. Shaw Perkins
 - c. Approved equal
 - 3. The following three phase voltage monitors are acceptable:
 - a. Motor Saver
 - b. Approved equal
 - 4. The following needlepoint bipolar ionization manufacturers are acceptable:
 - a. GPS
 - b. Plasma Air International
 - c. Aerisa
 - d. Bio-Oxygen

PART 2 - PRODUCTS

2.1 GENERAL:

- A. The building environmental controls shall be provided by the Building Environmental Controls Contractor.
- B. The Building Environmental Controls Contractor shall have a local office within a 75 mile radius of the job site, staffed with factory trained engineers. The engineers shall be capable of providing instructions and maintenance service on all system components.
- C. The Building Environmental Controls Contractor shall have a 5-year successful history in the design and installation of building systems and automatic temperature controls similar in performance to that specified herein and shall be prepared to evidence this history as condition of acceptance and approval prior to bidding.
- D. The Building Environmental Controls system shall be installed by competent controls mechanics who are full time employees of the Building Environmental Controls Contractor.
- E. The Environmental Control Contractor shall be responsible for the quality and satisfactory operation of the devices within the system and for the overall performance of the specified air flow control system.

2.2 SYSTEM:

- A. Provide all thermostats, humidistats, sensors, transmitters, controllers, actuators, control panels, conduit, wiring, accessories and appurtenances for a complete building environmental control system.
- B. Provide switches, fuses, disconnects and all other devices necessary for protection and convenient operation of system.
- C. The contractor shall be responsible for providing power wiring, conduit, breakers and final connections for all control devices, panels, and components unless specifically shown on electrical plans:
 - 1. Control devices
 - 2. Smoke devices
 - 3. Smoke dampers
 - 4. Motorized dampers
- D. The control system shall be on normal power.

2.3 CONDUIT:

- A. General:
 - 1. All control conduit shall be furnished and installed under this division except where specifically indicated otherwise.
 - 2. All line voltage and control wiring in new construction shall be run in conduit.

3. All control wiring in existing construction shall be run in conduit.
 4. Conduit shall be provided in accordance with the Electrical Division of this specification unless noted otherwise in these specifications.
 5. Outdoor conduit shall be GRC or IMC.
 6. Indoor conduit may be EMT.
 7. Conduit shall be 3/4".
- B. Below slab or below grade conduit:
1. Metallic conduits installed in or below slabs or below grade shall be galvanized rigid steel or IMC and shall be protected against corrosion with two field coatings of asphaltum black varnish or approved equal.
 2. All metallic conduits installed below slab or below grade shall be provided with watertight couplings.
 3. Conduits passing through concrete foundation walls or floor slabs below grade or below ground water level shall be provided with waterproof conduit entrance sealing sleeves.
- C. Exposed Conduit:
1. All exposed (in corridors and all other spaces where visible without removing ceiling tile but not in mechanical or electrical spaces) conduit shall be prepainted conduit.
 2. Conduit shall be prepainted color to be selected by Owner.

2.4 CONTROLS WIRING:

- A. Wiring for low voltage circuits generally shall be No. 18B and S gauge or larger RSH-2 heat resistant.
- B. Cables of two or more conductors, not smaller than 22 B and S gauge if shielded or No. 18 B and S gauge if not shielded, may be used for low voltage d-c and electronic circuits carrying less than 1.50 amperes, in lieu of individual wires.
- C. Cables carrying a-c circuits sensitive to external fields shall be shielded.
- D. Cables having fewer than 12 conductors shall have thermoplastic or rubber insulation for 300 volts or more and a heavy outer braid or thermoplastic sheath. Shields shall be grounded to building's grounding system, using wire not smaller than No. 14 B and S gage. Shields shall not be grounded to conduit systems or building piping.
- E. Cables shall terminate in solder or screw type terminal strips. All terminal strips shall be numbered.
- F. Cables shall not be tapped at intermediate points.

G. All wires, whether individual or in cables, shall be color coded and numbered for identification in accordance with the National Electric Code.

H. Where wire is not in conduit, wire shall be plenum rated.

2.5 TRANSFORMERS:

A. Transformers shall be furnished and installed for supplying current to control equipment as required.

B. Transformers shall conform to NEMA standards, shall be capable of supplying 125 percent the connected load, shall be enclosed in U.L. listed cabinets, ventilated, with conduit connections, and provided with fused disconnect switches on primary side and on secondary side.

2.6 CONTROL VOLTAGE:

A. Voltage shall not exceed 120 volts where located within occupied spaces and not integral with the equipment (such as a unit mounted thermostat).

B. Voltage in wet or damp locations shall not exceed 24V.

2.7 SPEED SWITCHES:

A. Speed switches, rheostats, and other fan speed control devices may be furnished by either the equipment manufacturer or the controls contractor.

2.8 THERMOSTATS AND HUMIDISTATS:

A. Thermostats:

1. Thermostats shall have minimum adjustable operating range of 20 degrees F above and below design setpoint.

2. Wall mounted room thermostats shall be with thermometer and without setpoint indicator.

3. Thermostat shall have external adjustments with internal stops for minimum and maximum settings.

4. Thermostats shall be 24V.

B. Humidistats:

1. Humidistats shall have minimum adjustable operating range of 15 percent above and below design setpoint.

2. Control setting shall be accessible by removal of locking cover.

C. Remote Thermostats:

1. Remote bulb type shall have liquid filled capillary and bulb.

2. Provide sensor well in all piping.

2.9 DDC THERMOSTATS:

A. General:

1. Provide electronic thermostat with sensor, night setback, night override switch, and digital setpoint adjustment. The digital setpoint adjustment only shall be visible through cover. Override switch duration and setpoint adjustment range shall be programmable from the front end.
2. Thermostats shall connect to unit controller via communication cable with a standard jack. The thermostat shall also have a connection available for field monitoring.
3. Devices installed in duct system shall be specifically designed for duct systems.

B. Construction:

1. Device shall be polymer construction.
2. Circuit boards shall be coated.

C. Technical Specifications:

1. Ambient Operating Conditions: 32 deg F to 140 deg F, 0 to 100% RH
2. Accuracy: $\pm .34$ deg F @ 70 deg F (thru film nickel)

2.10 DDC HUMIDISTAT:

A. General:

1. Provide electronic humidistat without setpoint adjustment.
2. Humidistat shall connect to unit controller via communication cable with a standard jack. The humidistat shall also have a connection available for field monitoring.
3. Devices installed in duct system shall be specifically designed for duct system.
4. Where humidistat and thermostat are located adjacent to each other and both are providing input for the same piece of equipment, a combination humidity transmitter and temperature sensor may be provided at the contractor's option.
5. The humidistat shall be a separate device from other control sensors/devices when input is not used to control one specific piece of equipment.

B. Construction:

1. Devices shall be polymer construction.
2. Circuit boards shall be coated.

C. Technical Specification (@ 77 deg F):

1. Ambient operating conditions: 32 deg F to 140 deg F, 0 to 100% RH
2. Accuracy: $\pm 3\%$ RH for 20-80% RH
 $\pm 5\%$ RH for 5-20% and 80-95% RH
3. Temperature Coefficient: .12% RH/deg F
4. Response: less than 120 sec between 50-90% RH
5. Offset Adjustment: ± 5

2.11 SENSORS, TRANSMITTERS, AND OTHER CONTROL DEVICES:

A. General:

1. Provide the type device specified for the specific application. Where the device is not specifically indicated, provide the device best suited to provide the control specified.

B. Location of device:

1. Device shall be located as indicated on the drawings or as stated in the specifications.
2. Where no device location is indicated or specified, the device shall be located as recommended by the manufacturers to provide the best practical results.
3. Where the location indicated on the drawings or stated in the specifications does not provide the best practical results, the manufacturers shall provide recommendations for relocating the device.
4. It shall be the responsibility of the contractor to identify all conflicts between indicated device locations and manufacturers recommended locations prior to installation of any related components (i.e., sensor wells, conduit, etc.).

2.12 SAFETY DEVICES:

A. General:

1. Safety devices including, but not limited to, the following shall be hard wired to perform their required function. Status, where specified, shall be monitored by the building automation controls system and initiate other sequences where required:
 - a. Condensate overflow switch
 - b. Smoke alarm, via unit duct detector, where shutdown sequence is specified to be by mechanical.

2.13 CONTROL PANELS:

A. General:

1. All controllers, relays, switches, etc., for equipment shall be mounted in enclosed control panels with key lockable, piano hinged door.
2. Location of each panel shall be where indicated on plans, approved by A/E, and convenient for adjustment and service.
3. Label each panel properly identifying function or service of panel and all surface mounted devices.
4. Control panels shall be extruded or formed, cold-rolled steel, enamel surfaced, with full length mounting brackets, drilled wall mounting holes.
5. The control panel shall be key lockable.
6. Provide a 24V control transformer.

2.14 CARBON DIOXIDE SENSORS:

- A. Sensor shall be wall mounted or duct mounted.
- B. Sensor shall have LED readout with a range of 0-2000 ppm.
- C. Sensor output shall be compatible with building automation system and shall be analog.

2.15 CONTROL GUARDS:

- A. Provide heavy duty locking metal control guards for the following devices:
 1. Wrestling Room
 2. As indicated on the plans
- B. Guards shall be sized for device(s) enclosed.
- C. Steel control guards shall be constructed from 16 gauge steel with a beige finish.
- D. Flat plate sensors do not require guards.
- E. Provide the following accessories:
 1. Mounting base
 2. Surface mounted adapters (existing walls)
- F. Basis of design steel control guards shall be:
 1. VPI Model TG

2.16 FLOAT SWITCH:

A. General:

1. Float switch shall include a sealed, waterproof reed/magnet float switch with no exposed electrical contacts.
2. Float shall be prewired with 6 ft. long, 18 ga. lead cables.
3. Switch shall be tested to UL 508 and UL listed for 24V AC.
4. Float shall attach to drain pan with stainless steel clips.

B. Locations:

1. All drain pans.

C. Basis of design manufacturers shall be:

1. SMD Research Safe-T-Switch Model SS3.

2.17 EQUIPMENT STATUS:

- A. Equipment status shall be provided by solid state current sensors.
- B. Sensor shall have non-polarity sensitive outputs, trip point adjustment, trip LED, and power LED.

2.18 THREE PHASE VOLTAGE MONITOR:

- A. Monitor shall be autoranging type that detects single phasing, low voltage, phase reversal or voltage unbalance. When a harmful condition exists, the output relay shall deactivate. When the harmful condition is removed, the relay shall reactivate.
- B. The three phase voltage monitor shall be field or factory installed on all three phase equipment.
- C. If three phase protection is already provided with the equipment via the VFD or other means, the control contractor does not have to provide additional three phase protection.

2.19 FLAT PLATE TEMPERATURE SENSOR:

A. General:

1. Wall plate shall be standard size stainless steel with button sensor and security screws.
2. Sensor shall connect to unit controller via communication cable with a standard jack. The thermostat shall also have a connection available for field monitoring.
3. Circuit boards shall be coated.

4. The lead wires shall be Teflon and the sensor encapsulated for a watertight device.
 5. A closed cell foam backing shall insulate the plate from the wall temperature.
- B. Technical Specifications:
1. Ambient Operating Conditions: 32 deg F to 140 deg F, 0 to 100% RH
 2. Accuracy: $\pm .34$ deg F @ 70 deg F (thru film nickel)
- C. Provide flat plate temperature sensor for all heating and cooling equipment when the sensor is located in the following spaces:
1. Gymnasium
 2. Other locations where indicated.

2.20 BIPOLAR IONIZATION:

- A. General:
1. The electrodes shall be needlepoint type. Needlepoints shall not protrude into the airstream.
 2. The bipolar ionization system shall be capable of:
 - a. Effectively killing microorganisms downstream of the bipolar ionization equipment (mold, bacteria, virus, etc.).
 - b. Controlling gas phase contaminants generated from human occupants, building structure, furnishings and outside air contaminants.
 - c. Reducing space static charges.
 - d. Reducing space particle counts.
 3. The bipolar ionization system shall produce equal amounts of positive and negative ions.
 4. Relative humidity from 0 – 100%, condensing, shall not cause damage, deterioration, or dangerous conditions to the air purification system.
 5. Bipolar ionization units shall be tested and listed by either UL or ETL according to UL Standard 867 – Electrostatic Air Cleaners.
 6. The operation of the electrodes or bipolar ionization units shall conform to UL 867 with respect to ozone generation.
- B. Electrodes:

1. Each plasma generator shall include the required number of electrodes and power generators sized to the air handling equipment capacity.
 2. Ionization output from each electrode shall be a minimum of 5 million ions/cc when tested at 2" from the ion generator.
- C. Duct Mounted Units:
1. Ion generators shall be furnished with a factory-equipped gasketed mounting flange to prevent air leakage.
 2. Ion generators shall contain a built-in power supply and operate on 24V AC.
- D. Air Handler Mounted Units:
1. The entire cooling coil shall have equal and adequate ionization distribution across the face of the coil.
 2. Ion generators shall be mounted in a linear configuration to minimize space required. The ion generators and mounting bar shall be 4" deep or less.
 3. The power supply shall accept the following voltages: 12V DC; 24V AC; 120V AC; or 230V AC. Power from the power supply to the ionization generators shall be 12V DC.
- E. Electrical:
1. Generators shall include internal short circuit protection, overload protection, and automatic fault reset.
 2. Electrodes shall be energized when the main unit disconnect is turned on and the fan is operating.
 3. The power supply shall have an On/Off switch and power indicator LED.
- F. Control:
1. Generators shall include an external control interface to monitor generator status and alarm.
- G. Control (Air Handler Mounted Units):
1. The system shall be provided with a standalone ion sensor to monitor ion output.
 2. The ion sensor shall measure real time density of ions/CM³.
 3. Sensors shall be designed to be mounted anywhere in the system downstream of the ion generator.
 4. Sensor shall include an external control interface to monitor proper ion generation.

PART 3 - EXECUTION

3.1 INSTALLATION:

A. General:

1. The Building Environmental Controls Contractor shall be responsible for a complete operational system.
2. The installation shall include:
 - a. Drawings
 - b. Supervision
 - c. Interlocks
 - d. Adjustments
 - e. Verification
3. Location of sensing elements shall be the responsibility of the installer.

- B. Wiring splices shall not be permitted in electrical panelboards, junction boxes and switchgear.

3.2 THERMOSTATS, HUMIDISTATS AND SWITCHES:

A. General:

1. Install all devices as recommended by manufacturer.
2. When device is provided by the control contractor, the control contractor shall be totally responsible for all coordination with the equipment supplier to ensure compatibility of components to meet the requirements of the equipment manufacturer and the control sequence.

B. Installation:

1. Mount thermostats, sensors, and switches 4'-0" above finished floor to the top of the device's control mechanism unless noted otherwise.
2. Mount humidity sensors 7'-0" above finished floor unless noted otherwise.
3. Thermostats mounted on exterior walls shall be mounted on a thermally insulated sub-base.
4. When location is not shown, Contractor shall assume the most remote location served by unit. Coordinate exact location with A/E.
5. Contractor shall coordinate location of thermostat, humidistats, and switches with final architectural plans and actual field conditions to avoid locating them inside

cabinets, bookcases, casework, chalkboards, tackboards and behind door swings and similar obstructions that would limit access or limit the ability to properly sense space conditions.

3.3 REMOTE THERMOSTATS:

- A. Thermostats not shown on plans shall be mounted in convenient locations on duct, in mechanical space or on equipment. Provide access doors for sensor and for thermostat.

3.4 WIRING:

- A. All control wiring within starters (and motor control centers) shall be installed in a workmanlike manner and neatly laced.
- B. All wiring installed in manholes, below grade, or below ground water level shall be made up with waterproof connections.
- C. Wiring in manholes shall be continuous thru manholes.

3.5 CONDUIT:

- A. Conduit sleeves thru non-waterproofed walls and floors shall be grouted and caulked on both sides of wall.
- B. After installation, any painted pipe which is damaged shall be touch-up painted.

3.6 EXISTING CONSTRUCTION:

- A. Control wiring and conduit shall be installed in existing walls, slabs, and ceilings.
- B. Where conditions do not permit installation of conduit and wiring in existing walls, slabs, and ceiling; and, when approved by the engineer, wire mold and similar finished enclosures may be provided.
- C. Conduit and wiring shall be installed above existing ceilings except where removal of existing ceilings is specifically identified in other dimensions of work (if any). The Contractor shall be responsible for removal of all other existing tile/grid and replacement of the tile/grid as necessary. Any damaged tile/grid shall be replaced by the Contractor at the Contractor's expense.

3.7 DEVICES ON EXTERNALLY INSULATED DUCTS:

- A. Devices mounted on externally insulated ducts shall be mounted on standoff brackets to allow proper installation of duct. If device must be mounted directly to duct for proper operation, standoff bracket may be deleted.

3.8 GAS MONITORS:

- A. Install sensor at location and height recommended by manufacturer. Coordinate location with electrical prior to roughing-in electrical.
- B. Verify operation of the alarm at the setpoint.

3.9 SPEED SWITCHES:

- A. If switch is not factory installed on the unit, the control contractor shall field install the switch.

3.10 FLOAT SWITCH:

- A. Secure bracket to drain pan with screw.
- B. Verify float is properly positioned.

3.11 BIPOLAR IONIZATION:

A. Calculations:

- 1. Provide Indoor Air Quality calculations using the formulas within ASHRAE Standard 62.1 (latest edition) to validate acceptable indoor air quality at the quantity of outside air scheduled.

B. Submittals:

- 1. Air handler bipolar ionization generator submittals shall include dimensional drawings showing the units in which the generators are to be installed. The submittal shall include documentation stating that the installation requirements have been coordinated with the air handle manufacturer.

C. Installation (Air Handler Bipolar Ionization Generators):

- 1. Air handler bipolar ionization generators shall be factory or field installed. If field installed, installation shall be in strict accordance with manufacturer's written recommendations.
- 2. The ionization generators shall be wired to the remote mounted power supply.
- 3. Install ion sensor in duct system where accessible for servicing.

END OF SECTION 23 0900

SECTION 23 0904.05 - BUILDING AUTOMATION CONTROL SYSTEM (NIAGARA)

PART 1 - GENERAL

1.1 SCOPE OF WORK:

A. General:

1. Furnish all labor, materials, tools and equipment and perform all operations in connection with the installation of the building automation control system (BACS) shown on the drawings and specified hereinafter.

B. Description:

1. The building automation control system shall be comprised of a network of interoperable, stand-alone digital controllers, network area controllers, graphics and programming and other control devices for a complete system.

1.2 RELATED DOCUMENTS:

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 specification sections, apply to this section.
- B. All sections of Division 23 specifications apply to this section. In addition, refer to these specification sections:
 1. Section 23 0900 - Instrumentation and Control for HVAC (General)

1.3 QUALITY ASSURANCE:

A. Codes and Standards:

1. All equipment and components shall comply with all local codes and ordinances, and meet or exceed the following standards:
 - a. Federal Communications Commission (FCC), Rules and Regulations, Volume II -July 1986 Part 15 Class A Radio Frequency Devices.
 - b. FCC, Part 15, Subpart B, Class B
 - c. FCC, Part 15, Subpart C
 - d. FCC, Part 15, Subpart J, Class A Computing Devices.
 - e. UL 504 - Industrial Control Equipment.
 - f. UL 506 - Specialty Transformers.
 - g. UL 910 - Test Method for Fire and Smoke Characteristics of Electrical and Optical-Fiber Cables Used in Air-Handling Spaces.

- h. UL 916 - Energy Management Systems All.
 - i. UL 1449 - Transient Voltage Suppression.
 - j. Standard Test for Flame Propagation Height of Electrical and Optical - Fiber Cables Installed Vertically in Shafts.
 - k. EIA/ANSI 232-E - Interface Between Data Technical Equipment and Data Circuit Terminal Equipment Employing Serial Binary Data Interchange.
 - l. EIA 455 - Standard Test Procedures for Fiber Optic Fibers, Cables, Transducers, Connecting and Terminating Devices.
 - m. IEEE C62.41- Surge Voltages in Low-Voltage AC Power Circuits.
 - n. IEEE 142 - Recommended Practice for Grounding of Industrial and Commercial Power Systems.
 - 1) NEMA 250 - Enclosures for Electrical Equipment.
 - o. NEMA ICS 1 - Industrial Controls and Systems.
 - p. NEMA ST 1 - Specialty Transformers.
 - q. CE 61326
 - r. C-Tick
 - s. cUL
- B. All the equipment shall have the UL label.
- C. Manufacturers:
- 1. The following BACNet MSTP controllers are acceptable:
 - a. Honeywell
 - b. Distech Controls
 - c. Johnson Controls Inc. and Vykon
 - 2. The following network area controllers (NAC) are acceptable:
 - a. Honeywell
 - b. Distech Controls
 - c. Johnson Controls Inc. and Vykon

3. The following versions of Niagara 4 Framework are acceptable:
 - a. Honeywell
 - b. Distech Controls
 - c. Johnson Controls Inc. and Vykon

PART 2 - PRODUCTS

2.1 APPROVED CONTROL CONTRACTORS:

- A. Control contractors shall have an office with at least two (2) certified Niagara technicians located within 150 miles of Fort Mill, S.C.
- B. A local office may provide field support, but the office providing the shop drawings, presentation to the Owner, and final system checkout shall be the office with the certified technicians.

2.2 GENERAL SYSTEM DESCRIPTION:

- A. The building automation control system includes two distinct but interconnected control components. The first includes the building controls hardware up to and including the Network Area Controller (NAC). The second includes the supervisory software, programming and graphics.
- B. A single control contractor shall have overall responsibility for the installation and operation of the building automation control system.
- C. The product submittals, engineering, installation supervision, programming, startup, checkout and Owner's instructions and training shall be provided by Niagara 4 TCP certified personnel.

2.3 OWNERS WITH EXISTING BUILDING AUTOMATION SYSTEMS:

- A. When this facility is brought on-line, the existing software and hardware shall be upgraded as necessary to support the graphics, sequences and other functions of the building automation system.
- B. The data, information and graphical representations of the systems at this facility shall be equal to or greater than that installed for other facilities (in the District) or as indicated in these specifications, whichever is greater.

2.4 SYSTEM ARCHITECTURE:

- A. System architecture shall include a Network Area Controller (NAC) that resides on the IP network and the NAC shall fully support a multi-vendor environment and be able to integrate third party systems via LonTalk, BACnet, SNMP and Modbus.
- B. System architecture shall provide a minimum Transport Layer Security (TLS) (latest version supported) Web access using any of the current versions of Microsoft Internet

Explorer, Mozilla Firefox, or Google Chrome browsers from any computer on the owner's LAN.

- C. The software shall employ object-oriented technology for representation of all data and control devices within the system. Physical connection of any BACnet controllers shall be via BACnet IP or BACnet MS/TP. BACnet Ethernet or BACnet Arcnet communications are not acceptable for NAC, Server or field device communication.
- D. All components and controllers shall be true "peer-to-peer" communicating devices. With the exception of any previously installed legacy systems which cannot be updated to current open communication technologies, components or controllers requiring "polling" by a host to pass data shall not be acceptable.
- E. The system shall incorporate the ability to access all data using HTML5 enabled browsers without requiring proprietary operator interface and configuration programs or browser plug-ins.
- F. 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.

2.5 SYSTEM CONTROLLERS (GENERAL):

- A. Mechanical systems controllers shall communicate over a BACNet MSTP or BACNet IP protocol bus.
- B. Electrical systems controllers shall communicate over a BACNet MSTP, BACNet IP or Modbus TCP/IP protocol bus.
- C. The control shall use BACnet based devices where the application has BTL Listed PICS defined.
- D. The equipment controllers shall be fully programmable with full functionality on any Niagara 4 brand platform.
 - 1. Support downloads to the controller from any brand of Niagara 4 platform.
 - 2. Support uploads from the controller to any brand of Niagara 4 platform.
 - 3. Support simulation/debug mode of the controller.
 - 4. Maintain native GUI.
 - 5. All controllers shall be programmable directly from the Niagara 4 Workbench embedded toolset upon completion of this project. The use of configurable or programmable controllers or software tools and applications that require a specific Niagara 4 license brand to operate for post-installation maintenance shall not be acceptable.
- E. The equipment controllers shall have a visual indication (LED) of the status of the device:

1. Controller operating normally.
2. Controller in process of download.
3. Controller in manual mode under control of software tool.
4. Controller lost its configuration.
5. No power to controller, low voltage, or controller damage.
6. Processor and/or controller are not operating.

2.6 NETWORK AREA CONTROLLER (NAC):

- A. Manage communications between the programmable equipment controllers (PEC), unitary controllers (UC), and variable air volume controllers (VAV) which are connected to its communications trunks, manage communications between itself and other system network controllers (NAC) and with any operator workstations (OWS) that are part of the BACS, and perform control and operating strategies for the system based on information from any controller connected to the BACS.
- B. The controllers shall be fully programmable to meet the unique requirements of the facility it controls.
- C. The controllers shall be capable of peer-to-peer communications with other NAC's and with any OWS connected to the BACS whether the OWS is directly connected, connected via cellular modem, or connected via the Internet.
- D. The NAC shall employ a device/point count capacity license model that supports expansion capabilities.
- E. The NAC shall be enabled to support and shall be licensed to include the following Open protocol drivers (client and server) by default:
 1. BACnet
 2. Lon
 3. MODBUS
- F. The NAC 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. HTML5 User Configurable dashboard with Niagara Analytics
 7. Integration of LonWorks, BACnet, and MODBUS controller data.
 8. Network management functions for all NAC, PEC, and UC based devices.
- G. Certifications – All NACs shall be listed under with the following agencies at the certification levels appropriate to them:
1. UL 916
 2. CE EN 61326-1
 3. FCC Part 15 Subpart B, Class B
 4. FCC Part 15 Subpart C
 5. C-UL listed to Canadian Standards Association (CSA) C22.2 No. 205-M1983 “Signal Equipment”
 6. 1999/5/EC R&TTE Directive
 7. CCC
 8. SRRC
 9. RSS
 10. ROHS
 11. IEEE802.11a/b/g/n
 12. IEEE802.11n HT20 @ 2.4GHz
 13. IEEE802.11n HT20/HT40 @ 5GHz
 14. Configurable radio (Off, WAP, or Client)
 15. WPAPSK/WPA2PSK supported
- H. Minimum Specifications:
1. Operating temperature: -20–60°C
 2. Storage temperature: -40–85°C
 3. Humidity: 5%–95% — Non condensing
 4. Shipping & vibration: ASTM D4169, Assurance Level II
 5. MTTF: 10 years+

6. Batteryless operation
 - I. The NAC shall support standard Web browser access via the Intranet/Internet. It shall support a minimum of 16 simultaneous users.
 - J. The NAC shall provide alarm recognition, storage, routing, management and analysis to supplement distributed capabilities of equipment or application specific controllers.
 - K. The NAC shall be able to route any alarm condition to any defined user location whether connected to a local network, remote via cellular modem, or wide-area network.
 1. Alarm generation shall be selectable for annunciation type and acknowledgement requirements including but not limited to:
 - a. Alarm.
 - b. Return to normal.
 - c. To default.
 2. Alarms shall be annunciated in any of the following manners as defined by the user:
 - a. Screen message text.
 - b. Email of complete alarm message to multiple recipients.
 - c. Pagers via paging services that initiate a page on receipt of email message.
 - d. Graphics with flashing alarm object(s).
 3. The following shall be recorded by the NAC for each alarm (at a minimum):
 - a. Time and date.
 - b. Equipment (air handler #, access way, etc.).
 - c. Acknowledge time, date, and user who issued acknowledgement.
 - L. The NAC shall support the following security functions.
 1. Module code signing to verify the author of programming tool and confirm that the code has not been altered or corrupted.
 2. Role-Based Access Control (RBAC) for managing user roles and permissions.
 3. Require users to use strong credentials.
 4. Data in Motion and Sensitive Data at Rest be encrypted.

5. LDAP and Kerberos integration of access management.
 6. A CPU that incorporates secure boot technologies.
- M. The NAC shall support the data modeling structures provide with Niagara4 to utilize Search; Hierarchy; Template; and Permission functionality:
1. Metadata: Descriptive tags to define the structure of properties.
 2. Tagging: Process to apply metadata to components
 3. Tag Dictionary
- N. The NAC shall employ template functionality. Templates are a containerized set of configured data tags, graphics, histories, alarms, etc. that are set to be deployed as a unit based upon manufacturer's controller and relationships. All lower level communicating controllers (PEC, UC, VAV, etc.) shall have an associated template file for reuse on future project additions.

2.7 PROGRAMMABLE EQUIPMENT CONTROLLER (PEC):

- A. All PECs shall be application programmable and shall at all times maintain their certification. All control sequences within or programmed into the PEC shall be stored in non-volatile memory, which is not dependent upon the presence of a battery to be retained.
- B. The PEC shall provide LED indication of communication and controller performance to the technician, without cover removal.
- C. The PEC shall not require any external configuration tool or programming tool. All configuration and programming tasks shall be accomplished and accessible from within the Niagara 4 environment.
- D. The following integral and remote Inputs/Outputs shall be supported per each PEC:
1. Eight integral dry contact digital inputs.
 2. Any two digital inputs may be configured as pulse counters with a maximum pulse read rate of 15 Hz.
 3. Eight integral analog inputs (configurable as 0-10V, 0-10,000 ohm or, 20K NTC).
 4. Six integral 4-20 ma analog outputs.
 5. Eight integral 24 Vac Triac digital outputs, configurable as maintained or floating motor control outputs.
 6. One integral 20 Vdc, 65-mA power supply for auxiliary devices.

7. If a 20 Vdc 65-mA power supply terminal is not integral to the PEC, provide at each PEC a separate, fully isolated, enclosed, current limited and regulated UL listed auxiliary power supply for power to auxiliary devices.
- E. Each PEC shall have expansion ability to support additional I/O requirements through the use of remote input/output modules.
- F. PEC Controllers shall support at minimum the following control techniques:
 1. General-purpose control loops that can incorporate Demand Limit Control strategies, Set point reset, adaptive intelligent recovery, and time of day bypass.
 2. General-purpose, non-linear control loops.
 3. Start/stop Loops.
 4. If/Then/Else logic loops.
 5. Math Function loops (MIN, MAX, AVG, SUM, SUB, SQRT, MUL, DIV, ENTHALPY).

2.8 UNITARY CONTROLLER (UC):

- A. General:
 1. The unitary controller (UC) platform shall be designed specifically to control ventilation, heating, cooling, humidification, dehumidification, airflow, and similar functions.
 2. Equipment controlled includes but is not limited to: constant volume air handlers, VAV air handlers, packaged rooftop units, heat pumps, fan coils, heaters and similar equipment.
- 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 network communications. Controller memory minimum requirements include:
 - a. FLASH Memory Capacity: 60 Kilobytes with 8 Kilobytes for application program.
 - b. FLASH Memory settings retained for ten years.
 - c. RAM: 2 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 degrees F (25 degrees C).
 - c. Power Failure Backup: 24 hours at 32 degrees to 122 degrees F (0 degrees to 50 degrees C).
4. The controller shall have Significant Event Notification, Periodic Update capability, and Failure Detect when network inputs fail to be detected within their configurable time frame.
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 minimum controller Environmental ratings.
 - a. Operating Temperature Ambient Rating: -40 degrees to 150 degrees F (-40 degrees to 65.5 degrees C).
 - b. Storage Temperature Ambient Rating: -40 degrees to 150 degrees F (-40 degrees to 65.5 degrees C).
 - c. Relative Humidity: 5% to 95% non-condensing.
7. 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. CSA (LR95329-3) Listed.
 - c. Meets FCC Part 15, Subpart B, Class B (radiated emissions) requirements.
 - d. Meets Canadian standard C108.8 (radiated emissions).
 - e. Conforms to the requirements of the European Consortium standard EN 61000-6-1; 2001 (EU Immunity).
 - f. Conforms to the requirements of the European Consortium standard EN 61000-6-3; 2001 (EU Emission).
8. The controller housing shall be UL plenum rated mounting to either a panel or DIN rail (standard EN50022; 7.5mm x 35mm).

9. The controller shall have a mix of digital inputs (DI), digital Triac outputs (DO), analog outputs (AO), and universal inputs (UI).
 - a. Analog outputs (AO) shall be capable of being configured as digital outputs (DO).
 - b. Input and Output wiring terminal strips shall be removable from the controller without disconnecting wiring.
 - c. 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).
10. The controller shall provide "continuous" automated loop tuning with an Adaptive Integral Algorithm Control Loop.

2.9 VARIABLE AIR VOLUME CONTROLLER (VAV):

A. General:

1. The VAV controller platform shall be designed specifically to control pressure independent air flow control, pressure dependent damper control, pressurization control temperature, humidity, CO₂, occupancy, and similar control functions.
2. Equipment controlled includes but is not limited to: VAV terminal unit, VAV terminal unit with reheat, series fan powered terminal unit, parallel fan powered terminal unit, supply and exhaust air volume terminals, constant volume dual-duct terminal unit and similar units.

B. Minimum Requirements:

1. The controller shall be capable of either integrating with other devices or stand-alone room-level control operation.
2. The controller shall have an internal velocity pressure sensor.
 - a. Sensor Type: Microbridge air flow sensor with dual integral restrictors.
 - b. Operating Range: 0 to 1.5 inch H₂O (0 to 374 Pa).
 - c. Accuracy: $\pm 2\%$ of full scale at 32 degrees to 122 degrees F (0 degrees to 50 degrees C); $\pm 1\%$ of full scale at null pressure.
3. 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 network communications.
 - a. FLASH Memory Capacity: 60 Kilobytes with 8 Kilobytes for application program.

- b. FLASH Memory settings retained for ten years.
 - c. RAM: 2 Kilobytes.
 4. 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 degrees F (25 degrees C).
 - c. Power Failure Backup: 24 hours at 32 degrees to 122 degrees F (0 degrees to 50 degrees C).
 5. The controller shall have Significant Event Notification, Periodic Update capability and Failure Detect when network inputs fail to be detected within their configurable time frame.
 6. The controller shall have an internal DC power supply to power external sensors.
 - a. Power Output: 20 VDC $\pm 10\%$ at 75 mA.
 7. The minimum controller Environmental ratings:
 - a. Operating Temperature Ambient Rating: 32 degrees to 122 degrees F (0 degrees to 50 degrees C).
 - b. Storage Temperature Ambient Rating: 32 degrees to 122 degrees F (0 degrees to 50 degrees C).
 - c. Relative Humidity: 5% to 95% non-condensing.
 8. 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. CSA (LR95329-3) Listed.
 - c. Meets FCC Part 15, Subpart B, Class B (radiated emissions) requirements.
 - d. Meets Canadian standard C108.8 (radiated emissions).
 - e. Conforms requirements European Consortium standard EN 61000-6-1; 2001 (EU Immunity).

- f. Conforms requirements European Consortium standard EN 61000-6-3; 2001 (EU Emission).
9. The controller housing shall be UL plenum rated mounting to either a panel or DIN rail (standard EN50022; 7.5mm x 35mm).
10. The controller shall provide an integrated actuator option.
 - a. Actuator type: Series Floating.
 - b. Rotation stroke: 95 degrees \pm 3 degrees for CW or CCW opening dampers.
 - c. Torque rating: 44 lb-inch (5 Nm).
 - d. Run time for 90 degrees rotation: 90 seconds at 60 Hz.
11. The controller shall have digital inputs (DI), digital Triac outputs (DO), three analog outputs (AO), and universal inputs (UI).
 - a. Analog outputs (AO) shall be capable of being configured as digital outputs (DO).
 - b. Input and Output wiring terminal strips shall be removable from the controller without disconnecting wiring.
 - c. Input and Output wiring terminals shall be designated with color coded labels.
12. The controller shall provide "continuous" automated loop tuning with an Adaptive Integral Algorithm Control Loop.
13. The controller shall have a loop execution response time of 1 second.

2.10 WEB BROWSER GRAPHIC USER INTERFACE (SYSTEM OVERVIEW):

- A. The Controls Contractor shall provide system software based on server/thin-client architecture, designed around the open standards of web technology. The BACS Server shall communicate using Ethernet and TCP. Server shall be accessed using a web browser over Owner intranet and remotely over the Internet.
- B. The intent of the thin-client architecture is to provide the operators complete access to the BACS system via a web browser. The thin-client web browser Graphical User Interface (GUI) shall be browser and operating system agnostic, meaning it will support HTML5 enabled browsers without requiring proprietary operator interface and configuration programs or browser plug-ins. The web browser user interface shall be compatible with the current released versions of Microsoft, Firefox, and Chrome IE browsers.
- C. The BACS Server software shall support at a minimum, Windows and Windows Server (latest version supported) server platforms. The BACS Server software shall be

developed and tested by the manufacturer of the system stand-alone controllers and network controllers/routers.

- D. The web browser GUI shall provide a completely interactive user interface and shall provide a HTML5 experience that supports the following features as a minimum:
1. Trending.
 2. Scheduling.
 3. Electrical demand limiting.
 4. Duty Cycling.
 5. Downloading Memory to field devices.
 6. Real time 'live' Graphic Programs.
 7. Tree Navigation.
 8. Parameter change of properties.
 9. Set point adjustments.
 10. Alarm / event information.
 11. Configuration of operators.
 12. Execution of global commands.
 13. Add, delete, and modify graphics and displayed data.
- E. Software Components: All software shall be the most current version. All software components of the BACS system software shall be provided and installed as part of this project. BACS software components shall include:
1. Server Software, Database and Web Browser Graphical User Interface.
 2. Embedded System Configuration Utilities for future modifications to the system and controllers.
 3. Embedded Graphical Programming Tools.
 4. Embedded Direct Digital Control software.
 5. Embedded Application Software.
 6. Analytic Services.
 7. End User Configurable Dashboard.

- F. BACS Server Database: The BACS Server software shall utilize a Java Database Connectivity (JDBC) compatible database such as MS SQL, Oracle, or IBM DB2 (latest version supported). BACS systems written to non-standard and/or proprietary databases are NOT acceptable.

2.11 WEB BROWSER GRAPHICAL USER INTERFACE:

- A. Web Browser Navigation: The Thin Client web browser GUI shall provide a comprehensive user interface. Using a collection of web pages, it shall be constructed to "feel" like a single application, and provide a complete and intuitive mouse/menu driven operator interface. It shall be possible to navigate through the system using a web browser to accomplish requirements of this specification. The Web Browser GUI shall (as a minimum) provide for navigation, and for display of animated graphics, schedules, alarms/events, live graphic programs, active graphic set point controls, configuration menus for operator access, reports and reporting actions for events.
- B. Login: On launching the web browser and selecting the appropriate domain name or IP address, the operator shall be presented with a login page that will require a login name and strong password. Navigation in the system shall be dependent on the operator's role-based application control privileges.
- C. Navigation: Navigation through the GUI shall be accomplished by clicking on the appropriate level of a navigation tree (consisting of an expandable and collapsible tree control like Microsoft's Explorer program) and/or by selecting dynamic links to other system graphics. Both the navigation tree and action pane shall be displayed simultaneously, enabling the operator to select a specific system or equipment and view the corresponding graphic. The navigation tree shall as a minimum provide the following views: Geographic, Network, Groups and Configuration.
 - 1. Geographic View shall display a logical geographic hierarchy of the system including: cities, sites, buildings, building systems, floors, equipment and objects.
 - 2. Groups View shall display Scheduled Groups and custom reports.
 - 3. Configuration View shall display all the configuration categories (Operators, Schedule, Event, Reporting and Roles).
- D. Action Pane: The Action Pane shall provide several functional views for each subsystem specified. A functional view shall be accessed by clicking on the corresponding button:
 - 1. Graphics: Using graphical format suitable for display in a web browser, graphics shall include aerial building/campus views, color building floor-plans, equipment drawings, active graphic set point controls, web content and other valid HTML elements. The data on each graphic page shall automatically refresh.
 - 2. Dashboards: User customizable data using drag and drop HTML5 elements. Shall include Web Charts, Gauges, and other custom developed widgets for web browser. User shall have ability to save custom dashboards.

3. Search: User shall have multiple options for searching data based upon Tags. Associated equipment, real time data, Properties, and Trends shall be available in result.
 4. Properties: Shall include graphic controls and text for the following: Locking or overriding objects, demand strategies, and any other valid data required for setup. Changes made to the properties pages shall require the operator to depress an 'accept/cancel' button.
 5. Schedules: Shall be used to create, modify/edit and view schedules based on the systems hierarchy (using the navigation tree).
 6. Alarms: Shall be used to view alarm information geographically (using the navigation tree), acknowledge alarms, sort alarms by category, actions and verify reporting actions.
 7. Charting: Shall be used to display associated trend and historical data, modify colors, date range, axis and scaling. User shall have ability to create HTML charts through web browser without utilizing chart builder. User shall be able to drag and drop single or multiple data points, including schedules, and apply status colors for analysis.
 8. Logic - Live Graphic Programs: Shall be used to display 'live' graphic programs of the control algorithm, (micro block programming) for the mechanical/electrical system selected in the navigation tree.
 9. Other actions such as Print, Help, Command, and Logout shall be available via a drop-down window.
- E. Color Graphics: The Web Browser GUI shall make extensive use of color in the graphic pane to communicate information related to set points and comfort. Animated .gifs or .jpg, vector scalable, active set point graphic controls shall be used to enhance usability. Graphics tools used to create Web Browser graphics shall be non-proprietary and conform to the following basic criteria:
1. Display Size: The GUI workstation software shall graphically display in a minimum of 1024 by 768 pixels 24 bit True Color.
 2. General Graphic: General area maps shall show locations of controlled buildings in relation to local landmarks.
 3. Color Floor Plans: Floor plan graphics shall show heating and cooling zones throughout the buildings in a range of colors, as selected by Owner. Provide a visual display of temperature relative to their respective set points. The colors shall be updated dynamically as a zone's actual comfort condition changes.
 4. Mechanical Components: Mechanical system graphics shall show the type of mechanical system components serving any zone through the use of a pictorial representation of components. Selected I/O points being controlled or monitored for each piece of equipment shall be displayed with the appropriate engineering

- units. Animation shall be used for rotation or moving mechanical components to enhance usability.
5. Minimum System Color Graphics: Color graphics shall be selected and displayed via a web browser for the following:
 - a. Each piece of equipment monitored or controlled including each terminal unit.
 - b. Each building.
 - c. Each floor and zone controlled.
- F. Hierarchical Schedules: Utilizing the Navigation Tree displayed in the web browser GUI, an operator (with proper access credentials) shall be able to define a Normal, Holiday or Override schedule for an individual piece of equipment or room, or choose to apply a hierarchical schedule to the entire system, site or floor area. For example, Independence Day 'Holiday' for every level in the system would be created by clicking at the top of the geographic hierarchy defined in the Navigation Tree. No further operator intervention would be required and every control module in the system with would be automatically downloaded with the 'Independence Day' Holiday. All schedules that affect the system/area/equipment highlighted in the Navigation Tree shall be shown in a summary schedule table and graph.
1. Schedules: Schedules shall comply with BACnet standards, (Schedule Object, Calendar Object, Weekly Schedule property and Exception Schedule property) and shall allow events to be scheduled based on:
 - a. Types of schedule shall be Normal, Holiday or Override.
 - b. A specific date.
 - c. A range of dates.
 - d. Any combination of Month of Year (1-12, any), Week of Month (1-5, last, any), Day of Week (M-Sun, Any).
 - e. Wildcard (example, allow combinations like second Tuesday of every month).
 2. Schedule Categories: The system shall allow operators to define and edit scheduling categories (different types of "things" to be scheduled; for example, lighting, HVAC occupancy, etc.). The categories shall include: name, description, icon (to display in the hierarchy tree when icon option is selected) and type of value to be scheduled.
 3. Schedule Groups: In addition to hierarchical scheduling, operators shall be able to define functional Schedule Groups, comprised of an arbitrary group of areas/rooms/equipment scattered throughout the facility and site. For example, the operator shall be able to define an 'individual tenant' group - who may

- occupy different areas within a building or buildings. Schedules applied to the 'tenant group' shall automatically be downloaded to control modules affecting spaces occupied by the 'tenant group'.
4. **Intelligent Scheduling:** The control system shall be intelligent enough to automatically turn on any supporting equipment needed to control the environment in an occupied space. If the operator schedules an individual room in a VAV system for occupancy, for example, the control logic shall automatically turn on the VAV air handling unit, chiller, boiler and/or any other equipment required to maintain the specified comfort and environmental conditions within the room.
 5. **Partial Day Exceptions:** Schedule events shall be able to accommodate a time range specified by the operator (ex: board meeting from 6 pm to 9 pm overrides Normal schedule for conference room).
 6. **Schedule Summary Graph:** The schedule summary graph shall clearly show Normal versus Holiday versus Override Schedules and the net operating schedule that results from all contributing schedules. Note: In case of priority conflict between schedules at the different geographic hierarchy, the schedule for the more detailed geographic level shall apply.
- G. **Alarms:** Alarms associated with a specific system, area, or equipment selected in the Navigation Tree, shall be displayed in the Action Pane by selecting an 'Alarms' view. Alarms, and reporting actions shall have the following capabilities:
1. **Alarms View:** Each Alarm shall display an Alarms Category (using a different icon for each alarm category), date/time of occurrence, current status, alarm report and a bold URL link to the associated graphic for the selected system, area or equipment. The URL link shall indicate the system location, address and other pertinent information. An operator shall easily be able to sort events, edit event templates and categories, acknowledge or force a return to normal in the Events View as specified in this section.
 2. **Alarm Categories:** The operator shall be able to create, edit or delete alarm categories such as HVAC, Maintenance, Fire, or Generator. An icon shall be associated with each alarm category, enabling the operator to easily sort through multiple events displayed.
 3. **Alarm Templates:** Alarm template shall define different types of alarms and their associated properties. As a minimum, properties shall include a reference name, verbose description, severity of alarm, acknowledgement requirements, and high/low limit and out of range information.
 4. **Alarm Areas:** Alarm Areas enable an operator to assign specific Alarm Categories to specific Alarm Reporting Actions. For example, it shall be possible for an operator to assign all HVAC Maintenance Alarm on the 1st floor of a building to email the technician responsible for maintenance. The Navigation Tree shall be used to setup Alarm Areas in the Graphic Pane.

5. Alarm Time/Date Stamp: All events shall be generated at the DDC control module level and comprise the Time/Date Stamp using the standalone control module time and date.
6. Alarm Configuration: Operators shall be able to define the type of Alarm generated per object. A 'network' view of the Navigation Tree shall expose all objects and their respective Alarm Configuration. Configuration shall include assignment of Alarm, type of Acknowledgement and notification for return to normal or fault status.
7. Alarm Summary Counter: The view of Alarm in the Graphic Pane shall provide a numeric counter, indicating how many Alarms are active (in alarm), require acknowledgement and total number of Alarms in the BACS Server database.
8. Alarm Auto-Deletion: Alarms that are acknowledged and closed shall be auto-deleted from the database and archived to a text file after an operator defined period.
9. Alarm Reporting Actions: Alarm Reporting Actions specified shall be automatically launched (under certain conditions) after an Alarm is received by the BACS Server software. Operators shall be able to easily define these Reporting Actions using the Navigation Tree and Graphic Pane through the web browser GUI. Reporting Actions shall be as follows:
 - a. Print: Alarm information shall be printed to the BACS Server's PC or a networked printer.
 - b. Email: Email shall be sent via any POP3-compatible e-mail server (most Internet Service Providers use POP3). Email messages may be copied to several email accounts. Note: Email reporting action shall also be used to support alphanumeric paging services, where email servers support pagers.
 - c. File Write: The ASCII File write reporting action shall enable the operator to append operator defined alarm information to any alarm through a text file. The alarm information that is written to the file shall be completely definable by the operator. The operator may enter text or attach other data point information (such as AHU discharge temperature and fan condition upon a high room temperature alarm).
 - d. Write Property: The write property reporting action updates a property value in a hardware module.
 - e. SNMP: The Simple Network Management Protocol (SNMP) reporting action sends an SNMP trap to a network in response to receiving an alarm.
 - f. Run External Program: The Run External Program reporting action launches specified program in response to an event.

- H. Trends: As system is engineered, all points shall be enabled to trend. Trends shall both be displayed and user configurable through the Web Browser GUI. Trends shall comprise analog, digital or calculated points simultaneously. A trend log's properties shall be editable using the Navigation Tree and Graphic Pane.
1. Viewing Trends: The operator shall have the ability to view trends by using the Navigation Tree and selecting a Trends button in the Graphic Pane. The system shall allow y- and x-axis maximum ranges to be specified and shall be able to simultaneously graphically display multiple trends per graph.
 2. Local Trends: Trend data shall be collected locally by Multi-Equipment/Single Equipment general-purpose controllers, and periodically uploaded to the BACS Server if historical trending is enabled for the object. Trend data, including run time hours and start time date shall be retained in non-volatile module memory. Systems that rely on a gateway/router to run trends are NOT acceptable.
 3. Resolution. Sample intervals shall be as small as one second. Each trended point will have the ability to be trended at a different trend interval. When multiple points are selected for displays that have different trend intervals, the system will automatically scale the axis.
 4. Dynamic Update. Trends shall be able to dynamically update at operator-defined intervals.
 5. Zoom/Pan. It shall be possible to zoom-in on a particular section of a trend for more detailed examination and 'pan through' historical data by simply scrolling the mouse.
 6. Numeric Value Display. It shall be possible to pick any sample on a trend and have the numerical value displayed.
 7. Copy/Paste. The operator shall have the ability to pan through a historical trend and copy the data viewed to the clipboard using standard keystrokes (i.e. CTRL+C, CTRL+V).
- I. Security Access: Systems that Security access from the web browser GUI to BACS Server shall require a Login Name and Strong Password. Access to different areas of the BACS system shall be defined in terms of Role-Based Access Control privileges as specified:
1. Roles: Roles shall reflect the actual roles of different types of operators. Each role shall comprise a set of 'easily understood English language' privileges. Roles shall be defined in terms of View, Edit and Function Privileges.
 - a. View Privileges shall comprise: Navigation, Network, and Configuration Trees, Operators, Roles and Privileges, Alarm/Event Template and Reporting Action.
 - b. Edit Privileges shall comprise: Set point, Tuning and Logic, Manual Override, and Point Assignment Parameters.

- c. Function Privileges shall comprise: Alarm/Event Acknowledgement, Control Module Memory Download, Upload, Schedules, Schedule Groups, Manual Commands, Print and Alarm/Event Maintenance.
2. Geographic Assignment of Roles: Roles shall be geographically assigned using a similar expandable/collapsible navigation tree. For example, it shall be possible to assign two HVAC Technicians with similar competencies (and the same operator defined HVAC Role) to different areas of the system.

2.12 GRAPHICAL PROGRAMMING:

- A. The system software shall include a Graphic Programming Language (GPL) for all DDC control algorithms resident in all control modules. Any system that does not use a drag and drop method of graphical icon programming shall not be accepted. All systems shall use a GPL method used to create a sequence of operations by assembling graphic microblocks that represent each of the commands or functions necessary to complete a control sequence. Microblocks represent common logical control devices used in conventional control systems, such as relays, switches, high signal selectors etc., in addition to the more complex DDC and energy management strategies such as PID loops and optimum start. Each microblock shall be interactive and contain the programming necessary to execute the function of the device it represents.
- B. Graphic programming shall be performed while on screen and using a mouse; each microblock shall be selected from a microblock library and assembled with other microblocks necessary to complete the specified sequence. Microblocks are then interconnected on screen using graphic "wires," each forming a logical connection. Once assembled, each logical grouping of microblocks and their interconnecting wires then forms a graphic function block which may be used to control any piece of equipment with a similar point configuration and sequence of operation.
- C. Graphic Sequence: The clarity of the graphic sequence shall be such that the operator has the ability to verify that system programming meets the specifications, without having to learn or interpret a manufacturer's unique programming language. The graphic programming shall be self-documenting and provide the operator with an understandable and exact representation of each sequence of operation.
- D. GPL Capabilities: The following is a minimum definition of the capabilities of the Graphic Programming software:
 1. Function Block (FB): Shall be a collection of points, microblocks and wires which have been connected together for the specific purpose of controlling a piece of HVAC equipment or a single mechanical system.
 2. Logical I/O: Input/Output points shall interface with the control modules in order to read various signals and/or values or to transmit signal or values to controlled devices.
 3. Microblocks: Shall be software devices that are represented graphically and may be connected together to perform a specified sequence. A library of microblocks shall be submitted with the integrator system integrator's bid.

4. Wires: Shall be Graphical elements used to form logical connections between microblocks and between logical I/O.
5. Reference Labels: Labels shall be similar to wires in that they are used to form logical connections between two points. Labels shall form a connection by reference instead of a visual connection, i.e. two points labeled 'A' on a drawing are logically connected even though there is no wire between them.
6. Parameter: A parameter shall be a value that may be tied to the input of a microblock.
7. Properties: Dialog boxes shall appear after a microblock has been inserted which has editable parameters associated with it. Default parameter dialog boxes shall contain various editable and non-editable fields, and shall contain 'push buttons' for the purpose of selecting default parameter settings.
8. Icon: An icon shall be graphic representation of a software program. Each graphic microblock has an icon associated with it that graphically describes its function.
9. Menu-bar Icon: Shall be an icon that is displayed on the menu bar on the GPL screen, which represents its associated graphic microblock.
10. Live Graphical Programs: The Graphic Programming software shall support a 'live' mode, where all input/output data, calculated data and set points shall be displayed in a 'live' real-time mode.

2.13 BACS DATA MODEL AND SEMANTIC TAGGING:

- A. The BACS will represent all of the data, regardless of communication protocol or integration method, as common human and machine interpretable meta data. Examples of the meta data include but are not limited to buildings, floors, air handlers, meters and zones, among other commonly understood terminology of the building operators and building managers. Data will be represented in a hierarchical format such as Buildings > Floors > Equipment.
- B. The BACS will also have the ability to create tags that represent location and descriptive data that have nothing to do with the application of the particular data or group of data. Examples of this tagging may include operators' names, room names, etc. These tags shall be free form text in nature and shall be searchable by the user interface.
- C. The BACS will have the ability to use a Niagara Framework, Haystack or Custom tagging dictionaries or a combination of these dictionaries as well as any future tag dictionaries.

2.14 ANALYTICS:

- A. The BACS will support sequences, actions and routines to be programmed to execute against the data model. The execution of each analytics sequence shall be by; a scheduled trigger; interval based trigger, or an event based trigger. The analytics sequences shall be definable and customizable by the owner or the integrator without the requirement to use

line code programming. The programming and creation of the rules shall be in a wire sheet framework where objects are added to the wire sheet and connected together. Each of the sequences shall have the ability to execute independently or with dependency on other sequences.

- B. As separate programming language for analytic algorithm development or service will not be allowed. The analytic software shall use the historical data and/or real time BACS data without having to first store the data in a database that is separate from the BACS data.
- C. The analytic algorithms shall be supported on both the BACS Server and NACs to provide data analysis in real time within the limits of NACs and the BACS Server data communication and resources as well as historical based on the BACS Server historian.
- D. The specification calls for analytics of both historical and real time data for reporting, diagnostics and event notification.
- E. For energy and equipment optimization analytics, the analytic software shall change set point values and commands as analytic results dictate.

2.15 SOFTWARE ANALYSIS AND REPORTING TOOLS:

- A. Accessing the system shall be via a web browser or mobile devices including IOS, Windows Mobile and Android. In general the system shall enable the user to:
- B. Access and view data from all smart meters from a central dashboard
- C. Analyze utility usage patterns
- D. Measure its CO2 footprint
- E. Assess energy performance of buildings
- F. Identify variances using KPIs, targets, comparisons to historical patterns, etc.
- G. Investigate the time, duration and cause of variances
- H. Generate time-of-use consumption and peak loads (e.g. peak, shoulder and off peak kWh and KvA)
- I. Use algorithms for the analysis of gas and water leakages (based on volume or flow)
- J. Tools to set-up new meters
- K. Configure dashboards
- L. Use a variety of common reporting formats e.g. text files (txt, csv), Microsoft Excel (xls,xlsx)
- M. Print reports via a local printer (with appropriate page management) and to email reports.

2.16 SYSTEM NAVIGATION:

- A. System navigation shall be via a standardized navigation tree with hyperlinked for each user, given access to specific areas of the data model. Each user's navigation will dynamically update based on the permissions given in the data model.
- B. In addition, the user shall be able to access a map of buildings and navigate via a geographic Map, Site Plan, or building floor plan.
- C. Each user shall have the ability to modify his own dashboard as the need arises by simply saving the current Dashboard session.

2.17 BASIC ANALYTIC DASHBOARDS:

- A. Dashboards as a minimum shall contain (for each building group, building, area, switchboard, or grouping in the metering tree) graphics showing live and historical utilities usage, loads and CO2 emissions. Specifically dashboards shall show:
- B. Utility Usage for default period
- C. Profile of usage for default period
- D. Contribution of sub meters for default period
- E. CO2 emissions

2.18 ANALYTIC GRAPHICAL DATA OUTPUTS:

- A. Time-series daily load profiles displayed with time, in intervals of an hour or less, along the horizontal axis and load along the vertical axis
- B. Overlay plots displaying multiple daily profiles on a single 24-hour time-series graph
- C. Viewing of multiple time series data points on the same graph
- D. Calendar profile: View up to an entire month of consumption profiles on a single screen as one long time series
- E. X-Y scatter plots: X-Y scatter plots for visualizing correlations between two variables
- F. Intuitive graphical axes that are scaled and labeled

2.19 ANALYTICAL DATA OUTPUTS:

- A. Basic statistical analysis such as mean, median, standard deviation, correlation, and regression.
- B. Benchmarking against set building energy standards
- C. Intra/inter-facility comparisons against the building's historical data or across multiple buildings
- D. Aggregate data among multiple data points. Integrate different energy units using energy conversions

- E. Data mining (data slice/drill-down) time series data by monthly, weekly, daily, hourly, or trended interval
- F. Normalization of energy usage or demand by factors such as building area, number of occupants, outside air temperature, and cooling or heating degree-days (CDD, HDD) to make a fair comparison between buildings
- G. Hierarchical summary of usage and cost information by different levels
- H. A comprehensive and simple graphical programming tool allowing the users to create their own views, graphs, charts, gauges, and other widgets for viewing live or historical data. Dashboards shall be capable of export to printers or PDF, CSV, Excel or image formats for use in reports, spreadsheets or as live media to display systems

2.20 BACS INTEGRATION AND MANUAL DATA ENTRY:

- A. The software shall feature a rich set of enterprise data integration tools. This will allow the system to export data to SQL databases (such as Oracle or SQL Server) or spreadsheets. The system must offer open SQL data connectivity (such as ODBC) in addition to export of CSV files.
- B. The software must be capable of user-friendly import of meter data either by meter or in bulk by defining a data structure and method for users to input ad-hoc data or historical utility data.

2.21 ALARMS:

- A. The BACS shall provide functionality to set alarm for thresholds on each individually metered value and send alert notifications for corrective action via SMS, SNMP and Email.

2.22 SYSTEM SOFTWARE:

- A. All Niagara 4 software licenses shall have the following NiCS: "accept.station.in=*"; "accept.station.out=*" and "accept.wb.in=*" and "accept.wb.out=*".
- B. All open NIC statements shall follow Niagara Open NIC specifications.
- C. The Open NIC ensures that software or controller can be serviced or programmed by any qualified Niagara N4 TCP certified contractor the Owner chooses.

2.23 OWNER ACCESS AND LICENSING:

- A. Owner shall receive all Administrator level login and passwords for engineering toolset.
- B. The Owner shall have full licensing and full access rights for all network management, operating system server, engineering and programming software required for the ongoing maintenance and operation of the building automation control system.
- C. All NAC hardware licenses and certificates shall be stored on local MicroSD memory card employing encrypted "safe boot" technology.

- D. All software maintenance licenses for the NAC and BACS servers shall be included for five (5) years.

2.24 GRAPHICS (SITE PAGE):

- A. (This initial project shall establish a graphics showing the City of Columbia, S.C. to the extent required to show all State buildings which will eventually be added to this building control system. This includes approximately 30 (thirty) buildings throughout the Columbia area.)
- B. (Upon award of this contract, the locations of all state buildings in the Columbia area will be provided to the successful contractor.)
- C. (The graphics developed by the contractor shall include a tag for each one of the buildings.)

PART 3 - EXECUTION

3.1 SUBMITTAL (GENERAL):

- A. Manufacturer's product data sheets including:
 - 1. Preparation instructions and recommendations.
 - 2. Storage and handling requirements and recommendations.
 - 3. Installation methods.
 - 4. Open NiC Statement for all Niagara4 licenses indicating that the licenses comply with Niagara Open NIC specifications.
- B. Contractor qualifications.
- C. Samples of written Controller Checkout Sheets and Performance Verification Procedures for applications similar in scope shall be included for approval.
- D. Wiring and schematic diagrams, sequences of operation, control system bus layout and 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.

3.2 CONTROL PANEL CONSTRUCTION:

- A. Control panels shall be assembled by the Control Contractor in a UL-Certified 508A panel shop.

3.3 ACCEPTANCE TESTING:

- A. Upon completion of the installation, the Control Contractor shall load all system software and start-up the system. The Control 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. The Control 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. The Control Contractor shall provide all testing to show performance to the satisfaction of the Owner.

3.4 OPERATOR TRAINING:

- A. During system commissioning and at such time acceptable performance of the Control System hardware and software has been established, the Control Contractor shall provide on-site 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. The Control Contractor shall provide 32 total hours of comprehensive training in multiple sessions for system orientation, product maintenance and troubleshooting, programming and engineering. These classes are to be spread out during the 1st year warranty period in no less than four (4) 8 hour classes. The first class starting after final commissioning and the last class is to be in the last month of 1-year warranty period.
- C. Training materials, including manuals in 3 ring binders, shall be provided for up to eight (8) attendees.

3.5 WARRANTY PERIOD SERVICES:

- A. Equipment, materials and workmanship incorporated into the work shall be warranted for a period of one year from the time of system substantial completion.
- B. Within this period, upon notice by the Owner, any defects in the BACS due to faulty materials, methods of installation or workmanship shall be promptly repaired or replaced by the Control Contractor at no expense to the Owner.
- C. The Control Contractor shall maintain all software during the standard first year warranty period. In addition, all factory or sub-vendor upgrades to software that occur during the first year warranty period shall be added to the systems, at no additional cost to the Owner.
- D. Labor to implement software maintenance upgrades in years two through five are not included in the warranty.
- E. The Control Contractor shall inspect, repair, replace, adjust, and calibrate, as required, the controllers, control devices and associated peripheral units during the warranty period.
- F. During the warranty period, the Control Contractor shall review system at approximately the midpoint of the warranty service and just prior to the end of the warranty period.
- G. During the warranty period, the Control Contractor shall respond to warranty issues within 48 hours.

- H. After each service call or system review, the Control Contractor shall furnish a report describing the status of the equipment, problem areas (if any) noticed during service work, and description of the corrective actions taken. The report shall clearly certify that all hardware is functioning correctly.
- I. The Owner shall grant to the Control Contractor reasonable access to the BACS during the warranty period. Remote access to the BACS for the purpose of diagnostics and troubleshooting, via the Internet, during the warranty period will be allowed.

3.6 SYSTEM SECURITY:

- A. The control contractor shall coordinate security policies with the Owner's IT security protocol.
- B. The installed system shall provide secure strong password access to all features, functions and data.

3.7 OPERATION & MAINTENANCE MANUALS:

- A. O&M manuals shall include, but not be limited to, the following:
 - 1. As-built control drawings for all equipment.
 - 2. As-built Network Communications Diagram.
 - 3. General description and specifications for all components.
 - 4. Completed Performance Verification sheets.
 - 5. Completed Controller Checkout/Calibration Sheets.

END OF SECTION 23 0904

SECTION 23 0905 - SMOKE DEVICES AND SYSTEMS

PART 1 - GENERAL

1.1 SCOPE OF WORK:

A. General:

1. Furnish all labor, materials, tools and equipment and perform all operations in connection with the installation of the smoke devices and systems shown on the drawings and specified hereinafter.

1.2 RELATED DOCUMENTS:

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 specification sections, apply to this section.
- B. All sections of Division 23 specifications apply to this section. In addition, refer to these specification sections:
 1. Section 23 0900 - Instrumentation and Control for HVAC (General)
 2. Section 23 0906 - Smoke Control Systems

1.3 QUALITY ASSURANCE:

- A. The requirements of the Building Environmental Controls specifications are entirely applicable to these specifications including standards, Contractor requirements, and acceptable manufacturers.
- B. Indoor panels shall be NEMA 1 unless specifically noted otherwise.

PART 2 - PRODUCTS

2.1 SMOKE DETECTORS:

A. General:

1. Provide all controls, wiring, contacts, relays, switches and other devices required for system to meet the requirements of the sequence of operation.
2. Division of responsibility shall be as listed for each system.

B. Duct Detectors and Smoke Detectors installed in HVAC equipment:

1. Electrical Installer:
 - a. Furnish detector.
 - b. Wire detector to fire alarm system.

c. Provide power to detector.

2. Division 23:

a. Install detector.

b. Wire detector to shut down equipment.

c. Provide duct access door.

2.2 EQUIPMENT SHUTDOWN:

A. General:

1. Provide all controls, wiring, contacts, relays, switches, and other devices required for system to meet the requirements of the sequence of operation.

2. Division of responsibility shall be as listed for each system.

B. Electrical Installer:

1. Provide addressable control module at each piece of equipment.

2. Wire addressable control module to fire alarm system.

3. Program the addressable control module for equipment shutdown.

C. Division 23:

1. Wire output of addressable control module to each piece of equipment.

2. Upon receiving a signal from the fire alarm system, the equipment will be commanded to shut down.

3. If the manufacturer of the equipment requires some minimal shutdown time, a delay of a maximum of 10 seconds may be allowed from the time that the fire alarm device is activated.

2.3 BACK-UP POWER:

A. Provide a UPS on all panels in this specification.

PART 3 - EXECUTION

3.1 SMOKE DETECTORS:

A. Detectors shall be installed in accordance with manufacturers requirements.

B. Duct access door shall be located to provide access to sampling tube.

3.2 TESTING:

- A. General:
 - 1. Furnish all personnel and equipment for the testing of the smoke devices and systems.
 - 2. Test shall include simulation of actual fire/smoke conditions.
 - 3. Include approximately three (3) full days for all personnel for testing.
 - 4. Personnel shall include:
 - a. Controls contractor.
 - b. HVAC installer.
- B. Test Verification:
 - 1. Verify proper operation of devices and system in all modes.
- C. Demonstration:
 - 1. Upon completion of testing, the A/E shall be notified and the Contractor shall demonstrate operation of devices and system in all modes.
- D. Documentation:
 - 1. Submit in writing three copies of the test procedure, results and verification of proper system operation.
- E. Clean-Up:
 - 1. Thoroughly clean all affected spaces of smoke residue and odors.

END OF SECTION 23 0905

SECTION 23 0993 - SEQUENCE OF OPERATIONS FOR HVAC CONTROLS AND POINTS LIST

PART 1 - GENERAL

1.1 SCOPE OF WORK:

A. General:

1. Furnish all labor, materials, tools and equipment and perform all operations in connection with the installation of controls system shown on the drawings and specified hereinafter.

B. Description:

1. Points shown for equipment shall be for each item of equipment except:
 - a. When noted otherwise.
 - b. When exhaust fans are grouped together.

1.2 RELATED DOCUMENTS:

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 specification sections, apply to this section.
- B. All sections of Division 23 specifications apply to this section. In addition, refer to these specification sections:
 1. Section 23 0900 - Instrumentation and Control for HVAC (General)
 2. Section 23 0993.1 - Sequence of Operation (Central Air Handling Equipment)
 3. Section 23 0993.2 - Sequence of Operation (Air Handling Equipment)
 4. Section 23 0993.6 - Sequence of Operation (Single Zone Packaged Equipment)
 5. Section 23 0993.9 - Sequence of Operation (Various Systems)

PART 2 - SEQUENCE OF OPERATION

2.1 GENERAL:

- A. These sequence descriptions and definitions shall apply to all sequences unless sequence specifically indicates otherwise.

2.2 SETPOINTS:

- A. In general, the specification indicates setpoints or range of setpoints for most devices.
- B. Temperatures shall be field settable to any temperature.

- C. Time of day operations shall be field settable to any time.
- D. The contractor shall adjust setpoints in the following manner:
 - 1. As required to start-up, test, debug and otherwise ensure equipment and system is operating as intended.
 - 2. Dampers, actuators, and similar devices should be left in their optimum operating position.
 - 3. Thermostats, humidistats, and similar devices should be left as indicated on drawings or in specifications. If no value is indicated, contractor should set at a reasonable value.
 - 4. Equipment and system schedules should be reviewed with the Owner and A/E prior to initiating the schedule.

2.3 MORNING WARM-UP/COOL-DOWN:

- A. This mode is the mode between night setback and normally occupied mode and is used to bring area served from unoccupied conditions to conditions required for occupancy.
- B. This mode typically will operate with outside air systems closed or de-energized.
- C. The start time of this mode shall be determined by the building automation system based upon space temperatures, building characteristics, outside temperature, and historical ability of each system to warm up or cool down the building.

2.4 NIGHT SETBACK:

- A. This mode is the unoccupied mode.
- B. This mode is a timed function of adjustable duration.
- C. This mode typically will operate with outside air systems closed or de-energized and is used primarily to maintain unoccupied space temperature (adjustable) or space humidity level (adjustable).
- D. All HVAC equipment required to maintain space conditions shall be energized in this mode.

2.5 OVERRIDE:

- A. When override is activated, the system shall operate with that zone, equipment, or system in the occupied mode.
- B. At the end of the override time period, the zone equipment or system shall return to the mode scheduled at that time.

2.6 OUTSIDE AIR CONTROL:

- A. Where motorized dampers are specified, the dampers shall open to maintain the airflow quantity indicated on the equipment schedule.

2.7 FAILURE MODES:

A. General:

1. Initiating devices shall each be hard wired.
2. Manual reset of temperature alarm and pressure alarm shall be required. Other alarms shall automatically reset unless manual reset indicated.

B. Smoke and Fire Alarm:

1. The fans shall be de-energized and smoke dampers shall shut. The fan shall de-energize as fast as practical and smoke dampers shall begin closing after fan is de-energized.

C. Low Temperature (Recirculating System):

1. A low temperature condition may be caused by mixed air low limit or leaving air low limit.
2. Unless sequences specifically identify alternative modes of operation, the following shall be provided:
 - a. The system shall operate in occupied mode.
 - b. Outside air dampers shall be closed or outside air supply fans shall be de-energized.
 - c. Heating system shall energize including heat sources and distribution system.
3. Alarm shall be indicated at building automation system.

D. High Condensate Level:

1. Upon a rise in condensate level in the condensate pan, the float switch shall de-energize the unit.

2.8 STARTER "HAND-OFF-AUTO":

- A. When in "HAND" position, equipment shall be able to run.
- B. When in "OFF" position, equipment shall not be able to run.
- C. When in "AUTO" position, equipment shall be able to run if commanded by sequence of operation.

2.9 SYSTEM OPTIMUM START:

- A. The building automation control system shall provide an optimum start sequence for the HVAC system.

- B. Optimization shall be determined by a comparison of indoor and outdoor environmental conditions and system capacities.
- C. At the completion of optimum start, the building shall be at design temperatures. This is not necessarily, and in most cases will not be, the same time as the start of the occupied period. For example, the completion of optimum start could be set at 7 am and the occupied mode set at 9 am. The occupied mode is typically when ventilation air would be energized.

2.10 ALARMS:

- A. In addition to the alarms indicated, all temperatures and other monitored or sensed conditions that fall above or below the normal range shall be alarmed.
- B. Alarms shall be assigned a level of alarm (minimum three levels - low (maintenance), high (important), and critical).

PART 3 - POINT SCHEDULE

3.1 DEFINITION OF POINTS:

A. Binary Output:

- 1. Control Relay - Energize/de-energize
- 2. Solenoid - Steam Valve
Gas Valve
- 3. Hand/Off/Auto - Starter

B. Analog Output:

- 1. Cooling - Control Valve
- 2. Heating - Control Valve
SCR Heater
- 3. Humidification - Control Valve
- 4. Economizer - Dampers
- 5. Position Adjust - Fan Drives
Pump Drives
Dampers
VAV Damper

C. Binary Input:

- 1. Differential Pressure - Fan Status
Pump Status
- 2. Pressure Switch - Pressure

-
- | | | |
|----|------------------|---------------------------------|
| 3. | Flow Switch | - Fan Status
Pump Status |
| 4. | Fire/Smoke | - Smoke Detector
Fire Sensor |
| 5. | Freeze | - Low Limit |
| 6. | Filter | - Filter Pressure |
| 7. | Setback Override | - Night Setback
Override |
| D. | Analog Input: | |
| 1. | Humidity | - Humidity |
| 2. | Temperature | - Temperature |
| 3. | Static Pressure | - Static Pressure |
| 4. | Fan Speed/Load | - Fan Drives |
| 5. | Air Flow | - Air Flow |

Insert points list

END OF SECTION 23 0993

SECTION 23 0993.6 - SEQUENCE OF OPERATION (SINGLE ZONE PACKAGED EQUIPMENT)

PART 1 - GENERAL

1.1 SCOPE OF WORK:

A. General:

1. Furnish all labor, materials, tools and equipment and perform all operations in connection with the installation of controls system shown on the drawings and specified hereinafter.

1.2 RELATED DOCUMENTS:

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 specification sections, apply to this section.
- B. All sections of Division 23 specifications apply to this section. In addition, refer to these specification sections:
 1. Section 23 0993 - Sequence of Operations for HVAC Controls and Points List

PART 2 - SEQUENCE OF OPERATION

2.1 GENERAL:

A. Unit Operation:

1. The indoor fan, compressors, heating coil, reheat coil, and outside air damper shall be controlled independently of each other by the direct digital controller.
2. Cooling and heating shall not operate simultaneously except where specifically specified otherwise.
3. Electric heat shall be disabled until air flow switch proves proper air flow.
4. When system is in occupied or override modes, the system shall operate in occupied mode.

B. Heating Control (Air Conditioning Unit):

1. Upon a demand for heating, the unit heating sequence shall be energized.
2. Electric heat shall stage (single or multiple) or proportionally energize as indicated on equipment schedule or specifications to maintain sensor setpoint.
3. Gas valve shall stage or proportionally energize as indicated on equipment schedule or specification to maintain sensor setpoint.

C. Cooling Control:

1. Upon a demand for cooling, the unit cooling sequence shall energize.
 2. The compressors shall load to maintain sensor setpoint.
- D. Indoor Fan Operation:
1. The fan shall run continuously when the unit is energized except where noted otherwise.
- E. Morning Warm-Up:
1. Unit shall operate in heating to bring space to design temperature.
- F. Outside Air Damper:
1. The outside air damper shall be closed during unoccupied mode.
 2. The outside air damper shall be closed during morning warm-up mode.
 3. The outside air damper shall be open during occupied mode.
- G. Unoccupied Mode:
1. When space temperatures drop below the night low limit setpoint, the unit shall energize in heating.
 2. When space temperatures rise above the night high limit setpoint, the unit shall energize in heating.
 3. When the space humidity rises above setpoint, the system shall operate in dehumidification mode.
- H. Failure Mode:
1. High condensate level
 2. Smoke detection
 3. Others indicated with equipment or required by manufacturer.
- 2.2 PACKAGED COOLING AND HEATING UNITS (WITH HOT GAS REHEAT – SPAC-1,2,3):
- A. Unit Operation:
1. The units shall be controlled by a space thermostat, space humidistat and direct digital controller.
- B. Dehumidification Mode:
1. The unit shall operate in cooling mode when humidity level exceeds setpoint.

2. The hot gas reheat valve shall modulate to maintain the space temperature setpoint.
- 2.3 PACKAGED COOLING AND HEATING UNITS (SZVAV WITH HOT GAS REHEAT – SPAC-4,5):
- A. Unit Operation:
 1. The units shall be controlled by a space thermostat, space humidistat, space CO₂ sensor and direct digital controller.
 - B. Dehumidification Mode:
 1. The unit shall operate in cooling mode when humidity level exceeds setpoint.
 2. The hot gas reheat valve shall modulate to maintain the space temperature setpoint.
 - C. Single Zone VAV:
 1. Units that are indicated as Single Zone VAV shall vary the airflow (between the minimum setpoint and the maximum setpoint) during cooling and stage or proportionally control the cooling as indicated on the schedule to provide maximum space comfort.
 2. Heating airflow shall remain constant.
 - D. Outside Air:
 1. Upon beginning of occupancy plus time delay of x minutes, minimum outside air damper shall open and maintain required airflow.
 2. Outside air shall be controlled by a return air CO₂ sensor in occupied mode.
 3. When CO₂ sensor is below setpoint, OA shall be at a minimum position.
 4. When CO₂ sensor is above setpoint, OA shall be a maximum position.

END OF SECTION 23 0993.6

SECTION 23 2113 - HVAC PIPING (GENERAL)

PART 1 - GENERAL

1.1 SCOPE OF WORK:

A. General:

1. Furnish all labor, materials, tools and equipment and perform all operations in connection with the installation of pipe, pipe fittings, accessories and appurtenances where shown on the drawings and specified hereinafter.

1.2 RELATED DOCUMENTS:

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 specification sections, apply to this section.
- B. All sections of Division 23 specifications apply to this section. In addition, refer to these specification sections:
 1. Section 23 0517 - Sleeves, Seals, and Escutcheons
 2. Section 23 0523.03 - Gas Valves for HVAC Systems
 3. Section 23 0529 - Hangers and Supports for HVAC Piping
 4. Section 23 0548 – Sound, Vibration, and Seismic Control for HVAC

1.3 QUALITY ASSURANCE:

A. Codes and Standards:

1. All pipe and pipe fittings shall comply with American National Standards Institute Code, all local codes and ordinances, and meet or exceed the standards and procedures (latest editions) of the following:
 - a. Ferrous Pipe and Fittings:
 - 1) Malleable Iron Screwed Fittings. ANSI B16.3
 - 2) Steel Flanges. ANSI B16.5
 - 3) Steel Fittings. ANSI B16.9
 - 4) Steel Pipe, Welded or Seamless, Black or Galvanized. ASTM A53, A106, and A120
 - 5) Steel Pipe, Welded or Seamless (for coiling) Black or Galvanized. ASTM A53
 - 6) Wrought Iron Pipe. ASTM A72

- b. Pipe Joining Materials, Gaskets, Methods, and Accessories:
 - 1) Soldering and brazing ANSI B9.1
- B. Material shall be new domestic materials (made in the USA) of standard manufacture suitable for specified use.
- C. Manufacturer shall certify materials conform to reference specifications, or specification number shall be cast into or marked on each piece.

PART 2 - PRODUCTS

2.1 GENERAL:

- A. No materials shall be co-mingled within the same system except those which are specifically approved in these specifications.

2.2 PIPE SCHEDULE:

- A. Cooling Coil Condensate Drain Piping:
 - 1. Outdoor piping shall be schedule 40 PVC.
- B. Gas Piping and Gas Relief Piping:
 - 1. Steel pipe shall be Schedule 40 black steel complying with ANSI B36.10 and ASTM A53 as follows:
 - a. Pressures 3 psig and less:
 - 1) Piping 3" and smaller shall be threaded.

PART 3 - EXECUTION

3.1 GENERAL:

- A. Pipe shall be installed in strict accordance with manufacturer's recommendations.
- B. Cut pipe accurately to measurements established at building or site, and work into place without springing or forcing, properly clearing all window, doors, and other openings or obstructions. Excessive cutting or other weakening of building to facilitate piping installation will not be permitted. Piping shall line up flanges and fittings freely and shall have adequate unions and flanges so that all equipment can be disassembled for repairs.
- C. Each length of pipe, as erected, shall be upended and rapped. Dirt and all foreign matter shall be cleaned from pipe and fittings before installation.
- D. All turns and connections shall be made with long radius fittings as specified hereinafter.
- E. Provide proper provision for expansion and contraction in all portions of pipework, to prevent undue strains on piping or apparatus connected therewith. Provide double swings

at coil connections, riser transfers, and other offsets wherever necessary to take up expansion. Arrange riser branches to take up motion of riser.

- F. Piping shall be installed straight and level except where required to be sloped.

3.2 ISOLATION VALVES:

- A. Provide shutoff valves at all major branches and at each riser.

3.3 BLACK STEEL PIPING:

- A. Screwed piping shall conform to the following:

1. Pipe nipples - Any piece of pipe 3" in length or smaller shall be considered a nipple. All nipples with unthreaded portion 1-1/2" and smaller shall be extra heavy. Only shoulder nipples shall be used. No close nipples shall be provided.
2. Screw threads shall be cut clean and true; screw joints shall be made tight without caulking. No caulking shall be permitted. A nonhardening lubricant shall be permitted. No bushings shall be used. Reductions shall be made with eccentric reducers or eccentric fittings to eliminate objectionable water or air pockets. All pipe shall be reamed out after cutting to remove all burrs.

3.4 SITE UTILITIES:

- A. Provide all site surveys, excavation, and other investigative work to determine the exact location and invert of site utilities if utilities are in place prior to construction beginning. The Contractor shall perform this work prior to installation of any affected piping systems.

3.5 PIPE INSPECTION:

- A. The Owner and A/E reserve the right to inspect, sample, and test any pipe after delivery and to reject all pipe represented by any sample which fails to comply with the specified requirements. Inspection of pipe shall be for pits, blisters, rough spots, breakage, or other imperfections. Any pipe which has been rejected because of the above shall be conspicuously identified and immediately removed from the construction site.

3.6 DRAINAGE PIPING:

- A. Provide cleanouts at all changes of direction totaling 90 degrees or more.

END OF SECTION 23 2113

SECTION 23 3112 - MECHANICAL DUCT

PART 1 - GENERAL

1.1 SCOPE OF WORK:

A. General:

1. Furnish all labor, materials, tools, and equipment and perform all operations in connection with the installation of mechanical duct, accessories, and appurtenances where shown on the drawings and specified hereinafter.

1.2 RELATED DOCUMENTS:

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. All sections of Division 23 Specifications apply to this section. In addition, refer to these specification sections:
 1. Section 23 0548 – Sound, Vibration, and Seismic Control for HVAC
 2. Section 23 3113.01 - Metal Duct
 3. Section 23 3300 - Duct Accessories

1.3 QUALITY ASSURANCE:

A. Codes and Standards:

1. Mechanical duct systems shall be fabricated and installed in accordance with the manufacturer's recommendations and meet or exceed the standards and procedures (latest editions) of the following:
 - a. SMACNA, Balancing and Adjustment of Air Distribution
 - b. SMACNA, High Velocity Duct Construction Standards
 - c. SMACNA, Low Pressure Duct Construction Standards
 - d. SMACNA, Fire Damper and Heat Stop Guide
 - e. SMACNA, Ducted Electric Heat Guide
 - f. SMACNA, Duct Cleanliness for New Construction Guidelines
 - g. SMACNA, HVAC Duct Construction Standards
 - h. NEBB Procedural Standards for Testing, Adjusting and Balancing of Environmental Systems

- i. ASHRAE Handbook of Fundamentals and ASHRAE Systems and Equipment Handbook
 - j. International Building Codes
 2. Duct shall be Class 0 in accordance with UL Standard 181. Where permitted by Code, Class 1 duct shall be allowed.
 3. All duct system components including insulations, adhesives, mastics, cements, tapes, coverings, connectors and appurtenances shall have a maximum UL flame spread of 25 and a smoke development rating of 50 as tested by ASTM E-84.
 4. Duct sealants shall meet UL 181A and UL 181B.
- B. Manufacturers:
1. The following duct sealant manufacturers are acceptable:
 - a. AirSeal McGill
 - b. Ductmate
 - c. Hardcast

PART 2 - PRODUCTS

2.1 GENERAL:

- A. Dimensions shown on the plan are finished inside dimensions. The sizes of internally lined ducts shall be increased accordingly. The size of dampers, security bars and accessories shall also be increased in size.
- B. Ducts shall be smooth on inside.
- C. The general location of ducts shall be as shown on the contract drawings. Exact location of ductwork shall be determined by the Contractor.

2.2 SEALING DUCTS:

- A. General:
 1. Sealants shall be water based. Solvent based sealants are not acceptable.
 2. Sealants shall be UV, water and mildew resistant.
 3. Sealants shall be suitable for low, medium and high pressure applications up to 15" WG.
 4. Sealants shall have a mild odor, no flashpoint, and not require a respirator for application.

- B. All ducts shall be sealed in accordance with Seal Class A. Seal all joints (longitudinal and traverse) and all penetrations. The following shall not require sealant:
 - 1. Spiral lockseams
 - 2. Gasketed connections
- C. Basis of design sealant (not exposed to weather) shall be:
 - 1. McGill AirSeal United Duct Sealer (Water Based).
- D. Basis of design sealant (exposed to weather) shall be:
 - 1. McGill AirSeal Uni-Weather.

2.3 DUCT SHIPMENT:

- A. Intermediate Level (SMACNA):
 - 1. Ducts leaving the place of fabrication shall be kept clean and dry.
- B. Advanced Level (SMACNA):
 - 1. Ducts leaving the place of fabrication shall be wiped clean (interior) and have all ends capped.

PART 3 - EXECUTION

3.1 GENERAL:

- A. Contractor shall provide additional bends and offsets as may be required to bring ductwork into proper relation with other equipment and features of the building.
- B. Where changes are made in shape of ducts, full area shall be maintained and changes shall be gradual to minimize pressure drop.
- C. Ducts terminating at grilles and registers shall be provided with suitable means of attachment.
- D. All ductwork shall operate without chatter and vibration, and shall be free from pulsation.
- E. The following work shall be performed under direction of the System Test and Balance Contractor.
 - 1. Provide necessary sheet metal baffle plates to eliminate stratification and provide air volumes specified. Locate baffles by experimentation and affix and seal permanently in place after stratification problem has been eliminated.
 - 2. Provide access doors to adjust, maintain, or service equipment sensors, controllers and all other devices.

3.2 DUCT STORAGE:

- A. Duct shall be protected by storing on elevated supports.
- B. All ducts shall have ends capped during storage.
- C. The area used for storage shall be kept dry and clean.

3.3 PROTECTION AND CLEANING DURING INSTALLATION:

- A. During construction, all open ends of duct installed shall be capped.
- B. Prior to capping, all interior duct surfaces shall be wiped clean.

3.4 HANGING:

- A. Hanging and support systems shall be in accordance with SMACNA Duct Construction Standards and drawing details.
- B. Vertical ducts shall be supported by extending bracing angles to rest firmly on floors or shall be bolted to walls, columns or other construction.
- C. Where duct is supported by threaded rods, see Mechanical Sound, Vibration, and Seismic Control specifications for threaded rod requirements and attachment requirements.
- D. Where duct is supported by sheetmetal straps, the strap shall attach to the duct with two #10 sheetmetal screws located within 2 inches of the top of the duct.

3.5 ACCESSORIES:

- A. Doors, dampers, and other accessory items shall be installed as detailed in the SMACNA Duct Construction Standard with adequate reinforcement and support to accommodate additional weight without damage to the duct.

3.6 COMPLETION AND DEMONSTRATION:

- A. Upon completion of the duct system installation, and before the A/E has inspected the system operation, open all system dampers and turn on fans to blow all scraps and other loose material out of the duct system. Allow for a means of removal of such material.
- B. Check the duct system to ensure there are no excessive air leaks through joints, at reinforcement locations, seams, points of connection with fire dampers, coils, or other duct accessories. Where there are unacceptable leaks, the leakage shall be repaired and shall be done so in a manner of a new installed system. Excessive air leaks shall be leaks that exceed industry standards, cause higher than acceptable noise, or where leakage exceeds reasonable expectations.

END OF SECTION 23 3112

SECTION 23 3113.1 - METAL DUCT

PART 1 - GENERAL

1.1 SCOPE OF WORK:

A. General:

1. Furnish all labor, materials, tools and equipment and perform all operations in connection with the installation of all metal duct where shown on the drawings and specified hereinafter.

1.2 RELATED DOCUMENTS:

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 specification sections, apply to this section.
- B. All sections of Division 23 specifications apply to this section. In addition, refer to these specification sections:
 1. Section 23 3112 - Mechanical Duct

1.3 QUALITY ASSURANCE:

- A. Codes and Standards: All work shall meet or exceed the standards and procedures (latest editions) of the following:
 1. ASTM A527 Galvanized Steel Spiral Lock Seam Duct
 2. Underwriter Laboratories, UL 103
 3. ANSI Z223.1
 4. NFPA 96
- B. Material shall be free from blisters or other mechanical defects. Material shall be galvanized prime sheet steel unless noted otherwise.
- C. Sheet metal thickness, cross joints, seams, slip-connections, cross-breaking, bracings, duct supports and reinforcing shall be in accordance with the more stringent requirements of ASHRAE Guide and SMACNA Duct Construction Manual for system pressure classifications. Minimum gauge thickness is 26 unless thicker gauges are indicated.

PART 2 - PRODUCTS

2.1 GENERAL:

A. Materials:

1. Duct shall be galvanized or as indicated elsewhere on the plans or in these specifications.

2. Plenums, collars, flashing, etc. located on roofs, exterior of the building, or other locations where exposed to the weather shall be stainless steel.

B. Closure:

1. Transverse joints and seams in sheet metal duct shall be of the types and sizes recommended by SMACNA and the ASHRAE Handbook for the specific duct pressure classification.

2.2 RECTANGULAR DUCT (DUAL WALL):

A. Duct:

1. Dual wall shall be:
 - a. Outdoor supply: 3"
 - b. Outdoor return: 3"

B. Materials:

1. Outer wall stainless steel (outdoor)
2. Inner wall galvanized

C. Fittings:

1. Fittings shall be constructed similar to fittings specified for single wall duct except that they shall be dual wall.

D. Liner:

1. Fittings shall have solid liner.
2. Dual wall duct shall have solid liner.

E. Insulation:

1. Insulation shall be .27K @ 75 degrees F.
2. Insulation shall be thickness of the dual wall.

F. Location:

1. Dual wall duct shall be provided in the following locations:
 - a. As indicated on plans.

PART 3 - EXECUTION

3.1 DUCT DRAWINGS:

- A. Provide 1/4" scale CADD drawings indicating layout of all dual wall duct.
- B. Where new duct ties into existing duct, existing duct must also be shown based upon field verified dimensions.

3.2 SUBMITTALS:

- A. Provide a list of all duct materials and systems in which they are to be installed for the entire project.

3.3 CUTTING DUCTS:

- A. Ducts shall be cut with a hand held plasma cutter whenever practical. This shall include, but not be limited to, cutting openings for access doors, duct taps, cutting into existing ducts, and similar applications.

END OF SECTION 23 3113.1

SECTION 23 3113.5 - FABRIC DUCT

PART 1 - GENERAL

1.1 SCOPE OF WORK:

A. General:

1. Furnish all labor, materials, tools and equipment and perform all operations in connection with the installation of all fabric duct where shown on the drawings and specified hereinafter.

1.2 RELATED DOCUMENTS:

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 specification sections, apply to this section.
- B. All sections of Division 23 specifications apply to this section. In addition, refer to these specification sections:
 1. Section 23 3112 - Mechanical Duct

1.3 QUALITY ASSURANCE:

A. Manufacturers:

1. The following fabric duct manufacturers are acceptable:
 - a. Duct Sox
 - b. Fabric Air
 - c. Approved equal

PART 2 – PRODUCTS:

2.1 FABRIC DUCT:

A. General:

1. Duct shall be classified by Underwriter's Laboratories in accordance with the 25/50 Flame spread/smoke developed requirements.
2. Duct material shall be machine washable and designed for use from 0 degrees F to 180 degrees F.
3. Minimum weight of 6.8 oz/yd² per ASTM D3776.

B. Fabrication:

1. Air dispersion shall be by linear vents and permeable fabric. Linear vents shall include open orifices. Mesh style vents are not acceptable.
2. Duct system shall produce air film at outer wall of duct that prevents condensation.
3. Size and location of air dispersion shall be designed by manufacturer.
4. Connection to metal duct shall be by draw band and anchor patches. Inlet connection shall include a zipper for duct removal.
5. System shall include adjustable flow devices to balance airflow.
6. Provide end cap with zipper.
7. Connections to or offsets from straight runs shall be gored elbows or energy efficient tees. Elbows shall have a 1.5D radius.

C. Suspension Systems (3 x 1):

1. System includes a 3 row connection to the fabric duct at 10, 12, and 2 o'clock locations.
2. Powder coated aluminum hangers connect to an aluminum track every 3 ft. oc and to the fabric at the 10 and 2 o'clock locations with D-clasps (detachable).
3. The fabric system shall have intermediate track supports at 12 o'clock.
4. Hardware shall be provided by the fabric duct manufacturers and shall include the track, connectors, endcaps, and vertical cable kits. Radius track shall be provided for all radius sections.

D. Suspension System (Cable):

1. A suspension cabling system shall support the fabric duct.
2. All accessories to support the duct shall be provided by the duct manufacturer including but not limited to stainless steel cable, eye bolts, thimbles, cable clamps, and turnbuckles. All hardware shall be type 316 stainless steel.

E. Fabric Duct Color:

1. Color shall be custom color.

F. Basis of design manufacturer shall be:

1. Duct Sox Sedona - Xm

PART 3 – EXECUTION:

3.1 SUBMITTAL:

- A. Include all materials, duct, fittings, supports, and accessories.
- B. Provide a 1/8" scale min. drawing of duct layout based upon review of all construction documents and field measurements of existing conditions.
- C. Submittal shall include airflow performance (horizontal and vertical) at 100 FPM, 75 FPM, and 50 FPM.

END OF SECTION 23 3113.5

SECTION 23 3300 - DUCT ACCESSORIES

PART 1 - GENERAL

1.1 SCOPE OF WORK:

A. General:

1. Furnish all labor and materials, and perform all installation of duct accessories and appurtenances where shown on the drawings and specified hereinafter.

1.2 RELATED DOCUMENTS:

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 specification sections, apply to this section.
- B. All sections of Division 23 specifications apply to this section. In addition, refer to these specification sections:
 1. Section 23 3112 - Mechanical Duct

1.3 QUALITY ASSURANCE:

A. Codes and Standards:

1. Duct accessories shall be fabricated and installed in accordance with the manufacturer's recommendations and meet or exceed the standards and procedures (latest editions) of the following:
 - a. UL Standard 214 for Fire Retardancy
 - b. NFPA 90A and 90B
 - c. SMACNA
 - d. ASTM E84
 - e. AMCA Standard 500
2. Duct accessories shall have AMCA Certified Rating Seal when specified.

B. Manufacturers:

1. The following access door (low pressure) manufacturers are acceptable:
 - a. Ruskin
 - b. Air Balance
 - c. KEES

- d. National Controlled Air
2. The following flexible duct connector manufacturers are acceptable:
 - a. Ventfabrics
 - b. Ductmate
 - c. Approved Equal
3. The following test cap manufacturers are acceptable:
 - a. Ventlok
 - b. Approved equal

PART 2 - PRODUCTS

2.1 FLEXIBLE CONNECTORS:

A. General:

1. Flexible connectors shall consist of two strips of 24 gauge metal and a coated fabric.
2. Metal strips shall be 2-3/4" minimum and fabric shall be 5" minimum.
3. Connectors shall be unaffected by mildew, resistant to weather and have a fire retardant coating on a noncombustible fabric.
4. Connector shall be suitable for -40 degree F to 180 degree F.
5. Where duct has roll formed mating flange, metal strips shall be roll formed.

B. Indoor Applications:

1. Characteristics:
 - a. Fabric: woven nylon
 - b. Weight: 22 oz/sq. yd.
 - c. Tongue Tear: 150/150 lbs.
 - d. Tensile Strength: 500/400 lbs.
2. Metal strips shall be galvanized or aluminum.
3. Basis of design manufacturer shall be:
 - a. DuctMate Proflex Vinyl Super Duty

- C. Locations:
 - 1. Inlet and outlet of each duct at all equipment with a fan.
 - 2. Other locations where indicated.

2.2 DUCT ACCESS DOORS (LOW PRESSURE):

- A. Low pressure access doors shall be provided in duct systems with static pressures up to 2 inches W.G. and for velocities up to 2400 FPM except where low leak duct access doors are required.
- B. Frame and door shall be 20 gauge galvanized steel in galvanized duct (and stainless steel in stainless duct). Door shall be dual wall with 1/2" insulation minimum.
- C. Door shall be removable cam type with two cams for doors less than 16" and four cams for door 16" and larger.
- D. Polyurethane foam seals shall be provided between frame and duct and between door and frame.
- E. Multiple doors shall be provided in all ducts larger than 48".
- F. Access doors shall be the following sizes:

<u>Duct Maximum Dimensions</u>	<u>Access Door</u>
6"	6" x 6"
14"	10" x 14"
18"	14" x 14"
Larger than 18"	16" x 16"

2.3 AIRFLOW TEST CAPS:

- A. Provide 304L stainless steel test ports and cap on each main fume exhaust duct and each runout to a fume hood, equipment or grille in the fume exhaust system where airflow cannot easily or accurately be measured at the equipment or device.

PART 3 - EXECUTION

3.1 DUCT ACCESS DOOR:

- A. General:
 - 1. Duct access door shall be provided for access to all fire dampers, smoke dampers, combination fire smoke dampers, smoke detector sampling tube, sensors, and other devices and appurtenances requiring periodic maintenance or inspections.
 - 2. Access door shall be within 24" of damper and damper linkage. There shall not be turning vanes or any other devices prohibiting access to damper and replacement of linkages.

B. Duct Access Door:

1. Access door shall be attached to housing with sheet metal screws. Frame shall be sealed to duct with high pressure duct sealant.

3.2 FLEXIBLE DUCT CONNECTORS:

- A. Installed length of material shall be 50% flat length.

3.3 AIR FLOW TEST CAP:

- A. Coordinate with Test and Balance Agency the required location for each test port.
- B. If duct surface is not flat or test port is not available in the duct radius, weld a test port extension to the duct.

END OF SECTION 23 3300

SECTION 23 3713 - DIFFUSERS, REGISTERS, AND GRILLES

PART 1 - GENERAL

1.1 SCOPE OF WORK:

A. General:

1. Furnish all labor, materials, tools and equipment and perform all operations in connection with the installation of air distribution equipment and appurtenances where shown on the drawing and specified hereinafter.

1.2 RELATED DOCUMENTS:

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 specification sections, apply to this section.
- B. All sections of Division 23 specifications apply to this section.

1.3 QUALITY ASSURANCE:

A. Codes and Standards:

1. All work shall meet or exceed the standards and procedures of the following as referenced (latest editions):
 - a. AMCA 300 - Certified Ratings for Sound and Airflow
 - b. AMCA 210 - Test Code for Air Moving Devices
 - c. Insulation - NFPA 90A and UL 181
 - d. NAAMM Metal Finishes Manual

B. Manufacturers:

1. The following air distribution manufacturers are acceptable:
 - a. Krueger
 - b. Metal Aire
 - c. J and J Register
 - d. Titus
 - e. Carnes
 - f. Tuttle and Bailey
 - g. E.H. Price

h. Nailor

PART 2 - PRODUCTS

2.1 AIR DISTRIBUTION UNITS (GENERAL):

A. General:

1. Furnish and install where shown on the plans, air distribution units in accordance with the air distribution schedules on the drawings and as specified hereinafter.
2. Provide round to square adapter for flex duct connecting to square neck.

B. Material:

1. General purpose use: steel or aluminum unless other material indicated.
2. Special applications as noted or indicated on schedules.

C. Finish:

1. All air distribution units shall be furnished with manufacturer's standard off-white baked enamel finish unless specifically noted otherwise on plans or in specifications.

D. Frame Style:

1. Frame style shall be suitable for surface in which air distribution unit is to be installed. Manufacturers or contractor shall provide all accessories such as plaster rings, etc., as necessary for a complete, finished installation.
2. Air distribution units shall typically be supplied with frame style as follows:
 - a. Units installed in sheetrock, plaster, or other hard finish shall have surface mounted frame style or plaster rings.

2.2 HEAVY DUTY GYM GRILLE:

- A. 14 gauge steel border with smooth contours and steel blades with 45 degree deflection, 3/4" on center blade spacing.
- B. Front blades shall be horizontal.
- C. Grille shall have a custom finish to match the owner's color sample.
- D. Grille basis of design shall be:
 1. Price Model 96

END OF SECTION 23 3713

SECTION 23 4100 - PARTICULATE AIR FILTRATION

PART 1 - GENERAL

1.1 SCOPE OF WORK:

A. General:

1. Furnish all labor, materials, tools and equipment and perform all operations in connection with the installation of air distribution equipment and appurtenances where shown on the drawing and specified hereinafter.

1.2 RELATED DOCUMENTS:

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 specification sections, apply to this section.
- B. All sections of Division 23 specifications apply to this section.

1.3 QUALITY ASSURANCE:

A. Codes and Standards:

1. All work shall meet or exceed the standards and procedures of the following as referenced (latest editions):
 - a. AMCA 300 - Certified Ratings for Sound and Airflow
 - b. AMCA 210 - Test Code for Air Moving Devices
 - c. Insulation - NFPA 90A and UL 181
 - d. ASHRAE 52 Test Standard for filter efficiencies
 - e. UL Standard 900 for filter flame and smoke rating
 - f. Institute of Environmental Services Standard IES-RP-CC-DDI-86 for HEPA filters

B. Manufacturers:

1. The following filter manufacturers are acceptable:
 - a. Camfil Farr
 - b. American Air Filter
 - c. Airguard
 - d. Flanders Precisionaire

- e. Glasfloss
- f. Airflow, Inc.

PART 2 - PRODUCTS

2.1 GENERAL:

- A. Equipment with filters 4" or less in depth requires the following filters:
 - 1. First set shall be installed before initial start-up.
 - 2. Second set shall be installed for testing and balancing.
 - 3. Third set shall be turned over to the Owner at final inspection.
- B. Equipment with permanent filters requires the following filters:
 - 1. One set of throwaway filters shall be installed during construction.
 - 2. One set of permanent filters shall be installed at time of testing and balancing.

2.2 ONE INCH (1") AND TWO INCH (2") PLEATED PANEL FILTERS:

- A. MERV 13 Filters:
 - 1. Panel filters shall be flat throwaway type constructed of high strength moisture resistant board forming a double wall around the filter media.
 - 2. A metal support grid is bonded to the leaving air side of the pleated media.
 - 3. The filters shall be UL Class 2 approved and listed.
 - 4. Filter shall have a maximum initial pressure drop of 0.41 inches WG at 500 FPM and 15 pleats per linear foot for 2 inch filters.
 - 5. Filter shall not have an electrostatically enhanced media.
 - 6. Filter media and frame shall be from 100% recyclable material.
 - 7. Basis of design filter shall be:
 - a. Camfil Farr AP-Thirteen

2.3 PERMANENT FILTERS:

- A. Thirty percent (30%) efficiency:
 - 1. Filters shall be aluminum.
 - 2. PTAC filters shall be plastic with a nylon media.

3. Filters shall be sized to fit housing.
4. Filters shall be washable.

2.4 TEMPORARY FILTERS:

- A. During start-up, preliminary testing of system, operation of system prior to system being ready for testing and balancing, or operation of a system prior to final building cleaning, the contractor shall protect all equipment, coils, and the entire duct system with filters.
- B. Filters shall be MERV 8 minimum and contain an antimicrobial biocide to control the growth of mold, mildew, algae, and fungi on the filters (i.e., fibers shall not support microbial growth). Biocide shall not offgas, migrate, or leach into the airstream.
- C. Basis of design filter shall be:
 1. Fiberbond Dustlok

2.5 EQUIPMENT REQUIREMENTS:

- A. Filters shall be provided on all equipment to protect heat transfer components from outside air, building exhaust air or other airstreams that would foul heat transfer surfaces.
- B. Where no other filtration is indicated or scheduled, air handling equipment shall have a 2" pleated panel filter. The 2" filter shall be MERV 8.

PART 3 - EXECUTION

3.1 TEMPORARY FILTERS:

- A. The contractor shall install temporary filter media on all negative pressure openings if the system is to be operated prior to the final cleaning of all spaces served by a system. These openings include open return ducts, exhaust ducts, and grilles. All filters shall be replaced as often as necessary.
- B. All temporary filters shall be held securely in place and with minimum bypass. Filters shall be changed as needed.
- C. Systems shall not be operated without filters equaled to specified filters in place to protect coils and other heat exchanger devices.

3.2 SPARE FILTERS:

- A. The spare set of filters shall be stored at the project site at the location designated by the Owner.

END OF SECTION 23 4100

SECTION 23 9005 - HEAT TRANSFER (ELECTRIC COOLING)

PART 1 - GENERAL

1.1 SCOPE OF WORK:

A. General:

1. Furnish all labor, materials, tools and equipment and perform all operations in connection with the installation of heat transfer equipment and appurtenances where shown on the drawings and specified hereinafter.

1.2 RELATED DOCUMENTS:

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 specification sections, apply to this section.
- B. All sections of Division 23 specifications apply to this section. In addition, refer to these specification sections:
 1. Section 23 0502 - Common HVAC Materials

1.3 QUALITY ASSURANCE:

A. Codes and Standards:

1. All work shall meet or exceed the standards and procedures of the following as referenced (latest editions):
 - a. ARI Standards 210/240, 340, and 360
 - b. ANSI Z21.47/UL - Unitary Air Conditioning Standard for Safety Requirements
 - c. Underwriter's Laboratory
 - d. NFPA 90A
 - e. AMCA 210 Test Code For Air Moving Devices
 - f. National Electric Code
 - g. ASHRAE 15 - Safety Code for Mechanical Refrigeration

- B. All motors and equipment shall be U.L. labeled.
- C. All insulation and materials shall have a flame spread rating of less than 25 and smoke developed of less than 50.
- D. All heating and cooling equipment shall bear the ARI seal.
- E. All coils shall be ARI certified.
- F. All electric heaters shall have impedance protection per UL519.

- G. Burner assembly, including the gas train, shall be FM and IRM approved.
- H. All outdoor cabinets shall meet or exceed the 500 hour salt spray test unless more stringent tests are specified.
- I. Manufacturers:
 - 1. The following constant volume packaged heating and cooling unit manufacturers are acceptable:
 - a. Trane
 - b. Carrier
 - c. JCI
 - 2. The following constant volume packaged heating and cooling unit manufacturers (with hot gas reheat) are acceptable:
 - a. Trane
 - b. Carrier
 - c. JCI
 - 3. The following single zone VAV packaged heating and cooling unit manufacturers (with hot gas reheat) are acceptable:
 - a. Trane
 - b. Carrier
 - c. JCI

PART 2 - PRODUCTS

2.1 GENERAL:

- A. General:
 - 1. Equipment shall meet or exceed the scheduled efficiencies or ASHRAE 90.1, whichever is greater.
 - 2. Furnish and install heating and cooling units in accordance with the drawings and as specified hereinafter.
 - 3. Units shall be air conditioning or heat pump as shown on equipment schedules.
 - 4. Unit shall be factory assembled and tested.
 - 5. Standard operating range for cooling shall be 55°F to 120°F outdoor ambient except where low ambient controls are required. See equipment schedule.

6. Provide all controls and accessories for a complete operating system including but not limited to:
 - a. Crank case heater
 - b. Start capacitor kit (single phase condensers)
 7. Refrigerant shall be R410A.
 8. Motors shall be premium efficiency.
- B. Outdoor Cabinets:
1. Unit shall be designed for outdoor installation.
 2. Cabinet shall be insulated and constructed of heavy duty galvanized steel. Frame and panels shall be 18 gauge minimum. They shall be zinc coated or epoxy coated with a baked-on finish.
 3. Prewired control panel.
 4. Hinged access doors with quick release handles shall be provided as follows:
 - a. On all access sections on units 3 tons and larger.
 - b. On filter sections for all units smaller than 3 tons.
 5. Single wall cabinets shall be thermally and acoustically insulated with a minimum of R4 fiber insulation. Provide a foil, sprayed neoprene, or mat faced finish.
- C. Refrigerant Circuits:
1. All units shall have factory installed liquid line filter dryer, liquid line sight glass, pressure tap ports, check valves, and suction and liquid service valves.
 2. Heat pump units shall also have reversing valve, suction line accumulator, and discharge muffler.
 3. Where low ambient control is required, electronic head pressure control shall be provided.
- D. Compressors (up to 7 tons):
1. Compressor shall have centrifugal oil pump.
 2. Motor shall have internal temperature and current sensing motor.
 3. Compressor shall have totally dipped hermetic motor windings.
 4. Compressor shall be resiliently mounted and seismically isolated.

- E. Compressors (7-1/2 tons to 30 tons):
1. Compressors shall have centrifugal oil pumps.
 2. Motor shall be suction gas-cooled with internal temperature and current sensing motor overloads.
 3. External high and low pressure cutout devices shall be provided.
 4. Compressor shall be resiliently mounted and seismically isolated.
 5. Minimum of two compressors for units larger than 120 MBH (nominal capacity).
- F. Outdoor Coil:
1. The outdoor coil shall be constructed of aluminum spine fin mechanical bonded to seamless aluminum or copper tubing with all joints brazed.
 2. Surface shall be engineered to facilitate defrost water runoff.
 3. Louvered panels.
- G. Indoor Coil:
1. The indoor coil shall be constructed of aluminum plate fins mechanically bonded to seamless copper tubes with all joints brazed.
 2. Coil shall include factory installed refrigerant metering device and refrigerant line fittings.
- H. Outdoor Fans:
1. Fan motors shall be permanently lubricated, weatherproof motors suitable for outdoor use.
 2. Motor shall have built-in current and thermal overload protection.
 3. Fans shall be resiliently mounted and seismically isolated.
 4. Fans shall be statically and dynamically balanced.
 5. Provide PVC coated fan guard.
- I. Indoor Fan:
1. Indoor fan shall be direct drive plenum fan with ECM motor and speed adjustment feature or inverter duty motor with a variable frequency drive.
 2. Fan shall be seismically isolated.

- J. Safeties:
1. Heat pumps shall have a solid state defrost control. Defrost shall occur only when coil saturated suction temperature indicates freezing temperatures. Defrosting shall be limited to a maximum of 10 minutes over a 90 minute period.
 2. Provide a time-guard device to prevent compressor recycling by requiring a 5-minute delay before restarting.
 3. Three phase protection.
- K. Electrical (Outdoor Unit):
1. Provide control voltage transformer.
 2. Provide an unswitched GFI service receptacle on all three phase outdoor units. Receptacles shall have metal covers.
 3. Provide transformer for motor or heaters as required.
 4. Transformers shall be factory mounted and wired.
 5. Power to the packaged unit shall be through the interior of the unit curb.
- L. Electric Heaters:
1. Heaters shall have a total output as scheduled on drawings.
 2. Each heater assembly shall include power supply fusing if over 48 amps, automatic resetting limit switches and heat limiters for thermal protection.
 3. Heaters shall be provided with polarized plug for quick connection to unit low voltage wiring.
 4. Electric heaters factory furnished and installed capacity not to exceed scheduled capacity at rated voltage.
 5. If larger heaters are supplied, they shall not be large enough to require larger supply wiring or disconnects.
 6. Heaters shall have SCR control except where staged heaters are scheduled.
- M. Refrigerant Circuit (Units with Hot Gas Reheat):
1. Provide full modulating control of hot gas reheat.
 2. Reheat control shall maintain space setpoint to ± 2 degrees F.
 3. Discharge air temperature shall be adjustable from the building automation control system.

- N. Drain Pan:
1. Provide dual slope insulated non corrosive drain pan.
- O. Filters:
1. Provide flat filter rack for 2 inch pre filter.
 2. Where additional filters are specified, additional filter racks shall be provided for the additional filters.
- P. Indirect Fired Gas Furnaces (Units with Gas Heat):
1. General:
 - a. Furnace shall be an integral component of packaged equipment.
 - b. The furnace shall be natural gas.
 2. Furnace:
 - a. The gas furnaces shall contain a heat exchanger of 439 stainless steel, die-formed burners of 439 stainless steel and a stainless steel drip pan.
 - b. Furnaces shall be gravity vented unless power venting is indicated.
 - c. Minimum thermal efficiency shall be 80 percent unless a higher efficiency is indicated.
 - d. Vent shall be raintight.
 3. Burner:
 - a. The burner assembly shall be complete with pressure regulator, main manual shut-off valve, gas connections and controls.
 - b. Provide a gas regulator to reduce line pressure to burner pressure.
 - c. Burner shall be designed to operate:
 - 1) Natural gas: 5" w.g. to 11" w.g.
 - d. The ignition system shall be:
 - 1) Natural gas: intermittent spark ignition system.
 - e. Provide a burner air sheet for propane systems.
 - f. Burner shall be modulating with a 10:1 turndown (min.) unless a greater turndown is specified.
- Q. Outside Air Intake:

1. Provide outside air intake hoods with birdscreen when outside is specified directly from outdoors.
 2. Settable low leak, motorized, outside air dampers.
- R. Provide BacNet communication card on all equipment.
- S. Controls:
1. The unit shall be provided with factory provided and installed controls required to meet the specified sequence of operations. All required points and devices shown in the System Point Schedule shall be available through the unit supplied BACnet Interface. See the Sequence of Operations specification 23 0993. If equipment is unable to meet the specified sequence or points, the equipment manufacturer shall contract with the controls vendor to accomplish the specified sequences and points.
- 2.2 PACKAGED UNITS (CONSTANT VOLUME – SPAC-6):
- A. Unit:
1. Unit shall be single wall construction.
- B. Indoor Fan:
1. Fans shall be belt driven with adjustable pulleys.
- C. Accessories:
1. Power through curb
 2. Adapter curb
 3. Bipolar ionization
 4. Condenser Hailguard
- 2.3 PACKAGED UNITS (CONSTANT VOLUME WITH HOT GAS REHEAT – SPAC-1,2,3):
- A. Unit:
1. Unit shall be dual wall construction.
- B. Indoor Fan:
1. Fans shall be direct drive with VFD.
- C. Compressors:
1. Units over 7-1/2 tons shall have a minimum of 2 compressors.
 2. At least one compressor in each unit shall be a digital scroll compressor.

- D. Hot Gas Reheat:
 - 1. Hot gas reheat coil with full modulation.
 - E. Controls:
 - 1. Controls shall be coordinated with building automation controls contractor to provide the required sequence of operations. Factory mounted controllers shall work with the BAS system to provide the required sequence.
 - F. Accessories:
 - 1. Bipolar ionization
 - 2. IFM Piezo Ring and PE Piezo Ring/Tap
 - 3. Condenser Hailguard
- 2.4 PACKAGED UNITS (SINGLE ZONE VAV WITH HOT GAS REHEAT – SPAC-4,5):
- A. Unit:
 - 1. Unit shall be dual wall construction.
 - 2. Unit shall have an outside air louver or hood.
 - B. Indoor Fan:
 - 1. Fans shall be direct drive with VFD.
 - C. Compressors:
 - 1. Units over 7-1/2 tons shall have a minimum of 2 compressors.
 - 2. At least one compressor in each unit shall be a digital scroll compressor.
 - D. Hot Gas Reheat:
 - 1. Hot gas reheat coil with full modulation.
 - E. Controls:
 - 1. Controls shall be coordinated with building automation controls contractor to provide the required sequence of operations. Factory mounted controllers shall work with the BAS system to provide the required sequence.
 - 2. See single zone VAV and averaging temperature control sequences in 23 0993.6.
 - 3. Demand control ventilation
 - F. Electrical:
 - 1. Power through curb
 - G. Accessories:

1. Adapter curb
2. Bipolar ionization
3. IFM Piezo Ring and PE Piezo Ring/Tap
4. Condenser Hailguard

PART 3 - EXECUTION

3.1 CONDENSATE DRAIN LINES:

- A. Provide a weather seal grommet where drain penetrates casing and wall sleeve.

3.2 WARRANTY:

- A. Compressor Failure:

1. When a compressor fails within the warranty period, the compressor shall be replaced. If the system has multiple compressors on a single refrigerant circuit, and one compressor fails, all compressors shall be replaced during the warranty period.

END OF SECTION 23 9005

SECTION 26 0500 - ELECTRICAL GENERAL REQUIREMENTS

PART 1 - GENERAL CONDITIONS

1.1 WORK INCLUDED:

- A. The work covered under these sections of the specifications consists of furnishing all labor, equipment, supplies and materials, and of performing all operations, including cutting, channeling, chasing, excavating and backfilling necessary for the installation of complete wiring systems, raceways, wiring, and electrical equipment in accordance with this section of the specifications and the accompanying drawings.
- B. The Electrical Work shall include, but not be limited to, the following:
 - 1. Electrical distribution system
 - 2. Wiring devices
 - 3. Raceway system
 - 4. Conductors and cables
 - 5. Fire Alarm system

1.2 RELATED WORK:

- A. Related work to Division 26:
 - 1. Division 1
 - 2. The provisions, conditions, and requirements preceding and including general and supplemental conditions apply to and are a part of Divisions 26 and 28.

1.3 DEFINITIONS:

- A. Provide: Furnish and install complete ready for use, including all accessories required for operation.
- B. Furnish: Purchase and deliver to the project site complete with every necessary appurtenance, support and accessories required for operation.
- C. Install: Unload at the delivery point at the site and perform every operation necessary to establish secure mounting and correct operation at the proper location in the project.

1.4 DESCRIPTION OF SYSTEMS:

- A. Furnish and install all materials for systems, resulting upon completion, in functioning systems in compliance with performance requirements specified. The omission of express reference to any parts necessary for or reasonably incidental to a complete installation shall not be construed as a release from furnishing such parts.

- B. The wiring specified and shown on the drawings is for complete and workable systems. Any deviations from the wiring shown due to a particular manufacturer's requirements shall be made at no cost to either the contract or to the Owner. Changes in electrical service to equipment due to substitutions of equipment by any Divisions of this specification shall be at no additional cost to the Owner.

1.5 QUALITY ASSURANCE:

- A. All equipment and materials required for installation under these specifications shall be new and without blemish or defect. All equipment shall bear labels attesting to Underwriters Laboratories approval where subject to Underwriters Laboratories label service.
- B. Equipment and material which are not covered by UL Standard will be accepted provided equipment and material is listed, labeled, certified or otherwise determined to meet safety requirements of a nationally recognized testing laboratory. Equipment of a class which no nationally recognized testing laboratory accepts, certifies, lists, labels, or determines to be safe will be considered, if inspected or tested in accordance with national industrial standards, such as NEMA, ICEA or ANSI. Evidence of compliance shall include certified test reports and definitive shop drawings.
- C. All equipment of one type (such as panelboards, breakers, etc.) shall be the products of one manufacturer.

1.6 REQUIREMENTS OF REGULATORY AGENCIES/CODE COMPLIANCE:

- A. Contractors shall submit all items necessary to obtain all required permits to the appropriate Regulatory Agencies, obtain all required permits, and pay all required fees.
- B. All work shall conform to the following Building Codes:
 - 1. National Electrical Code (NEC-2017)
 - 2. National Electrical Safety Code (NESC) latest edition
 - 3. International Building Code (IBC 2018)
- C. All work shall conform to all federal, state and local ordinances.
- D. References to the National Electrical Code and National Fire Protection Association (NFPA) are a minimum installation requirement standard. Design drawings and other specification sections shall govern in those instances where requirements are greater than those specified in the NEC and NFPA.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS:

- A. All products shall be new (except where noted) and unused and without blemish or defect.

2.2 SUBSTITUTIONS:

- A. All requests for substitutions should be submitted so as to be received by the Architect/Engineer at least 10 working days before bid date and must be approved before award of Contract.
- B. Submittals shall be concise, clear, and brief as possible. Requests shall be accompanied by samples, descriptive literature and engineering information, as necessary, to fully identify and appraise the product.
- C. Items approved shall not be construed as authorizing any deviations from the plans and specifications unless such deviations are clearly indicated in the form of a table of compliance that is enclosed with the submittals. The table of compliance shall clearly identify all deviations from the specifications with clear proof of equality for each case of deviation. Each item in the table of compliance shall be marked to show specification reference including the section and paragraph numbers.
- D. Contractor shall be responsible for verifying all dimensions with available space conditions (with provisions for proper access, maintenance, part replacement, and for coordination with other trades--electrical, plumbing, structural, etc.) for proper services, and construction requirements. Contractor to bear any additional cost for required changes in associated items which are directly or indirectly related to a substituted unit.
- E. The Contractor shall furnish drawings showing all installation details, shop drawings, technical data and other pertinent information as required.
- F. Approval of the equipment does not relieve the contractor of the responsibility of furnishing and installing the equipment at no additional cost.
- G. Where Contractor substitutes equipment manufactured by an alternative vendor other than the Specification approved first named manufacturer, the Contractor shall become responsible for the operation of the product in the intended system, including all related costs required to make the design work, function, and fit in the allocated space.

PART 3 - EXECUTION

END OF SECTION 26 0500

SECTION 26 0501 - ELECTRICAL COORDINATION

PART 1 - GENERAL CONDITIONS

1.1 INTERPRETATION OF CONTRACT DOCUMENTS:

- A. This section of the specifications and related drawings describe general provisions applicable to every section of Division 26.
- B. Attention is directed to Instructions to Bidders and to Division 1, General Conditions, which are binding in their entirety on this portion of the work in particular to paragraphs concerning materials, workmanship and substitutions.
- C. The drawings of necessity utilize symbols and schematic diagrams to indicate various items of work. Neither of these have any dimensional significance nor do they delineate every item required for the intended installations. The work shall be installed, in accordance with the intent diagrammatically expressed on the drawings, and in conformity with Contractor field-verified dimensions and on equipment shop drawings. No interpretation shall be made from the limitations of symbols and diagrams that any elements necessary for complete work are excluded.
- D. Certain details appear on the drawings which are specific with regard to the dimensioning and positioning of the work. These details are intended only for the purpose of establishing general feasibility. They do not eliminate the requirement for field coordination for the indicated work.

1.2 EXISTING CONDITIONS:

- A. The Contractor shall visit the premises and thoroughly familiarize himself with all details of the work, working conditions, verify all dimensions in the field, advise the Engineer of any discrepancy, and submit shop drawings of any changes he proposes to make, in quadruplicate for approval, before starting the work. Contractor shall install all equipment in a manner to avoid building interference.

1.3 SHOP DRAWINGS:

- A. The Contractor shall not purchase any materials or equipment prior to receipt of approved shop drawings.
- B. Prior to assembling or installing the work, prepare and submit shop drawings for the following items of equipment:
 - 1. Circuit breakers
 - 2. Electrical distribution system
 - 3. Fire Alarm System

- C. All submittals shall include adequate descriptive literature, catalog cuts, shop drawings and other data necessary for the Engineer to ascertain that the proposed equipment and materials comply with specification requirements.
- D. Shop drawing sets shall be suitably bound and indexed. Loose sheets are not acceptable.
- E. Catalog cuts submitted for approval shall be legible and shall clearly identify equipment being submitted. Items of the submittal **that have been "faxed" are not** acceptable.
- F. Before preparing drawings, Contractor shall consult all contract drawings and specifications in detail, obtain manufacturer's recommended installation instructions, and have shop drawings prepared based on specific equipment and material intended for installation. A principal of the contracting firm shall sign all shop drawings (indicating conformance with plans and specifications) before submission
- G. Approval on shop drawings or schedules shall not relieve the Contractor from responsibility for deviations from drawings or specifications, unless he has in writing (and in letter form) called attention to such deviations at the time of submission and secured written approval; nor shall it relieve him from responsibility for errors in shop drawings or schedules.
- H. Submittals for individual systems and equipment assemblies which consist of more than one item or component shall be made for the system or assembly as a whole. Partial submittals will not be considered for approval.

1.4 AS-BUILT DRAWINGS:

- A. The Contractor shall keep a record set of drawings on the job and, as construction progresses, shall show the actual installed location of all items, material, and equipment on these job drawings.
- B. At the time of final inspection, and electronic (PDF) corrected set of drawings shall be delivered to the Engineer. All drawings costs to be by the Contractor.

1.5 OWNER'S MANUAL:

- A. The Contractor shall submit to the Engineer six identical manuals that contain manufacturer's brochures of all items installed by the Electrical Contractor.
- B. The cover of the manual shall state the following information:
 - 1. Project Name
 - 2. Location
 - 3. Owner
 - 4. Electrical Engineer
 - 5. Electrical Contractor (name, address, phone number)
 - 6. General Contractor

7. Project Supervisors (general and electrical)
8. Date Of Project Completion

1.6 OPERATING AND MAINTENANCE INSTRUCTIONS:

- A. After all final tests and adjustments have been completed, a competent employee of the Contractor shall be provided to instruct the Owner's Representative in all details of operation and maintenance for equipment installed. Supply qualified personnel to operate equipment for sufficient length of time to assure that Owner's Representative is qualified to take over operation and maintenance procedures. Instruction periods shall be as designated by the Owner and shall not necessarily be consecutive.

1.7 MAINTENANCE MATERIALS:

- A. All special tools for proper operation and maintenance of the equipment provided under this Specification shall be delivered to the Owner's Representative and a receipt requested for same.
- B. Where specified, provide Owner's Representative with spare parts, equipment and materials and request a receipt for same.

PART 2 - PRODUCTS

2.1 EQUIPMENT IDENTIFICATION:

- A. In addition to the requirements of the National Electrical Code, install an identification sign which will clearly indicate information required for use and maintenance of items such as panelboards, cabinets, motor controllers (starters), safety switches, separately enclosed circuit breakers, individual breakers and controllers in switchgear and motor control assemblies, control devices and other significant equipment.
- B. Nameplates shall be laminated black phenolic resin with a white core and engraved lettering, a minimum of 1/4-inch high. Nameplates that are furnished by manufacturer, as a standard catalog item, or where other methods of identification is herein specified, are exceptions.

2.2 UNDERGROUND WARNING TAPE:

- A. Furnish and install a six (6) inch wide polyethylene tape, permanently colored yellow, for all electric underground work (outside the building) with wording indicating type of service and "caution". Install twelve (12) inches below finished grade and directly above underground equipment.

PART 3 - EXECUTION

3.1 SURFACE CONDITIONS:

- A. Inspection:
 - 1. Prior to any Work, the Contractor shall carefully inspect the installed Work of all other Trades and verify that all such Work is complete to the point where his installation may properly commence.
 - 2. Verify that all equipment may be installed in accordance with all pertinent codes and regulations, the original design, and the referenced standards.
- B. Discrepancies:
 - 1. In the event of discrepancy, immediately notify the Engineer.
 - 2. Do not proceed with installation in areas of discrepancy until such discrepancies have been fully resolved.
- C. Return to original (pre-construction) condition any paved areas, sidewalks, planting, etc., disturbed during electrical system installation.

3.2 INSTALLATION:

- A. Install all equipment in strict accordance with the manufacturer's recommendations and the shop drawings approved by the Engineer.
- B. Secure equipment using fasteners suitable for the use, materials, and loads encountered. If requested, submit evidence proving suitability. Do not attach electrical materials to roof decking, removable or knockout panels, or temporary walls and partitions, unless indicated otherwise.
- C. Coordinated electrical systems, equipment and materials complete with auxiliaries and accessories shall be installed. Remove, modify, relocate and reinstall the existing electrical equipment and materials as shown.
- D. Equipment location: Shall be as close as practicable to locations shown on drawings.
- E. Working spaces shall be not less than specified in the National Electrical Code for all voltages specified.
- F. Inaccessible Equipment:
 - 1. Where the Engineer determines that the Contractor has installed equipment not conveniently accessible for operation and maintenance, equipment shall be removed and reinstalled as directed at no additional cost to the Owner.
 - 2. "Conveniently accessible" is defined as being capable of being reached without the use of ladders, or without climbing or crawling under or over obstacles such as motors, pumps, belt guards, transformers, piping, and duct work.

G. Equipment and Materials:

1. New equipment and materials shall be installed unless otherwise specified.
2. Equipment and materials shall be designed to assure satisfactory operation and operating life for environmental conditions where being installed. NEC and other code requirements shall apply to the installation in areas requiring special protection such as explosion-proof, vapor-proof, watertight and weatherproof construction.

3.3 COORDINATION WITH OTHER TRADES:

- A. Coordinate all work of each section with work of other sections to avoid interference. Bidders are cautioned to check their equipment against space available as indicated on drawings, and shall make sure that proposed equipment can be accommodated. If interferences occur, Contractor shall bring them to the attention of Engineer, in writing, prior to signing of contract; or, Contractor shall, at his own expense, provide proper materials, equipment, and labor to correct any damage due to defects in his work caused by such interferences.

3.4 SERVICE CONTINUITY

- A. At all times during the construction of the project, electric service shall be maintained to all portions of the site except with prior written approval of interruptions. Any required interruptions of electric service due to work being performed under this contract shall be scheduled in advance after consultation with the Owner and shall generally occur between the hours of five o'clock p.m. and five o'clock a.m. The Contractor shall be responsible for any material and labor costs, including overtime pay, to meet these requirements as part of the Division 26 scope of work.
- B. At least 14 days prior to the requirement of any interruption of electrical service, the Contractor shall furnish to the Engineer for approval a written plan for the work associated with the outage including a description of the installation and removal of temporary wiring and facilities necessary to be installed.

3.5 WORK PERFORMANCE:

- A. Arrange, phase and perform work to assure electrical service for other buildings at all times. See General Methods of Procedure under Section GENERAL REQUIREMENTS.
- B. New work shall be installed and connected to existing work neatly and carefully. Disturbed or damaged work shall be replaced or repaired to its prior condition.
- C. Coordinate location of equipment and conduit with other trades to minimize interferences.
- D. Cutting of Holes:
1. Holes through concrete and masonry in new and existing structures shall be cut with a diamond core drill or concrete saw. Pneumatic hammer, impact electric, hand or manual hammer type drills shall not be allowed.

2. Holes shall be located so as not to affect structural sections such as ribs or beams.
 3. Holes shall be laid out in advance. The Engineer shall be advised prior to drilling through structural sections, for determination of proper layout.
- E. Where conduits, wireways, busduct, and other electrical raceways pass through fire partitions, fire walls or walls and floors, install a firestop that provides an effective barrier against the spread of fire, smoke and gases. Fire-stop material shall be packed tight, and completely fill clearances between raceways and openings. Installation of fire-stop material shall conform to Section 260503 Cutting, Patching and Repair, Firestopping.
 - F. Hangers and other supports shall support only electrical equipment and materials. Provide not less than a safety factor of 5, which shall conform with any specific requirements as shown on the drawings or in the specifications.
 - G. In security areas, exposed equipment and materials, including screws and other fasteners, shall be tamperproof. Cover plates shall have beveled edges.
 - H. Exposed conduit shall be painted, see Section 09900 PAINTING. Fire alarm junction boxes, pull boxes, and wireways, exposed or concealed, shall be painted red.

3.6 PROTECTION AND CLEANING OF SYSTEMS AND EQUIPMENT:

- A. Protect all materials and equipment from damage during storage at the Site and throughout the construction period. Equipment and materials shall be protected during shipment and storage against physical damage, dirt, moisture, cold and rain.
- B. Damage from rain, dirt, sun and ground water shall be prevented by storing the equipment on elevated supports and covering them on all sides with securely fastened protective rigid or flexible waterproof coverings.
- C. Conduit shall be protected by storing it on elevated supports and capping the ends with suitable closure material to prevent dirt accumulation in the piping.
- D. During construction cap the top of all conduits and raceway installed vertically.
- E. During installation, equipment, controls, controllers, circuit protective devices, etc., shall be protected against entry of foreign matter on the inside; and be vacuum cleaned both inside and outside before testing, operating and painting.
- F. Damaged equipment shall be placed in first class operating condition or be returned to source of supply for repair or replacement.
- G. Painted surfaces shall be protected with removable heavy kraft paper, sheet vinyl or equal, installed at the factory, and removed prior to final inspection.
- H. Damaged paint on equipment and materials shall be repainted with painting equipment and finished with same quality of paint and workmanship as used by manufacturer so repaired areas are not obvious.

3.7 DISPOSITION OF EXISTING MATERIAL AND EQUIPMENT:

- A. All material and equipment which is noted, specified, or required by the Owner to be salvaged and which is not scheduled to be reused or relocated shall be carefully removed and shall be delivered to the Owner and stored where directed on the site.
- B. Carefully remove and store on the site all material and equipment noted or specified to be reused or relocated. Thoroughly clean this equipment prior to installation.
- C. Remove all other materials or debris resulting from demolition operations from the site.

3.8 EXCAVATING, TRENCHING, BACKFILLING AND RESURFACING:

- A. Perform work as required, indicated, and in compliance with site work. All excavation depths indicated are below finished grade.
- B. Do not excavate below required depth except as necessary for removal of unstable soil. Unless indicated otherwise, pitch all electrical conduit runs downward away from buildings.
- C. Where backfill compaction is critical (e.g. under floor slabs, roadways, sidewalks, trenches deeper than four feet), test the degree of compaction each 75 linear feet of trench and each two feet of depth. Test as required by Division - "Sitework" and compact backfill until density is acceptable.
- D. Repair the excavated area to original pre-excavation condition. Repair and replace sidewalks, roadways, etc.

3.9 IDENTIFICATION:

- A. Upper case letters of uniform height; centered on device, coverplate, or enclosure; engraved letters filled with a contrasting color; and all characters made clearly and distinctly.
- B. Use abbreviations defined in the contract documents whenever possible. Use plan designations for labeling, unless indicated otherwise. Indicate loads served using designations from electrical schedules and designations from the trade furnishing the equipment served.
- C. Label the following with marking pen.
 - 1. Junction boxes or portions of junction boxes with 277 or 480 volt wiring; communications system pull and junction boxes; and pull, junction boxes, and raceway installed above ceilings and for future use. Label inside covers in exterior locations and outside covers in unfinished areas.
- D. Label feeder conductors and control conductors with self adhesive, numbered labeling tapes; Brady Co. or equal. Indicate feeder numbers on feeders and terminal numbers for control conductors. Label conductors at origin and destination points and at all junction boxes where two or more feeder or control circuits are present.

3.10 ACCESS TO EQUIPMENT:

- A. All equipment shall be installed in location and manner that will allow for convenient access for maintenance and inspection.

3.11 CONNECTION OF EQUIPMENT FURNISHED AND INSTALLED UNDER OTHER DIVISIONS OF THE WORK:

- A. This Contractor shall rough-in and make final electrical connection to all pieces of equipment requiring electrical connections. Such equipment being furnished and installed under other Divisions of the Work.
- B. Installations shall be functional and code complying.
- C. This Contractor shall provide whatever incidental devices are necessary for final connection, such as, but not necessarily limited to outlet boxes, receptacles, connectors, clamps and switches.

3.12 GENERAL COMPLETION AND DEMONSTRATION:

- A. Results expected:
 - 1. All systems shall be complete and operational, and all controls shall be set and calibrated.
 - 2. All testing, start-up and cleaning work shall be complete.
- B. Demonstration:
 - 1. Upon notification by the Contractors, the Engineer will visit the project for a demonstration of the building system and an inspection of the completed work.
 - 2. Items which do not comply with the Contract Documents or which function incorrectly will be listed, and the list will be submitted by the Engineer to the Contractors for repairs.
 - 3. After all corrections have been made the Contractors shall notify the Engineer who will recheck the systems for compliance of all items listed.

3.13 COORDINATION WITH COMMISSIONING AGENT:

- A. Contractor shall coordinate their work with the Owner's Commissioning Agent. Provide all necessary labor, materials, test equipment, etc. Attend all meetings with the Commissioning Agent and participate in the development and implementation of the Commissioning Plan.
- B. Perform all necessary corrective work to comply with deficiencies noted by the Commissioning Agent.

3.14 CLEANING:

- A. Periodically during construction and prior to Owner acceptance of the building, Contractor shall remove from the premises and dispose of all packing material and debris.
- B. Clear away all debris and surplus material resulting from electrical work. Remove all dust and debris from interiors and exteriors of electrical equipment. Clean accessible current carrying elements prior to being energized.

END OF SECTION

SECTION 26 0502 - ELECTRICAL DEMOLITION

PART 1 - GENERAL

1.1 SCOPE:

- A. This section describes the electrical demolition work to be done to existing facilities.
- B. The term demolition, as used in this specification, shall mean any and all removal of electrical equipment as shown on the demolition plans or as described herein.

1.2 RELATED WORK/SECTIONS:

- A. In addition to this section, refer to other specification sections and drawings to ascertain the extent of work included. This shall include, but not be limited to, the following:
 - 1. Division 1.
 - 2. All other Division 26000 sections.

1.3 WORK INCLUDED:

- A. The work under this section consists of furnishing equipment, performing labor and services necessary for the demolition and removal of the electrical system shown on the drawings and hereinafter noted.

1.4 AS-BUILT DRAWINGS:

- A. Where existing raceways and outlet boxes are used in the renovation work, they shall be shown on the "As-Built Drawings".

1.5 SALVAGED MATERIALS:

- A. The Owner shall have priority for the selection of salvaged material and equipment. Any equipment and material selected to remain the property of the Owner shall be removed and delivered to a location on the site as designated by the Owner. Material and equipment not retained by the Owner shall become the property of the Contractor and shall be removed from the site by him.

PART 2 - PRODUCTS

NOT APPLICABLE

PART 3 - EXECUTION

3.1 EXAMINATION:

- A. Verify field measurements and circuiting arrangements prior to commencement of work.
- B. Verify that abandoned wiring and equipment serve only abandoned facilities.

- C. Demolition drawings are based on casual field observation and existing record documents. Report discrepancies to Architect/Engineer before disturbing existing installation.

3.2 PREPARATION:

- A. Disconnect electrical systems in walls, floors, and ceilings scheduled for removal.
- B. Coordinate electrical service outages with Owner.
- C. Provide temporary wiring and connections to maintain existing systems in service during construction. When work must be performed on energized equipment or circuits, use personnel experienced in such operations.
- D. Reconnect existing circuits and services interrupted by demolition.

3.3 DEMOLITION AND EXTENSION OF EXISTING ELECTRICAL WORK:

- A. Remove abandoned wiring to source of supply.
- B. Remove exposed abandoned conduit, including abandoned conduit above accessible ceiling finishes. Cut conduit flush with walls and floors, and patch surfaces and fire stop opening.
- C. Disconnect abandoned outlets and remove devices. Remove abandoned outlets if conduit servicing them is abandoned and removed. Provide blank cover for abandoned backboxes which are not removed.
- D. Replace/rework/extend existing Fire Alarm circuits as required to accommodate the new devices shown on the drawing. Schedule disruptions to the existing Fire Alarm system with the Owner in advance of disruptions.
- E. Disconnect and remove electrical devices and equipment serving utilization equipment that has been removed.
- F. Repair adjacent construction and finishes damaged during demolition and extension work.

END OF SECTION

SECTION 26 0503 - CUTTING, PATCHING, REPAIR, AND FIRESTOPPING

PART 1 - GENERAL REQUIREMENTS

1.1 SCOPE OF WORK:

- A. Cutting: Furnish all labor, materials, tools and equipment and perform all operations in connection with the cutting of new and existing building structure, finishes and building assemblies as specified hereinafter.
- B. Patching: Furnish all labor, materials, tools and equipment and perform all operations in connection with the installation of watertight sealant as required to seal voids or gaps around Division 26 equipment at penetrations through exterior floors, walls, and roof systems.
- C. Repair: Furnish all labor, materials, tools and equipment required to repair all existing or new building components and finishes, outside components, landscaping, utilities, or other appurtenances that are damaged as a result of the performance of this contract.
- D. Firestopping: Furnish all labor, materials, tools and equipment and perform all operations in connection with the installation of firestopping systems required to seal off all voids or gaps at interfaces of Division 26 equipment, wires, cables, sleeves, raceways and other penetrations at fire rated walls, roofs, floors, floor-ceilings, roof-ceilings and similar assemblies.
- E. All existing branch circuits and fire alarm wiring, etc. shall be reconnected to new or existing systems as required to maintain the same functions as existed prior to new work.

1.2 RELATED WORK/SECTIONS:

- A. In addition to this section, the Contractor shall refer to other specification sections and drawings to ascertain the extent of work included. This shall include but not be limited to, the following:
 - 1. Division 1
 - 2. All other Division 26 sections

1.3 QUALITY ASSURANCE:

- A. **All firestopping work shall be performed by an installer specializing in firestopping work and certified by the material manufacturer.**
- B. All fill, void, and cavity firestopping materials shall be UL classified and FM approved as a through-penetration Firestop System for 1 hour, 2 hour, or 3 hour construction.
- C. Sealants shall equal or exceed all requirements of ASTM E-814.
- D. All applicable codes as stated elsewhere in these specifications for the type of work performed.

- E. No penetrations through any fire rated walls, floors, roofs, floor-ceilings, or ceiling-roof assemblies will be allowed unless they are sealed with firestop systems which are included in assemblies tested in accordance with ASTM E119 and ASTM E814 and are Factory Mutual approved for the assembly.
- F. All firestop systems shall have an F rating equal to or greater than the assembly in which the penetration occurs.
- G. All firestop systems used to seal floor penetrations which are outside of a shaft enclosure shall have a T rating equal to or greater than one-half of the fire rating of the floor being penetrated.

1.4 SUBMITTALS:

- A. Submit catalog cuts, descriptive literature and manufacturers fire stop penetration details for approval in accordance with Section 26 0500, ELECTRICAL GENERAL REQUIREMENTS.
 - 1. Fire stop penetration details must be specific for all required applications. Details submitted that do not apply to the required applications will be rejected.
- B. Submit manufacturer's details of all fire stop systems to be used to demonstrate compliance with U.L fire stop system assembly specifications.
- C. The specific item proposed and its area of application shall be marked on the catalog cuts.

PART 2 - PRODUCTS

2.1 FIRESTOPPING:

- A. Firestopping material shall maintain its dimension and integrity while preventing the passage of flame, smoke and gases under conditions of installation and use when exposed to the ASTM E119 time-temperature rating of the assembly penetrated. Cotton waste shall not ignite when placed in contact with the non-fire side during the test. Firestopping material shall be noncombustible as defined by ASTM E136; and in addition for insulation materials, melt point shall be a minimum of 1700 degrees F or one (1) hour protection and 1850 degrees F for two (2) hour protection.
- B. The following firestopping sealant manufacturers are acceptable:
 - 1. Nelson
 - 2. Thomas & Betts
 - 3. 3M
 - 4. Hilti
- C. Materials shall be new, unused, (not more than one year old) properly stored and matching existing in colors, texture, finish, appearance and function.

- D. The firestopping compound shall be dry to the touch within 2 hours after installation but shall not set up immediately so as to allow easy working of the compound during installation.
- E. Fire-stopping compounds shall have a minimum shelf life of 1 year and shall be delivered to the job site and used at least 3 months prior to the expiration of its shelf life.

2.2 WATERPROOFING:

- A. Sealant materials shall be as follows:
 - 1. Penetrations in Fire Rated assemblies shall meet the requirements of 2.1 FIRESTOPPING specified hereinbefore.
 - 2. Exterior joint sealant shall be Polyurethane base, multi-component; self-leveling type for application in vertical joints; capable of withstanding
 - 3. Movement of up to 50% of joint width and satisfactorily handled throughout temperature of 4 to 27 degrees C.; uniform, homogeneous, and free from lumps, skins and coarse particles when mixed; Shore "A" hardness of minimum 15 and maximum 50; non-staining; non-bleeding; colors selected by Architect/Engineer.
- B. The following waterproofing sealant manufacturers are acceptable:
 - 1. TREMCO
 - 2. Sonneborn - Contech
 - 3. W. R. Meadows
 - 4. Hilti

PART 3 - EXECUTION

3.1 GENERAL:

- A. Patch and repair all building finishes, structural components, or other appurtenances that are damaged as a result of the performance of this contract. Patch and repair work shall include finishes, components, substructure and materials required for the installation of such work in accordance with standard practices.
- B. Replace all building components, outside components, shrubbery, or other appurtenances which are damaged beyond repair. Replacement item(s) shall be of equal or higher quality than the original item(s).
- C. All penetrations thru exterior floors, walls, and roof systems shall be sealed watertight.
- D. All roof penetrations shall be patched in accordance with roofing manufacturers' recommendations.
- E. Patched and repaired work shall be finished to match existing or adjacent construction and conditions.

3.2 INSTALLATION OF SEALANT MATERIALS:

- A. Install materials in accordance with manufacturer's recommendations for installation of these materials.
- B. Clean and prepare joints for sealant application in accordance with manufacturer's recommendations. Ensure that joint forming materials are compatible with sealant. Use joint filler to achieve required joint depths. Apply primers as recommended by sealant manufacturer.
- C. Openings larger than required for proper installation of electrical raceways or conduits shall be patched or repaired.

3.3 INSTALLATION OF FIRESTOPPING:

- A. Firestop material shall be packed tight and completely fill annular clearances around all Division 26 & Division 28 equipment, wires, cables, sleeves, raceways and other penetrations at fire rated walls, roofs, floors, floor-ceilings, roof-ceilings, and similar assemblies.
- B. During construction, field verify locations and ratings of all fire barriers with the Owner (obtain current life safety drawings indicating the fire resistive ratings of all walls, roofs, floors, floor-ceilings, ceiling-roofs, and similar assemblies). Concrete floors shall be considered as 2-hour fire rated. Field verification of ratings shall dictate the actual firestop systems applied.
- C. Firestop all existing openings in walls, roofs, slabs and similar assemblies remaining as a result of removing existing wires, cables, sleeves, raceways, equipment and appurtenances.
- D. Firestop all new penetrations through fire rated walls, roofs, floors, floor-ceilings, roof-ceilings and similar assemblies for wires, cables, sleeves, raceways, conduits, equipment and appurtenances.
- E. Firestopping materials shall be delivered to the job site ready to install and require no critical mixing procedures or precise installation time constraints.
- F. Materials shall be delivered to each site in sealed containers, fully identified with manufacturer's name, brand, type, grade and U.L. and FM labels. Store materials in a dry space under cover and off the ground.
- G. Firestopping, patching, and sealant material, once installed, shall not shrink after curing so as to allow voids or through openings to form.
- H. Firestopping, patching, sealant material shall be sufficiently flexible and pliable after curing so as to allow for normal expansion and contraction of the building assemblies and the penetrating objects without cracking, becoming displaced or allowing voids or through openings to occur.
- I. The thickness of all finished firestopping material shall meet the minimum specified for the hourly fire resistance rating of the wall, floor, floor-ceiling or ceiling-roof assembly being firestopped. Verify in field.

- J. Seal openings with firestop sealant as recommended by manufacturer.
- K. The thickness of the finished firestopping material shall meet the minimum specified for the hourly fire resistance rating of the assembly being firestopped.
- L. Protect other surfaces and equipment from being damaged by the application or overspray of firestopping compound. Remove excess and spillage promptly.
- M. Clean up of the firestopping compound shall be performed without the use of flammable or corrosive solvents.

3.4 LABELING OF FIRESTOPPING:

- A. Provide stick-on labels at each fire-stopped penetration from the manufacturer (required only on one side of fire barrier).
- B. Labels shall provide the following minimum information:
 - 1. Manufacturer.
 - 2. Firestopping material used (model number).
 - 3. U.L. detail number.
 - 4. Installer.
 - 5. Date of installation.

END OF SECTION 26 0503

SECTION 26 0519 - WIRE AND CABLE - BUILDING WIRE (600 VOLTS AND BELOW)

PART 1 - GENERAL

1.1 SCOPE:

- A. This section includes the furnishing, installation, and connection of the building wire for power and lighting circuits.
- B. Unless otherwise specified in other sections of these specifications, control wiring shall be provided, installed, and connected to perform the functions specified in other sections of these specifications.
- C. Unless otherwise specified in other sections of these specifications, communication and signal wiring shall be provided, installed, and connected to perform the function specified in other sections of these specifications.

1.2 RELATED WORK/SECTIONS:

- A. In addition to this section, the Contractor shall refer to other specification sections and drawings to ascertain the extent of work included. This shall include, but not be limited to, the following:
 - 1. Division 1
 - 2. All other Division 26000 sections

1.3 WORK INCLUDED:

- A. The work under this section consists of furnishing materials and equipment, performing labor and services necessary for the installation of the electrical cable and wiring system shown on the drawings and hereinafter specified.

1.4 APPLICABLE PUBLICATIONS:

- A. The following specifications and standards, except as hereinafter modified, are incorporated herein by reference and form a part of this specification to the extent indicated by the references thereto. Except where a specific date is given, the issue in effect (including amendments, addenda, revisions, supplements, and errata) on the date of Invitation for Bids shall be applicable. In text such specifications and standards are referred to by basic designation only.
 - 1. National Fire Protection Association (NFPA) Publications
No. 70National Electrical Code (NEC)
 - 2. Underwriters' Laboratories, Inc. (UL) Publications:
No. 44Rubber-Insulated Wire and Cables

No. 83 Thermoplastic-Insulated Wires

No 493 Thermoplastic-Insulated Underground Feeder and Branch Circuit Cables

No. 486. Wire Connectors and Soldering Lugs

PART 2 - PRODUCTS

2.1 MATERIALS:

A. Building Wire (Power and Lighting):

1. Cable and wire shall be in accordance with UL, NEC, as shown on the drawings, and as hereinafter specified.

2. Conductors:

a. Shall be annealed copper.

b. Shall be stranded for sizes No. 8 and larger. Sizes No. 10, and smaller shall be solid.

c. Size shall be not less than shown on the drawings. Minimum size shall be No. 12 AWG.

3. Insulation: Unless otherwise shown on the drawings, insulation shall be as follows:

a. THWN - Dry Locations.

b. THHN - Dry, Damp Locations.

c. XHHW - Dry, Damp, Wet Locations.

4. Color Code:

a. All secondary service, feeder, and branch circuit conductors shall be color coded as follows:

<u>208/120 Volt</u>	<u>Phase</u>	<u>480/277 Volt</u>
Black	A	Brown
Red	B	Orange
Blue	C	Yellow
White	Neutral	Gray

- b. All No. 12 and No. 10 branch circuit conductors shall have solid color compound or solid color coating.
 - c. No. 8 AWG and larger phase conductors shall have either:
 - 1) Solid color compound or solid color coating.
 - 2) Stripes, bands, or hash marks of colors specified above.
 - 3) Colored pressure-sensitive plastic tape. Tape shall be applied in half overlapping turns for a minimum of three inches for all terminal points, and in all junction boxes, pull boxes, troughs, manholes, and handholes. Tape shall be 3/4-inch wide with colors as specified above. The last two laps of tape shall be applied with no tension to prevent possible unwinding. Where cable markings are covered by tape, apply tags to cable stating size and insulation type.
 - d. The neutral conductor shall have a colored strip matching the phase conductor color it is paired with where dedicated neutral conductors for single phase circuits are shown.
 - e. For modifications and additions to existing wiring systems, color coding shall conform to the existing wiring system.
- B. Splices and Joints:
- 1. Shall be in accordance with UL and NEC.
 - 2. Branch circuits (No. 10 AWG and smaller):
 - a. Connectors shall be solderless, screw-on, pressure cable type, 600 volt, 105 degree C, with integral insulation. They shall be approved for copper conductors, and shall be reusable.
 - b. The integral insulator shall have a skirt to completely cover the stripped wires.
 - c. The number, size, and combination of conductors as listed on the manufacturers packaging shall be strictly complied with.
 - 3. Feeder Circuits:
 - a. Connectors shall be indent, hex screw, or bolt clamp-type. Material shall be high conductivity and corrosion-resistant.
 - b. Connectors for cable sizes 250 MCM and larger shall have not less than two compression indents.
 - c. Splices and joints shall be insulated with materials approved for the particular use, location, voltage, and temperature. Insulation shall be not less than that of the conductors being joined.

- d. Plastic electrical insulating tape:
 - 1) Tape shall be flame retardant, cold and weather resistant.
- C. Fire Alarm Wiring: See Specification Section 28 3111
- D. Wire Lubricating Compound shall be suitable for the wire insulation and conduit it is used with, and shall not harden or become adhesive.

PART 3 - EXECUTION

3.1 INSTALLATION:

- A. Installation shall be in accordance with the NEC, as shown on the drawings, and as hereinafter specified.
- B. All wiring shall be installed in raceway systems, except where direct burial is shown on the drawings.
- C. Cables and wires shall be spliced only in outlet boxes, junction boxes, pull boxes, manholes, or handholes.
- D. Cable supports shall be installed for all vertical feeders in accordance with the NEC. They shall be of the split wedge type which firmly clamps each individual cable and tightens due to cable weight.
- E. For panelboards, cabinets, wireways, switches, and equipment assemblies, neatly form, train, and tie the cables in individual circuits.
- F. Cable and wire entering a building from underground shall be sealed between the wire and conduit, where the cable exits the conduit, with a nonhardening approved compound.
- G. Wire Pulling:
 - 1. Suitable installation equipment shall be provided to prevent cutting or abrasion of conduits during pulling of feeders.
 - 2. Ropes used for pulling feeders shall be made of suitable nonmetallic material.
 - 3. Pulling lines for feeders shall be attached by means of either woven basket grips or pulling eyes attached directly to the conductors.
 - 4. All cables to be pulled in a single conduit shall be pulled in together.

3.2 FIELD TESTING:

- A. Feeders and branch circuits shall have their insulation tested after installation and before connection to utilization devices such as fixtures, motors, or appliances.
- B. Test shall be performed by megger and conductors shall test free from short-circuits, grounds, and opens.

- C. Conductors shall be tested phase-to-phase and phase-to-ground.
- D. Record test results and include report within the OWNER'S MANUAL.

END OF SECTION

SECTION 26 0526 - GROUNDING

PART 1 - GENERAL

1.1 SCOPE OF WORK:

- A. This section includes the furnishing, installation, and connection of conduit, fittings, and boxes to form complete, coordinated, grounding systems.
- B. The term ground, as used in this specification, shall mean any or all of the grounding types specified.

1.2 RELATED WORK/SECTIONS:

- A. In addition to this section, the Contractor shall refer to other specification sections and drawings to ascertain the extent of work included. This shall include, but not be limited to, the following:
 - 1. Division 1
 - 2. All other Division 26 sections

1.3 QUALITY ASSURANCE:

- A. NEC Compliance: Comply with NEC requirements as applicable to materials and installation of electrical grounding systems, associated equipment and wiring. Provide grounding products which are UL listed and labeled.
- B. UL Compliance: Comply with applicable requirements of UL Standards Nos. 467 and 869 pertaining to electrical grounding and bonding.
- C. IEEE Compliance: Comply with applicable requirements of IEEE Standard 142 and 241 pertaining to electrical grounding.

PART 2 - PRODUCTION

2.1 GENERAL:

- A. Provide electrical grounding systems with assembly of materials, including cables/wires, connectors, terminals, solderless lugs, grounding rod/electrodes, bonding jumper braid and additional accessories needed for complete installation. Where materials or components are not indicated, provide products complying with NEC, UL, IEEE and established industry standards.

2.2 GROUNDING CONDUCTORS:

- A. Shall be UL and NEC approved types, copper, with insulation color identified green, except where otherwise shown on the drawings, or specified.
- B. Wire size shall not be less than #12 AWG and not less than required by the NEC.

PART 3 - EXECUTION

3.1 INSTALLATION OF ELECTRICAL GROUNDING:

- A. General: Install electrical grounding systems in accordance with applicable portions of NEC, with NECA's "Standard of Installation," and in accordance with recognized industry practices to ensure that products comply with requirements and serve intended functions.
- B. Coordinate with other electrical work as necessary to interface installation of electrical grounding system with other work.

3.2 FEEDERS AND BRANCH CIRCUITS:

- A. Install green insulated equipment grounding conductors with all feeders and branch circuits. Conductors shall be sized in accordance with NEC Article 250.

3.3 EQUIPMENT GROUNDS:

- A. All equipment that has electrical connections (lights, receptacles, panels, and utilization equipment) shall have a ground wire connected that is directly tied to the ground bus of the panel which serves it.
- B. Fixed electrical appliances and equipment shall have a ground lug installed and provided by this contractor for termination of the green ground conductor.

END OF SECTION 26 0526

SECTION 26 0533 - METALLIC CONDUITS/RACEWAYS AND FITTINGS

PART 1 - GENERAL

1.1 SCOPE:

- A. This section includes the furnishing, installation, and connection of conduit, fittings, and boxes to form complete, coordinated, grounded raceway systems.
- B. Types of raceways in this section include the following:
 - 1. Galvanized rigid metal conduit (GRC).
 - 2. Intermediate metal conduit (IMC).
 - 3. Electrical metallic tubing (EMT).
 - 4. Flexible metal conduit.
 - 5. Liquidtight flexible metal conduit.
- C. The term conduit, as used in this specification, shall mean any or all of the raceway types specified.

1.2 RELATED WORK/SECTIONS:

- A. In addition to this section, the Contractor shall refer to other specification sections and drawings to ascertain the extent of work included. This shall include, but not be limited to, the following:
 - 1. Division 1.
 - 2. All other Division 26000 sections.

1.3 QUALITY ASSURANCE:

- A. NEMA Compliance: Comply with applicable requirements of NEMA standards pertaining to raceways.
- B. UL Compliance and Labeling: Comply with provisions of UL safety standards pertaining to raceways systems; and, provide products and components which have been UL listed and labeled.
- C. NEC Compliance: Comply with requirements as applicable to construction and installation of raceway systems.

PART 2 - PRODUCTS

2.1 RIGID STEEL CONDUIT (GRC):

- A. Metal rigid steel conduit shall conform to ANSI C80.1 and Underwriter's Laboratories UL-6 specification, ANSI C80.1.
- B. Conduit shall be hot-dipped galvanized to provide a corrosion resistant coating.
- C. Fittings: Fittings shall be ANSI/NEMA FB 1 threaded type, hot dipped or electronic plated. Threaded conduit to be secured to boxes, cabinets, etc., by means of galvanized threaded bushings on the inside and bond-type locknuts on the inside and outside of such boxes and cabinets. Fittings shall be watertight and the same material as conduit installed with factory manufactured elbows.

2.2 RIGID INTERMEDIATE STEEL CONDUIT (IMC):

- A. Intermediate Metallic Conduit shall conform to ANSI C80.1 and proposed Underwriter's Laboratories UL 1242 specification.
- B. Conduit shall be hot-dipped galvanized to provide a corrosion resistant coating. Intermediate Metallic Conduit (IMC) shall have galvanized/metallized thread protection, and pipe interior shall be protected by corrosion inhibiting coating.
- C. Fittings: Shall be similar to GRC.
- D. Maximum allowable size shall be (4) inches.

2.3 ELECTRICAL METALLIC TUBING (EMT):

- A. Electrical metallic tubing shall conform to ANSI C80.3 and Underwriter's Laboratories UL 797.
- B. EMT shall be hot-dipped galvanized steel with internal coating of silicone epoxy lubricant to assist in wire pulling.
- C. Fittings: Shall be compression type, steel or malleable iron. Set screw or indentation type of fittings are not acceptable.

2.4 FLEXIBLE METAL CONDUIT:

- A. Flexible metal conduit shall conform to UL 1.
- B. Flexible conduit to be of hot-dipped galvanized interlocked spirally wound steel strip.
- C. Fittings shall be multiple point type, threading into the internal wall of the conduit convolutions, and shall have insulated throat. Connectors to be galvanized and be suitable for connection to associated boxes and conduits.

2.5 LIQUID TIGHT FLEXIBLE METAL CONDUIT:

- A. Liquid-tight flexible metal conduit shall conform to UL 360.

- B. Liquid-tight flexible metal conduit shall consist of flexible galvanized steel tubing over which is extruded a liquid-tight jacket of polyvinyl chloride (PVC). Conduit shall be provided with a continuous copper bonding conductor wound spirally between the convolutions.
- C. Fittings used shall be reusable type of malleable iron/steel construction, electro zinc plated inside and outside, furnished with nylon insulated throat and taper threaded hub. Connectors to be galvanized and be suitable for connection to associated boxes and conduits.

2.6 EXPANSION AND DEFLECTION COUPLINGS:

- A. UL 467 and UL 514 shall apply.
- B. Shall accommodate, 1.9 cm (0.75 inch) deflection, expansion, or contraction in any direction, and shall allow 30 degree angular deflections.
- C. Shall include internal flexible metal braid sized to guarantee conduit ground continuity and fault currents in accordance with UL 467, and the NEC code tables for ground conductors.
- D. Shall be watertight, seismically qualified, corrosion-resistant, threaded for and compatible with rigid or intermediate metal conduit.
- E. Jacket shall be flexible, corrosion-resistant, watertight, moisture and heat resistant molded rubber material with stainless steel jacket clamps.

2.7 CONDUIT SUPPORTS:

- A. All parts and hardware shall be zinc-coated or have equivalent corrosion protection.
- B. Pipe straps: Fed. Spec. FF-S-760, type 1, style A or B.
- C. Individual conduit hangers: Shall be designed for the purpose, and have pre-assembled closure bolt and nut, and provisions for receiving hanger rod.
- D. Multiple conduit (trapeze) hangers shall be not less than 1-1/2 x 1-1/2 inch, 12 gage steel, cold formed, lipped channels. Hanger rods shall be not less than 3/8 inch diameter steel.
- E. Solid masonry and concrete anchors: Fed. Spec. FF-S-325 shall apply. Anchors shall be GROUP III self-drilling expansion shields, or machine bolt expansion anchors GROUP II type 2 or 4, or GROUP VII.

PART 3 - EXECUTION

3.1 CONDUIT INSTALLATION SCHEDULE:

- A. Power distribution feeders such as feeders for switchboards, panelboard, transformers, etc.:
 - 1. Above Grade - GRC or IMC

2. Underground - S40 (PVC) (with green insulated grounding conductor sized in accordance with NEC 250-102).
- B. Motor feeders: Same requirements as power distribution feeders.
- C. Branch circuits from panelboards (not described above):
 1. Exposed to weather - GRC or IMC
 2. Concealed dry interior location - EMT.
 3. Exposed dry interior locations - GRC IMC within 8 ft. of finished floor, EMT above 8 ft.
 4. Underground - S40 (PVC).
- D. Fire alarm system conduits: Same requirements as branch circuits.

3.2 CONDUIT INSTALLATION - GENERAL:

- A. Installation shall be in accordance with UL, NEC, as shown on the drawings, and as hereinafter specified.
- B. Contractor shall lay out and install conduit runs to avoid proximity to hot pipes. In no case will a conduit be run within three inches of such pipes, except where crossings are unavoidable and then conduit shall be kept at least one inch from the covering on pipe crossed.
- C. Conduits shall be supported as required to comply with applicable paragraphs of the NEC.
- D. Conduit installation shall be as follows:
 1. Installed as complete runs before pulling in cables or wires.
 2. Flattened, dented, crushed or deformed conduit is not permitted and shall be removed and replaced at no cost to the Owner.
 3. Installed so they will not obstruct head room, walkways, doorways or work by other trades.
 4. Cut square with a hacksaw, reamed, burrs removed, and drawn up tight.
 5. Mechanically and electrically continuous.
 6. Supported within one foot of all changes of direction, and within one foot of each enclosure to which connected.
 7. Ends of empty conduit to be closed with plugs or caps at rough-in stage to prevent entry of debris until wires are pulled in.

8. Conduits shall be secured to cabinets, junction boxes, pull boxes, and outlet boxes by bonding type locknuts.
 9. Underground conduit runs shall be installed a minimum of 24" below finished grade (lower as required to avoid conflicts with encroaching underground utilities).
- E. Conduit Bends:
1. Shall be made with standard conduit bending machines.
 2. Conduit hickey may be used for slight offsets, and for straightening stubbed out conduits.
 3. Conduits shall not be bent with a pipe tee or vice.
- F. Conduit shall be securely fastened in place at intervals as specified by the code using suitable straps, hangers and other supporting assemblies. All strap hangers and supporting assemblies:
1. Shall be of rugged construction capable of supporting weight with a reasonable factor of safety.
 2. Shall be adequately protected against corrosion.
- G. In wet locations or in locations where corrosive conditions are present, vertical and horizontal runs of conduit shall be firmly supported so that there is at least 1/4" air space between the conduit and the wall or supporting surface. Spacers and supporting straps shall be of malleable iron construction, hot dipped galvanized.
- H. EMT shall be securely fastened in place at intervals as specified by the code using straps, hangers and other supporting assemblies.
1. Spacers and supporting straps shall be of rugged malleable iron or steel construction hot dipped galvanized.
- I. Flexible conduit when installed shall have sufficient slack to avoid sharp flexing and straining due to vibration and thermal expansion/construction. Conduit shall be installed in such a manner that liquids will tend to run off the surface instead of draining towards the fittings.
- J. Concealed work installation:
1. In concrete:
 - a. Conduit shall be run in direct lines.
 - b. Conduit shall not be installed through concrete beams, except where shown on the structural drawings or as approved by the Engineer prior to construction, and after submittal of drawing showing locations size, and position of each penetration.

- c. Conduit shall not be installed in concrete which is less than three inches thick.
 - d. Conduit outside diameter larger than 1/3 of the concrete thickness is not permitted.
 - e. Spacing between conduits in slab shall be approximately six conduit diameters apart except one conduit diameter at conduit crossings.
 - f. Conduits shall be installed approximately at the center of the slab.
 - g. Couplings and connections shall be water tight. Thread compounds shall be UL approved conductive type to ensure low resistance ground continuity through the conduits.
2. Conduit shall be run parallel or perpendicular to the building lines.
 3. Branch circuit conduits shall not be supported by the suspended ceiling, lighting fixtures, or air conditioning ducts.
 4. Conduit shall be run parallel or perpendicular to the building lines.
 5. Horizontal runs shall be installed close to the ceiling or beams and secured with approved conduit straps.
 6. Horizontal or vertical runs shall be supported at not over eight foot intervals.

3.3 UNDERGROUND INSTALLATION:

- A. Tops of conduits shall be:
 1. Not less than 24 inches and not less than shown on the drawings below finished grade.
 2. Not less than 30 inches and not less than shown on the drawings below road and other paved surfaces.
 3. Shall not be installed above power company direct burial primary feeder.
- B. Work with extreme care near existing ducts, conduits, cables, and other utilities to avoid damaging them.
- C. For excavation and back-filling, see Section 260501 ELECTRICAL COORDINATION.
- D. Seal conduits, including spare conduits, at building entrances and at outdoor terminations for equipment with a suitable compound to prevent the entrance of moisture and gases.

3.4 MOTORS AND VIBRATING EQUIPMENT:

- A. Flexible metal conduit shall be used for connections to motors and other electrical equipment subject to movement, vibration, misalignment, cramped quarters, or noise transmission. Flexible metal conduit shall be liquid-tight when installed in exterior

locations, moisture or humidity laden atmosphere, corrosive atmosphere, water or spray wash-down operations, and locations subject to seepage or dripping of oil, grease or water. Flexible metal conduit shall be installed with green ground wire.

3.5 EXPANSION JOINTS:

- A. Conduits 3 inches and larger, rigidly secured to building construction on opposite sides of a building expansion joint, shall be provided with expansion and deflection couplings. The couplings shall be installed in accordance with the manufacturer's recommendations.
- B. Conduits smaller than 3 inches shall be provided with junction boxes on both sides of the expansion joint, and connected by 15 inches of slack flexible conduit. Flexible conduit shall have a copper green ground bonding jumper installed. In lieu of this flexible conduit, expansion and deflection couplings as specified above may be installed.
- C. Expansion and deflection couplings shall also be installed where shown on the drawings.

3.6 CONDUIT SUPPORTS, INSTALLATION:

- A. Safe working load shall not exceed 1/4 of proof test load of fastening devices.
- B. Pipe straps or individual conduit hangers shall be used for supporting individual conduits.
- C. Multiple conduit runs shall be supported by trapeze hangers. Trapeze hangers shall be designed to support a load equal to or greater than the sum of the weights of the conduits, wires, hanger itself, and 200 pounds. Each conduit shall be attached by U-bolt or other approved fastener.
- D. Conduit shall be supported independently of junction boxes, pull boxes, fixtures, suspended ceiling T-bars, angle supports, etc.
- E. Solid Masonry and Concrete: Fasteners shall be as follows:
 - 1. New construction: Generally, steel or malleable iron concrete inserts in concrete prior to pouring.
 - 2. Existing construction:
 - a. Steel expansion anchors not less than 1/4-inch bolt size and not less than 1-1/8 inch embedment.
 - b. Power set fasteners shall be approved, and not less than 1/4-inch diameter with depth of penetration not less than three inches.
 - c. Anchors or fasteners attached to concrete ceilings shall be vibration and shock resistant.
- F. Hollow masonry. Toggle bolts are permitted. Bolts supported only by plaster are not acceptable.
- G. Metal structures. Fasteners shall be machine screw or devices specifically designed and approved for the application.

- H. Attachments by wood plugs, rawl plug, plastic, lead or soft metal anchors, or wood blocking is not permitted.
- I. Chain, wire, or perforated strap shall not be used to support or fasten conduit.
- J. Vertical supports. Vertical conduit runs shall have riser clamps and supports in accordance with the NEC and as shown on the drawings. Supports for cable and wire shall have fittings which include internal wedges and retaining collars.

3.7 FIRE ALARM SYSTEM CONDUIT:

- A. All wiring shall be installed in conduit.
- B. Size all conduit as required per NEC and manufacturers' recommendations for number of wires or cables but minimum size shall be 3/4".
- C. Install junction boxes and pull boxes as required for each system.
- D. Conduit bends shall be long radius.

3.8 PULL WIRES:

- A. Install a nylon pull string in Fire Alarm conduits.

3.9 PAINTING:

- A. Exposed non-fire alarm conduit shall be primed and painted to match existing room finishes (obtain paint chips from the Owner).
- B. Fire Alarm conduit and box covers shall be painted red.

END OF SECTION 26 0533

SECTION 26 0534 - RIGID NON-METALLIC (PVC) CONDUITS/RACEWAYS AND FITTINGS

PART 1 - GENERAL

1.1 SCOPE OF WORK:

- A. This section includes the furnishing, installation, and connection of rigid plastic (PVC) conduit, fittings, and boxes to form complete and coordinated raceway systems.
- B. The term conduit, as used in this specification, shall mean any or all of the raceway types specified.

1.2 RELATED WORK/SECTIONS:

- A. In addition to this section, the Contractor shall refer to other specification sections and drawings to ascertain the extent of work included. This shall include, but not be limited to, the following:
 - 1. Division
 - 2. All other Division 26000 sections
- B. See section on Substitutions.

1.3 SUBMITTALS:

- A. Provide cut sheets and descriptive literature for coatings utilized to protect metallic conduits specified for extension of PVC conduits within this section.

PART 2 - PRODUCTS

2.1 RIGID PVC FOR BELOW GRADE INSTALLATION:

- A. Conduit shall be UL rated 90°C and to UL-651. Fittings shall conform to UL-514.
- B. Conduit shall be S40 wall thickness made from polyvinyl chloride (recognized by UL) compound which includes inert modifier to improve weatherability and heat distortion. Conduit and couplings shall be homogenous plastic material free from visible cracks, holes, or foreign inclusions. Conduit bore shall be smooth and free from blisters, nicks, or other imperfections which could mar conductors or cables.
- C. **Bends: 90° bends shall be made with galvanized rigid steel PVC coated (externally) elbows. Bends other than 90° shall be made from S80 PVC conduit.**

PART 3 - EXECUTION

3.1 SPECIFICATION SECTION 260533 – METALLIC CONDUITS/RACEWAYS AND FITTINGS, PART 3 – EXECUTION, SHALL APPLY.

END OF SECTION 26 0534

SECTION 26 0535 - ELECTRICAL BOXES

PART 1 - GENERAL

1.1 SCOPE OF WORK:

- A. This section includes the furnishing, installation and connection of all outlet boxes, junction boxes, and floor boxes as shown on the drawings or as required to house the intended wiring, devices or equipment.
- B. Types of electrical boxes and fittings specified in this section include the following:
 - 1. Outlet boxes
 - 2. Junction boxes
 - 3. Pull boxes
 - 4. Floor boxes
 - 5. Bushings
 - 6. Locknuts
 - 7. Knockout closures

1.2 RELATED WORK/SECTIONS:

- A. In addition to this section, the Contractor shall refer to other specification sections and drawings to ascertain the extent of work included. This shall include, but not be limited to, the following:
 - 1. Division 1
 - 2. All other Division 26000 sections
- B. Other systems specified in Division 26000 may call for special boxes not covered in section 26 0535.

1.3 QUALITY ASSURANCE:

- A. NEC Compliance: Comply with NEC as applicable to construction and installation of electrical wiring boxes and fittings.
- B. UL Compliance: Comply with applicable requirements of UL 50, UL 514-Series, and UL 886 pertaining to electrical boxes and fittings. Provide electrical boxes and fittings which are UL listed and labeled.
- C. NEMA Compliance: Comply with applicable requirements of NEMA Stds./Pub No.'s OS1, OS2, and Pub 250 pertaining to outlet and device boxes, covers, and box supports.

PART 2 - PRODUCTS

2.1 FABRICATED MATERIALS:

- A. Outlet and Device Boxes (dry interior locations): Provide galvanized coated sheet-steel outlet wiring boxes, of shapes, cubic inch capacities, and sizes, including box depths as required by particular application, suitable for installation at respective locations. Construct outlet boxes with mounting holes, and with conduit size knockout openings in bottom and sides. Provide boxes with threaded screw holes, with corrosion-resistant cover and grounding screws for fastening surface and device type box covers, and for equipment type grounding.
- B. Outlet and Device Box Accessories: Provide outlet box accessories as required for each installation, including box supports, mounting ears and brackets, wallboard hangers, box extension rings, fixture studs and metal straps for supporting outlet boxes, which are compatible with outlet boxes being used to fulfill installation requirements for individual wiring situations.
 - 1. Plaster rings and device mounting rings shall be of proper depth such that the device mounting surface is flush with the finished wall/ceiling surface.
- C. Outlet and Device Boxes (damp and wet locations): Provide corrosion resistant cast metal raintight outlet and wiring device boxes of types, shapes and sizes required for each application, including depth of boxes, with threaded conduit holes for fastening electrical conduit, and cast metal face plates. Where weatherproof devices are indicated, provide spring hinged watertight caps suitable configured for each application, including face plate gaskets and corrosion resistant plugs and fasteners.
- D. Junction and Pull Boxes: Provide galvanized code-gage sheet steel junction and pull boxes, with screw-on covers; of types, shapes and sizes, to suite each respective location and installation; with welded seams and equipped with stainless steel nuts, bolts, screws and washers.
- E. Floor Boxes: Provide cast iron raintight adjustable floor boxes as indicated, with threaded conduit-entrance ends, and vertical adjusting rings, gaskets, brass floor plates with flush screw-on covers with ground flange and stainless steel cover screws.
- F. Bushings, Knockout Closures, and Locknuts: Provide corrosion resistant box knockout closures, conduit locknuts and malleable iron conduit bushings, offset connectors, of types and sizes, to suit respective installation requirements and applications.

PART 3 - EXECUTION

3.1 INSTALLATION OF ELECTRICAL BOXES AND FITTINGS:

- A. General: Install electrical boxes and fittings as indicated, in accordance with manufacturer's written instructions, applicable requirements of NEC and NECA's "Standard of Installation," and in accordance with recognized industry practices to fulfill project requirements.
- B. Coordinate installation of electrical boxes and fittings with wire/cable, wiring devices, and raceway installation work.

- C. Provide weathertight outlets for interior and exterior locations exposed to weather or moisture.
- D. Provide knockout closures to cap unused knockout holes where blanks have been removed.
- E. Avoid installing boxes back-to-back in walls.
- F. Position recessed outlet boxes accurately to allow for surface finish thickness. Boxes shall be installed such that the device mounting surface is flush with the wall/ceiling finished surface.
- G. Set floor boxes level and flush with finish flooring material. Provide trim flange to match finish floor material.
- H. Fasten electrical boxes firmly and rigidly to substrates, or structural surfaces to which attached, or solidly embed electrical boxes in concrete or masonry.

3.2 GROUNDING:

- A. Upon completion of installation work, properly ground electrical boxes and demonstrate compliance with requirements.

END OF SECTION 26 0535

SECTION 26 0548 - SEISMIC SUPPORT OF ELECTRICAL EQUIPMENT

PART 1 - GENERAL REQUIREMENTS

1.1 SCOPE OF WORK:

A. General:

1. Furnish all labor, materials, tools and equipment and perform all operations in connection with the installation of seismic support of electrical equipment systems and appurtenances where shown on the drawings and specified hereinafter.

1.2 RELATED WORK/SECTIONS:

- ##### A. In addition to this section, the Contractor shall refer to other specification sections and drawings to ascertain the extent of work included. This shall include, but not be limited to, the following:

1. Division 1
2. All other Division 26 sections
3. All Division 27 and 28 sections

1.3 QUALITY ASSURANCE:

A. Codes and Standards:

1. All seismic equipment and design shall comply with all local codes and ordinances and meet or exceed the standards and procedures (latest editions) of the following:

- a. IBC.

- ##### B. Seismic control equipment shall be sized and provided by manufacturer . Seismic bracing shall be a factory manufactured item listed in the manufacturers catalog for the intended use.

C. Manufacturer:

1. The seismic control supports manufacturers shall be as manufactured by one of the following or approved equal:
 - a. Mason Industries
 - b. Amber Booth
 - c. Peabody

1.4 SUBMITTALS:

- A. The manufacturer shall submit drawings including floor plans, sections and elevations showing piping, duct, and equipment. Drawings shall indicate location and type of all components provided.
- B. A schedule shall show capacity and load of each component at each location.
- C. Design shall be based upon actual installation and not contract drawing schematics.
- D. Submittals shall include:
 - 1. Sketches showing seismic loading, location of bracing and types and sizes of bracing assemblies.
 - 2. Submit seismic protection ratings in three principle axes certified by an independent laboratory.
 - 3. Submit calculations for shear, pull-up, primary overturning, and secondary overturning.
 - 4. Submit drawings indicating auxiliary supports and method of attachment.
 - 5. Calculations shall be submitted and signed by a licensed professional engineer.

PART 2 - PRODUCTS

2.1 GENERAL:

- A. All equipment and applicable conduit shall be mounted on or suspended from approved foundations and supports as specified herein and as shown on the drawings.
- B. Steel components shall be phosphated and painted. All nuts, bolts, and washers shall be zinc-electroplated.

2.2 BRACING HANGERS:

- A. Seismic bracing shall be a factory manufactured item listed in the manufacturers catalog for the intended use.
- B. Equipment sway bracing shall be provided for all items supported by off-the-floor structures or structures suspended from floors or roof above.
 - 1. Braces shall consist of angles, rods, bars, or pipes run at 45% angles from the equipment frame to the building structure secured at both ends with bolts 1/2" or larger.
 - 2. Bracing shall be provided in two planes of direction, 90 degrees apart, for each item of equipment.

2.3 ELECTRICAL EQUIPMENT:

- A. Systems include but are not limited to the following:
 - 1. Fire Alarm System Panels.
- B. Electrical conduit of any size suspended by individual hangers of less than 12 inches from top of conduit to the supporting structure do not have to be seismically braced.
- C. Roof Mounted Equipment:
 - 1. Equipment shall be direct anchored.
 - 2. Curbs and equipment supports shall be attached to roof structure.

2.4 SEISMIC ACCESSORIES:

- A. Provide all necessary brackets, bolts, fasteners, predrilled bases, oversized bases, accessory components and materials to install systems in accordance with manufacturer's requirements.

PART 3 - EXECUTION

3.1 GENERAL:

- A. If the equipment to be mounted is not furnished with integral structural frames and external mounting lugs (both of suitable strength and rigidity), approved structural subbase shall be installed in the field which shall support the equipment to be hung and to which shall be attached the hangers.

3.2 SUPERVISION:

- A. The manufacturer, or his qualified representative, shall be responsible for providing such supervision as may be necessary to assure correct installation and adjustment of the isolators. Upon completion of the installation and after the system is put into operation, the manufacturer, or his representative, shall make a final inspection and submit his report to the Engineer in writing certifying the correctness of installation and compliance with approved submittal data.

END OF SECTION 23 0548

SECTION 26 2726 - WIRING DEVICES

PART 1 - GENERAL

1.1 SCOPE:

- A. This section includes the furnishing, installation, and connection of wiring devices as shown on the plans.
- B. Types of electrical wiring devices in this section include the following:
 - 1. Receptacles
 - 2. Switches
 - 3. Faceplates
 - 4. Motor rated toggle switches

1.2 RELATED WORK/SECTIONS:

- A. In addition to this section, the Contractor shall refer to other specification sections and drawings to ascertain the extent of work included. This shall include, but not be limited to, the following:
 - 1. Division 1.
 - 2. All other Division 26000 sections.
- B. See section on Substitutions.

1.3 QUALITY ASSURANCE:

- A. NEC Compliance: Comply with NEC as applicable to installation and wiring of electrical wiring devices.

1.4 SUBMITTALS:

- A. Submit catalog cuts and descriptive literature for approval in accordance with Section 26 0500, ELECTRICAL GENERAL REQUIREMENTS.
- B. Sufficient information, clearly presented, shall be included to determine compliance with drawings and specifications.
- C. The specific item proposed and its area of application shall be marked on the catalog cuts.

PART 2 - PRODUCTS

2.1 FABRICATED WIRING DEVICES:

- A. General: Provide factory-fabricated wiring devices, in types, colors, and electrical ratings for applications indicated and which comply with NEMA Stds. Pub. No. WD 1. Unless noted otherwise device color shall be ivory.
- B. Wiring Devices: Wiring devices shall be as listed in the following table, or approved equal:

<u>Description</u>	<u>Cooper WD</u>	<u>Hubbell</u>	<u>P & S</u>
Single Pole Toggle Switch, 20A 120/277V	2221V	HBL1221-I	PS20AC1-I
Single Pole Keyed Toggle Switch	2221L	HBL1221-L	PS20AC1-IL
Three Way Toggle Switch	2223V	HBL1223-I	PS20AC3-I
Three Way Keyed Toggle Switch	2223L	HBL1223-L	PS20AC3-IL
Four Way Toggle Switch	2224V	HBL1224-I	PS20AC4-I
Four Way Keyed Toggle Switch	2224L	HBL1224-L	PS20AC4-IL
20A 125V 2P 3W Grounded Duplex Receptacle (NEMA 5-20R)	5362V	HBL5362-I	5362-AI
20A 125V 2P 3W Grounded Duplex Receptacle (Red) (NEMA 5-20R)	5362RD	HBL5362-R	5362ARED
20A 250V 2P 3W Grounded Single Receptacle (NEMA 6-20R)	5461V	HBL5461-I	5871-I

<u>Description</u>	<u>Cooper WD</u>	<u>Hubbell</u>	<u>P & S</u>
20A 125V 2P 3W 3W Grounded Duplex Isolated Ground Receptacle (Orange) (NEMA 5-20R)	IG5362RN	IG5362	5362-IG
20A 125V 2P 3W Grounded Duplex Ground Fault Interrupter (NEMA 5-20R)	GF20V	GF-5262-I	2091-I
Damp Location 20A 125V 2P 3W Grounded Duplex Ground Fault Interrupter with Weather Proof Cover (NEMA 5-20R)	GF20V- S966	GF-5262-I WP26	2091-I CA26GV
Weather Proof 20A 125V 2P 3W Grounded Duplex GFI With Weather Proof In-Use Cover (NEMA 5-20R)	GF20V- WIUHMV-1	GF-5252I- WP826	2095-SI- WIUC10CAGV
Dead Front 20A 125V GFCI Device	XDGF20V	GFR5350I	2085-I

2.2 WEATHERPROOF RECEPTACLES:

- A. Weatherproof receptacles shall be duplex GFI receptacles as specified under 26 2726 WIRING DEVICES, Part 2.1.B, mounted in cast metal outlet box fitted with specified while-in-use cover. Weatherproof receptacles shall be flush mounted in exterior walls.

2.3 DEVICE PLATES:

- A. All outlet boxes shall have a coverplate.
- B. All unused telephone outlets shall be fitted with a blank cover plate.
- C. Faceplates: Provide faceplates for single and combination wiring devices, of types, sizes, and with ganging cutouts as indicated. Select plates which mate and match wiring

devices to which attached. Metal screws shall be used for securing plates to devices; screw heads colored to match finish of plates.

- D. Faceplates shall be uniform in design and finish for switches, receptacles, and other outlets. Plates shall be one-piece of the required number of gangs; sectional plates shall not be used.
- E. Plates shall be jumbo oversize satin finished stainless steel.

PART 3 - EXECUTION

3.1 INSTALLATION OF WIRING DEVICES:

- A. Install wiring devices as indicated; in accordance with manufacturer's written instructions, applicable requirements of NEC and NECA's "Standard of Installation", and in accordance with recognized industry practices to fulfill project requirements.
- B. Coordinate with other work, including painting, electrical boxes and wiring work, as necessary to interface installation of wiring devices with other work.
- C. Install wiring devices only in electrical boxes which are clean; free from excess building materials, dirt, and debris.
- D. The devices shall be installed in such a manor as to allow the faceplates to be installed without distortion of the faceplate or gaps between the faceplate and wall.
- E. Install faceplates after painting work is completed.
- F. Unless otherwise specified, install faceplates on all device and outlet boxes including telephone outlet boxes. As a minimum, blank plates shall be included for 25% of telephone/data outlets shown on the drawings.
- G. Tighten connector and terminals, including screws and bolts, in accordance with equipment manufacturer's published torque tightening values for wiring devices. Where manufacturer's torquing requirements are not indicated, tighten connectors and terminals to comply with tightening torques specified in UL Stds. 486A. Use properly scaled torque indicating hand tool.

3.2 PROTECTION OF FACEPLATES AND RECEPTACLES:

- A. At time of Substantial Completion, replace those items which have been damaged, including those burned and scored by faulty plugs.

3.3 GROUNDING:

- A. Provide equipment grounding connections for wiring devices, unless otherwise indicated. Tighten connections to comply with tightening torques specified in UL Std. 486A to assure permanent and effective grounds.

3.4 TESTING:

- A. Prior to energizing circuitry, test wiring for electrical continuity, and for short circuits. Ensure proper polarity of connections is maintained. Subsequent to energization, test wiring devices to demonstrate compliance with requirements.

END OF SECTION 26 2726

SECTION 26 2816 - SAFETY/DISCONNECT SWITCHES

PART 1 - GENERAL

1.1 SCOPE OF WORK:

- A. This section includes the furnishing, installation, connection, and wiring of safety switches.

1.2 RELATED WORK/SECTIONS:

- A. In addition to this section, the Contractor shall refer to other specification sections and drawings to ascertain the extent of work included. This shall include, but not be limited to, the following:

- 1. Division 1
- 2. All other Division 26000 sections

- B. See section on Substitutions.

1.3 QUALITY ASSURANCE:

- A. Safety/Disconnect switches shall conform to Underwriter's Laboratories UL 98, "Enclosed and Dead-Front Switches."

1.4 SUBMITTALS:

- A. Submit catalog cuts and descriptive literature for approval in accordance with Section 260500, ELECTRICAL GENERAL REQUIREMENTS.

PART 2 - PRODUCTS

2.1 GENERAL SAFETY/DISCONNECT SWITCH FEATURES:

- A. Furnish and install safety/disconnect switches as indicated on the plans and specifications.
- B. Switches shall be NEMA type HD (Heavy Duty) and UL listed.
- C. All switches shall have switch blades which are fully visible in the "OFF" position when the switch door is open. All current carrying parts shall be plated to resist corrosion and promote cool operation. Switches shall have removable arc suppressors where necessary to permit easy access to line side lugs. Lugs shall be front removable and UL listed for 60 degrees C and 75 degrees C, aluminum or copper wires.
- D. Switches shall be quick-make, quick-break such that, during normal operation of the switch, the operation of the contacts shall not be capable of being restrained by the operating handle after the closing or opening action of the contacts has started. The operating handle shall be an integral part of the box, not the cover. Provisions for

padlocking the switch in the "OFF" position with at least three locks shall be provided. Switches shall have a dual cover interlock to prevent unauthorized opening of the switch door when the handle is in the "ON" position, and to prevent closing of the switch mechanism with the door open. The handle position shall indicate whether the switch is "ON" or "OFF".

- E. Switches shall be horsepower rated for AC and/or DC as indicated by the plans. All fusible switches rated 100 thru 600 amperes at 240 volts and 30 thru 600 amperes at 600 volts shall have a UL approved method of field conversion from standard Class H fuse spacing to Class J fuse spacing. The switch also must accept Class R fuses and have provisions for field installation of a UL listed rejection feature to reject all fuses except Class R. The UL listed short circuit rating of the switches shall be 200,000 rms symmetrical amperes when Class R or Class J fuses are used with the appropriate rejection scheme. The UL listed short circuit rating of the switch, when equipped with Class H fuses, shall be 10,000 rms symmetrical amperes. 800 and 1200 ampere switches shall have provisions for Class L fuses and shall have a UL listed short circuit rating of 200,000 rms symmetrical amperes.
- F. Disconnect switches shall be equipped with ground lug.

2.2 NEMA 1 AND 3R HEAVY DUTY SAFETY/DISCONNECT SWITCHES:

- A. Switches shall be furnished in NEMA 1 general purpose enclosures unless exposed to weather which shall be NEMA 3R. Covers on NEMA 1 enclosures shall be attached with pin type hinges. NEMA 3R covers shall be securable in the open position. NEMA 3R enclosures for switches thru 200 amperes shall have provisions for interchangeable bolt-on hubs. Hubs shall be as indicated on the plans. NEMA 3R enclosures shall be manufactured from galvanized steel. Enclosures shall have a gray baked enamel finish, electrodeposited on cleaned, phosphatized steel.
- B. Switches shall comply with paragraph 2.01 of this section.

2.3 NEMA 4X HEAVY DUTY SAFETY/DISCONNECT SWITCHES:

- A. Provide NEMA 4X disconnect switches where indicated on the drawings.

2.4 SPECIFIED MANUFACTURERS:

- A. Specified manufacturers shall be as follows, or approved equal:
 - 1. General Electric
 - 2. Square D
 - 3. Eaton

PART 3 - EXECUTION

3.1 INSTALLATION LOCATION:

- A. As a general rule, install switches on the equipment it serves, if shown that way on the drawings.

B. Do not install switch on equipment removable panel.

C. All switches shall be accessible.

3.2 GROUNDING:

A. Connect ground wires to ground lug.

B. See section "GROUNDING".

3.3 CONDUIT BUSHINGS:

A. Use plastic bushings where conduit enters switch.

END OF SECTION 26 2816

SECTION 28 3111 - FIRE ALARM SYSTEM

PART 1 - GENERAL

1.1 SCOPE:

- A. The work covered by this section of the specifications includes the furnishing of all labor, equipment, materials, and performance of all operations required to extend the existing Notifier NFS-640 Fire Alarm System serving the main school building to the renovation areas as shown on the drawings and as specified herein.
- B. The Fire Alarm System shall provide fire protection and warning to the school as presently configured.
- C. All equipment, devices and wiring required to form a complete code-compliant fire alarm system and comply with the requirements of this specification shall be included.
- D. For each new 24VDC power supply provided, provide a new dedicated 20A, 120V **circuit (not shown on drawings)** sized 2#12, #12Gnd., ¾"C. from the nearest existing 120/208V branch circuit panelboard.

1.2 RELATED WORK/SECTIONS:

- A. In addition to this section, the requirements of the conditions of the Contract, Supplementary Conditions and General Requirements, apply to the work specified in this section.
- B. The work covered by this section of the specifications is to be coordinated with the related work as specified elsewhere under the project specifications.

1.3 QUALITY ASSURANCE:

- A. The complete installation is to conform to the applicable sections of the International Building Code (IBC), NFPA-72, Local Code Requirements, and the National Electric Code, with particular attention to Article 760.
- B. UL Compliance and Labeling: Provide components which are UL listed and labeled in accordance with the following UL Standards:
 - 1. UL 268 – Standard for Smoke Detectors for Fire Alarm Signaling Systems
 - 2. UL 864 (9th edition) - Standard for Control Units and Accessories for Fire Alarm.
 - 3. UL 1481 - Standard for Power Supplies for Fire-Protective Signaling

4. UL 1971 – Standard for Signaling Devices for the Hearing Impaired
 5. UL 2572 - Standard for Control and Communication Units for Mass Notification Systems.
 6. Other UL listings: Each device, component and sub-component of the fire alarm system shall be listed for its intended function.
- C. NEMA Compliance: Comply with applicable portions of NEMA Std. Pub. SB 4 pertaining to installation of fire alarm systems.
- D. The system is not required to be U.L. certificated. However, the following items shall be included in the bid:
1. System installation, checkout/testing, and system demonstration for the Owner, Engineer, and Authority Having Jurisdiction per NFPA-72 requirements and per the Construction Drawings and Specifications.
 2. Central Station monitoring service is existing and is provided by the Owner's existing Central Station monitoring company (obtain monitoring company phone number and account numbers from the Owner).
 3. **Installation and testing of all fire alarm system devices, equipment, and wiring shall be performed by a qualified electronics contractor licensed specifically for signal systems installation and that is an authorized Notifier distributor.**
 - a. All installers shall be factory trained representatives of the equipment manufacturer and shall be licensed and authorized to install the fire alarm system wiring and equipment approved for the installation.
 - b. All installers shall have a minimum of two years of wire, equipment, and device installation experience *with the make/model of equipment being furnished.*
 - c. The installation of the system wiring, equipment, and devices shall be supervised throughout the entire duration of the project by a factory trained Technician or Engineer employed by the manufacturer's representative with a minimum of five years of experience *in the installation of the make/model of equipment being furnished.* This person shall hold a current minimum NICET III Certification.
 - d. All system programming shall be performed by a factory trained Technician employed by the manufacturer's representative with a minimum of two years of experience *in programming of the specified system.*

1.4 SUBMITTALS:

- A. Shop Drawings: As a minimum, the fire alarm and fire detection shop drawing submittal shall include the following:

1. Complete data sheets bearing the printed logo or trademark of the fire alarm control panel manufacturer for all equipment including but not limited to the following:
 - a. Control Panel modifications (FACP)
 - b. System power supplies with battery backup and charger
 - c. Standby batteries and battery charger
 - d. Each separate type of automatic smoke and heat detector to be connected to the system
 - e. Manual alarm initiating stations
 - f. Visual alarm notification appliances
 - g. Combination audible/visual notification appliances
 - h. Control and monitoring modules
 - i. Magnetic door holders
 - j. Any other items of fire alarm equipment required by the drawings and/or specifications
2. Battery manufacturer date-codes keys.
3. Evidence of listing of all proposed equipment by Underwriter's Laboratories for application as fire alarm equipment.
4. Provide complete narrative descriptions of all system operations including but not limited to alarm initiations, building alarm signals, automatic and manual controls, trouble and supervisory signals, auxiliary control module functions, silence and resetting procedures.
5. Submit a list of every system address provided for alarm initiation, status monitoring, supervised signaling, and auxiliary controls.
6. Complete calculations showing the following:
 - a. Battery calculations for all system power supplies and amplifiers.
 - b. Voltage drop (visual notification appliance circuits)
7. Written certification by the contractor that no battery, power supply or circuit on the system has an electrical load greater than 80% of its actual capacity, when all items are taken into account.
8. Provide scaled floor plans, riser diagrams, factory wiring diagrams, field wiring diagrams indicating the wiring of all devices to include raceway size and routing,

junction boxes, and conductor size, type and quantity in each raceway. Information to be included on layout plans shall include but shall not be limited to the following:

- a. Circuit tags on all circuit legs.
 - b. Labeling of all initiation devices (to include signaling circuit designation and device address).
 - c. Labeling of all notification appliances with specific device identifier label and notification circuit number.
 - d. Connections to HVAC systems.
 - e. Connections to fire protection systems.
9. Submit labeling scheme for typical alarm and supervisory points as they are to appear at the specified display points. Include all abbreviations for device types and operational areas.
 10. Provide specifications of all cable types labeled with their intended application. This cable shall have been tested and approved by the fire alarm control panel manufacturer for use with the manufacturer's equipment.
 11. Provide a table listing all duct smoke detectors, duct width, and sampling tube length for each duct detector application. Duct widths are to be derived from HVAC drawings (where applicable) and verified in the field prior to installation. The contractor is responsible for adjustments to sizes of sampling tubes as needed to adapt to duct size field changes.
 12. The Contractor shall not purchase any materials or equipment prior to receipt of approved shop drawings.

1.5 AS BUILT DRAWINGS:

- A. See Specification 26 0501 - ELECTRICAL COORDINATION.

1.6 SYSTEM SOFTWARE:

- A. Provide all fire alarm system operational software to owner that will allow the owner to operate, maintain the systems and make changes, additions and deletions to system initiation devices. Format shall be on flash drive.

1.7 SYSTEM DESCRIPTION:

- A. The major system elements include but are not limited to the following items:
 1. Control Panel modifications (FACP)

2. Manual pull stations
 3. Visual alarm notification appliances
 4. Audible/visual notification appliances
 5. Smoke detectors
 6. Duct smoke detectors
 7. Combination Smoke/Heat/Carbon Monoxide detectors
 8. Heat detectors
 9. Batteries and chargers at fire alarm control panels, and power extender panels.
- B. Audible & visual occupant notification configuration:
1. The system shall be configured to automatically activate all notification appliances throughout all areas of the facility upon activation of any manual or automatic fire alarm initiation device.
- C. The building's fire alarm system shall signal all system alarm, trouble and supervisory conditions to the remote monitoring station.
1. All fire alarm systems shall be configured to delay the signaling of building trouble conditions signaling from the moment any trouble condition is detected as noted herein.
 - a. Trouble conditions:
 - 1) With exception of primary power failure trouble conditions, only trouble conditions that are sustained for periods that exceed 30 seconds shall signal the owner's designated remote monitoring station.
 - 2) Primary power failure trouble conditions that are sustained for periods of less than 2 hours shall not signal the owner's designated remote monitoring station (to avoid nuisance signaling during short term power failures, short term brownout conditions, etc.).
 - b. All supervisory conditions detected by the fire alarm systems shall signal owner's designated remote monitoring station immediately.
 - c. All alarm conditions detected by the fire alarm systems shall signal the owner's designated remote monitoring station immediately.
- D. Power Extenders with battery backup and charger, locations as shown on plans. Provide additional units as required for power to all notification appliances.

- E. Conduit routing and system wiring is not shown on the plans. It shall be the responsibility of the fire alarm installer to coordinate with the fire alarm manufacturer to determine the conduit requirements (size and routing) and wiring required for system operation.
- F. Surge Protective Devices (SPD) shall be provided as recommended by the manufacturer for all copper cables (at each end - install at cable termination points.) that enter and leave the buildings and for all 120V circuits serving fire alarm panels.
- G. The system shall be electrically supervised non-presignal type.
- H. Operation of any manual or automatic device shall:
 - 1. Activate the audible and visual indicators and event message display at the local fire alarm control panel (FACP) and the remote annunciator panel(s) indicating the status of the event, initiating device or zone.
 - 2. Activate remote station alarm, supervisory and trouble reporting procedure through the digital communicator and telephone system.
 - 3. Initiate the local emergency evacuation signal throughout the building.
 - 4. The system may be "reset" to normal standby condition upon restoring the initiating device to "normal" and activating the "reset" switch on the FACP panel or the "reset" switch at the remote annunciator panel(s).
- I. All trouble and supervisory events shall cause the audible trouble signal to sound at the system control panels and Remote annunciator panel(s). Trouble and supervisory events shall be silenced locally by a switch at the control panels or Remote Annunciator panel. Visual indication of all trouble and supervisory events shall be displayed as follows:
 - 1. The common trouble lamp shall illuminate and the trouble/supervisory event shall be displayed alpha-numerically on the LCD display on the control panels and Remote annunciator panel(s). Visual indication of trouble events shall remain until the condition is corrected and the system is reset. Visual indication of supervisory events shall remain until the condition is corrected and the system is reset (latching applications) or until the supervisory condition is self-restored (non-latching application). Trouble/supervisory events include but are not limited to the following:
 - a. Ground, fault, or open on a signaling, 24VDC power circuit, or notification circuit.
 - b. Failure of a system component or device.
 - c. Loss of 120 volt operating power to control panel (see specifications on delay of remote reporting of this signal).
 - d. Activation of any fire protection system supervisory point.

- J. The main control panel (FACP) and Remote Annunciator panel (FAA) shall display system events via color touch screen liquid crystal display (LCD) screens. A consistent system of definitive and distinctive abbreviations shall be utilized to maintain a concise format of all displays. Upon activation of a fire alarm initiation and/or supervisory device, the FACP panel and FAA shall display information as follows.
1. Device type (i.e. smoke detector, duct smoke detector, fire suppression system, manual pull station, etc.).
 2. Air handler designation (if device is a duct smoke detector located at an air handler).
 3. Floor level.
 4. For fire protection system flow switches (where applicable), the display shall indicate the zone or area(s) served by that branch of the fire protection system.
 5. For fire protection system tamper switches (where applicable), the display shall indicate the room name and room number where device is located.
- K. For multiple alarm events, the FACP panel and FAA shall be furnished with a buffer memory and controls to scroll all events on the display panel.
- L. All initiating devices shall be equipped with a local LED indicator to indicate alarm status of the device.
- M. There shall be independently supervised notification appliance circuits for visual and audible notification appliances. Disarrangement conditions of any circuit shall not affect the operation of other circuits.
- N. All auxiliary manual controls shall be supervised so that all switches must be returned to the normal automatic position to clear system trouble.
- O. Each independently supervised circuit shall include a discrete panel readout to indicate disarrangement conditions per circuit.
- P. The incoming power to the system shall be supervised so that any power failure must be audibly and visually indicated at the control panel. A green "power on" LED shall be displayed continuously while incoming power is present.
- Q. The System Expansion Modules shall be electrically supervised for module placement. Should a module become disconnected from the controls, the system trouble indicator must illuminate and audible trouble signal must sound.
- R. The system shall have custom programmed select switches configured for disabling and enabling circuits and individual or grouped input/output modules and initiation devices for maintenance or testing purposes.
- S. Provide isolator modules as required by NFPA-72 to protect/isolate signaling circuit segments.
- T. The system shall be configured for control of auxiliary equipment as follows:

1. Provide individual, remote addressable output modules with form "C" contacts for control of auxiliary equipment as noted on the plans.
2. Addressable output modules shall not reset until the system is manually reset.
3. All addressable output modules shall be configured for programmable activation by any initiation point or grouping of initiation points.
4. Provide heavy duty slave relays as required to accommodate the current and voltage requirements of the peripheral systems connected to the fire alarm system.

1.8 POWER REQUIREMENTS:

- A. The system shall be provided with sufficient battery capacity to operate the entire system upon loss of normal 120 VAC power in a normal supervisory mode for a period of twenty-four (24) hours with 15 minutes of alarm operation at the end of this period. The system shall automatically transfer to the standby batteries upon power failure.
- B. Provide battery chargers at all system panels as recommended by the system manufacturer. The system batteries shall be supervised so that a low battery condition or disconnection of the battery shall be audibly and visually indicated at the control panel. All battery charging and recharging operations shall be automatic. The charging equipment shall be capable of recharging the batteries within 24 hours.
 1. With exception of batteries for amplifiers, all batteries shall be sized with 20% minimum spare capacity. "Derating" factors do not qualify as spare capacity.
- C. All circuits requiring system operating power shall be 24VDC and shall be individually fused at the control panel.
- D. Date marking of batteries:
 1. All system batteries shall be permanently marked by the manufacturer with the month/year of manufacture using the month/year format.
 - a. Date-codes are not acceptable.
 2. All system batteries shall be marked with machine generated stick-on labels by the contractor with the month/day/year of installation

1.9 COMMUNICATION WITH ADDRESSABLE DEVICES:

- A. The system must provide communication with all initiating and control devices individually. All of these devices are to be individually annunciated at the FACP panel and Remote annunciator panel(s). Annunciation shall include the following conditions for each point:
 1. Alarm

2. Trouble
 3. Open
 4. Short
 5. Ground
 6. Device Fail/or Incorrect Device
- B. All addressable devices are to have the capability of being disabled or enabled individually.
- C. Identification of Addressable Devices: Each addressable device must be uniquely identified by an address code entered on each device at time of installation. The use of jumpers to set address will not be acceptable due to the potential of vibration and poor contact.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS:

- A. Provide fire alarm system components and as manufactured by one of the following manufacturers (no equal):
1. Notifier

2.2 GENERAL:

- A. Furnish and install a complete Fire Alarm System as described herein and as shown on the plans. This shall include, but not be limited to, control panel(s), manual pull stations, automatic fire detectors, horn/strobe units, strobe units, monitoring devices, control devices, all wiring, raceways, connections to devices, outlet boxes, junction boxes, and all other necessary material for a complete operating system.
- B. All panels and peripheral devices shall be the standard product of a single manufacturer and shall display the manufacturer's name on each component.

2.3 FIRE ALARM CONTROL PANELS (FACP):

- A. Each Fire Alarm Control Panel shall be modular with solid state, microprocessor based electronics.
- B. Each fire alarm control panel shall allow for loading or editing special instructions and operating sequences as required. The system is to be capable of onsite programming to accommodate and facilitate expansion, building parameter changes or changes as required by local codes. All software operations is to be stored in a non-volatile programmable memory within the fire alarm control panel. Loss of primary and secondary power shall not erase the instructions stored in memory.

- C. The ability for selective input/output control functions based on ANDing, ORing, NOTing, timing and special coded operations is to also be incorporated in the resident software programming of the system.
- D. A local audible device shall sound during Alarm, Trouble or Supervisory conditions. This audible device shall sound differently during each condition to distinguish one condition from another without having to view the panel. This audible device shall also sound differently during each keypress to provide an audible feedback (chirp) to ensure that the key has been pressed properly.
- E. Panel Display:
 - 1. Display specifications (See Part 1 of this specification for panels designated to have display units):
 - a. Color
 - b. Touchscreen
 - c. LCD (provide the largest LCD display panel available by the manufacturer)
- F. Password Protection: The system shall be provided with 4 levels of password protection with up to 16 passwords.
- G. Equipment Enclosures: Provide cabinet(s) of sufficient size to accommodate the aforementioned equipment. The cabinet(s) shall be equipped with locks and transparent door panel(s) providing freedom from tampering yet allowing full view of the various lights and controls.
- H. The maximum time period allowable between an alarm initiation and status display at the FACP and Remote annunciator panel(s) shall be 5 seconds.
- I. All panel functions shall be field programmable.
- J. Remote reporting shall be provided via a digital cellular communicator (redundant communication path not required per NFPA-72, Part 26.6.3.3).
 - 1. Provide a digital cellular alarm communicator (CDACT) capable of programmable point (device) transmission of fire alarm, supervisory and trouble signals to a UL Listed Central Station or Remote Monitoring Station (Owner preference). The CDACT shall be programmed and configured to report alarm, trouble and supervisory signals based on individual initiation device point addresses as well as general system trouble conditions.
 - 2. Provide one (1) year of monitoring service.
 - 3. Provide an exterior-mounted remote antenna (coordinate location with Engineer/Owner) as required for boosting signal strength. Provide coax cable as required in 3/4" conduit between the remote antenna and the communicator. Coordinate all work with the Owner and the Owner's remote monitoring station service provider.

4. Remote maintenance diagnostics.
 5. FACP network program upload/download capabilities.
 - K. Existing Fire Alarm Control Panel (FACP) model is as follows
 1. EST: NFS-640
- 2.4 FIRE ALARM POWER EXTENDER (FPE):
- A. Fire alarm power extenders shall be Notifier Model FCPS-24S8E (no equal).
- 2.5 ALARM NOTIFICATION DEVICES:
- A. Alarm notification devices shall include:
 1. Horn/strobes (combination audiovisual)
 2. Strobes (visual only)
 - B. Audible/visual notification appliances shall meet the following requirements:
 1. **Wall appliance color: White**
 2. **Ceiling appliance color: White**
 3. Strobes:
 - a. Synchronized flashing for all units within any viewing area. Strobe flash frequency shall be 1 fps.
 - b. UL 1638 listed as a Visual Signaling Appliance for wall or ceiling mounted configuration as shown on the drawings.
 - c. Multi-candela type with field selectable candela ratings as follows:
 - 1) 15 cd
 - 2) 30 cd
 - 3) 75 cd
 - 4) 95 cd
 - 5) 110 cd
 - 6) 135 cd
 - 7) 185 cd

- d. Minimum strobe candela settings shall be as noted on the drawings. Final settings shall be adjusted as required to ensure compliance with NFPA-72.
 - e. Synchronized flashing for all strobe units within any viewing area (including strobes powered from different remote power supplies for which network synchronization modules shall be used). Strobe flash frequency shall be 1 fps.
 - f. UL 1638 listed as a Visual Signaling Appliance for wall or ceiling mounted configuration as shown on the drawings.
 - g. Red "FIRE" label on baffle.**
- C. Notification appliances shall operate from the 24V DC polarized indicating circuits.
 - D. All visual notification appliances shall have meet the equivalent requirements of the Americans with Disabilities Act (ADA).
 - E. Flush devices shall mount on 4 x 4-inch or 2-gang electrical boxes. Box depth shall be coordinated with device supplier.
 - F. Outdoor devices exposed directly to weather shall be U.L. listed as weatherproof.

2.6 ADDRESSABLE DEVICE TYPES:

- A. General: The system control panels, over the two wire signaling channels, must be capable of communicating with the types of addressable devices specified below. All smoke detectors and heat detectors and the associated control panel hardware and software shall utilize the latest and most advanced intelligent detection technology available from the manufacture at the time of bidding.
- B. Photo-electric Smoke Detectors:
 - 1. Photo-optic sensing chamber, UL listed to Standard 268.
 - 2. Low voltage, 2-wire solid state design incorporating tamper proof, plug-in head assembly.
 - 3. Tamper-resistant design.
 - 4. Intelligent addressable design with integral addressable transponder. Detector shall utilize fuzzy logic intelligence to continually analyze the ambient conditions present and shall signal the host control panel accordingly when ALARM or TROUBLE conditions are detected.
 - 5. Separate detector mounting base: Molded construction equipped with terminal screws for all wiring connections, designed for mounting on any standard 4 inch square outlet box for concealed wiring, or special box for surface raceway.

6. Design to produce TROUBLE signal if detector head is removed from its mounting base and ALARM signal if detection chamber is removed.
 7. LED that blinks when sensor is being polled and glows steady when in alarm.
 8. Factory set device type code.
- C. Automatic heat detectors: Combination rate-of-rise and fixed temperature type.
1. Combination rate-of-rise and fixed temperature type (135 degrees F threshold), automatically restorable.
 2. Low voltage, 2-wire solid state design incorporating tamper proof, plug-in head assembly.
 3. Tamper-resistant design.
 4. Intelligent addressable design with integral addressable transponder. Detector shall utilize fuzzy logic intelligence to continually analyze the ambient conditions present and shall signal the host control panel accordingly when ALARM conditions are detected.
 5. Separate detector mounting base: Molded construction equipped with terminal screws for all wiring connections, designed for mounting on any standard 4" square outlet box for concealed wiring, or special box for surface raceway.
 6. Detector shall report the detector status to the control panel. The control panel shall determine whether the condition at the detector is indicative of a NORMAL, ALARM, or SENSOR TROUBLE condition.
 7. Design to produce TROUBLE signal if detector head is removed from its mounting base and ALARM signal if detection chamber is removed.
 8. LED that blinks when sensor is being polled and glows steady when in alarm.
 9. Factory set device type code.
- D. Automatic fire detectors for ductwork:
1. Provide intelligent, addressable type photo-electric smoke detectors as specified herein.
 2. Duct accessories: Cast metal construction, with pre-cut keyed air sampling tubes (suitable for mounting detector either perpendicular or parallel to ducts) custom sized per each air handler ductwork application. Field verify all duct dimensions prior to ordering sampling tubes. *Uniform width sampling tubes cut in the field to fit ductwork are not acceptable.*
 3. Provide recessed adjustable screw to permit regulation of air flow, designed to allow easy detector removal for cleaning or service without removing entire unit from duct.

4. Provide a remote test station with red LED alarm lamp for each duct detector in a readily accessible location near each detector. Wire each test/alarm station to its respective detector.
 - a. Permanently label each station with the respective air handler designation.
- E. Addressable Pull Stations:
 1. Pull stations shall be addressable. The stations shall be manufactured from high impact red Lexan or cast metal. Lettering shall be raised and painted white. Stations shall be single-action pull type requiring a firm downward pull to activate.
 2. The station shall mechanically latch upon operation and remain so until manually reset by opening with a key common to all system locks.
 3. The front of the station is to be hinged to a backplate assembly and must be opened with a key to reset the station. The key shall be common with the control panels. The station shall consist of high impact Lexan, red in color.
 4. The addressable manual station shall be capable of field programming of its "address" location on an addressable signaling line circuit.
 5. There shall be no limit to the number of stations which may be activated or "in alarm" simultaneously.
- F. Carbon Monoxide Detectors:
 1. Multi-criteria detection device (Smoke, Light/flame, Carbon monoxide, Heat). UL listed to Standards 268 & 2075.
 2. Low voltage, 2-wire solid state design incorporating tamper proof, plug-in head assembly.
 3. Intelligent addressable design with integral addressable transponder.
 4. Sounder base with local audible signal (temporal 4-count per NFPA-720). Configurable via programming to alarm individually or in tandem with any one or combination of other CO detectors connected to the fire alarm system.
 5. Molded construction equipped with terminal screws for all wiring connections, designed for mounting on any standard 4 inch square outlet box for concealed wiring, or special box for surface raceway.
 6. Design to produce TROUBLE signal if detector head is removed from its mounting base and ALARM signal if detection chamber is removed.
 7. LED that blinks when sensor is being polled and glows steady when in alarm.
 8. Factory set device type code.

9. End of life warning signal at the control panel for CO cell.
10. One address for all modes of detection.
11. Each mode of detection shall be capable of being active or disabled through programming.

2.7 DOOR HOLDERS (MAGNETIC TYPE):

- A. Operation: Electromagnetic door holder/releases shall be controlled with addressable control modules by the local building fire alarm control panel. Doors shall release when an alarm is initiated by either of the local smoke detectors located immediately on either side of the smoke door.
- B. Operating voltage of holder/releases shall be dual voltage (120 volt A.C. & 24 volt D.C.) door holder/releases.
- C. Furnish, install, and wire one addressable control module for each door holder. Furnish, install and wire a power circuit for all door holders from the local fire alarm control panel.

2.8 CONTROL MODULES:

- A. Addressable (field programmable).
- B. Supervised.
- C. Lexan coverplate.
- D. Contacts shall be form "C", rated at 2A, 24 VDC and 0.5A, 120 VAC.
- E. Where higher contact current ratings are required for the controlled device, provide heavy duty relays with proper Form "C" contact ratings slaved directly off of a control module through a supervised control circuit.
- F. Provide supervised 24VDC circuits as required, powered from the local fire alarm control panel, for activating control modules and relays.
- G. Coordinate contact voltage and current ratings with voltage and current ratings of controlled devices.

2.9 AUXILIARY RELAYS:

- A. Specifications:
 1. Electrically held.
 2. 7A contact rating (@24Vdc & 120Vac).

3. 24Vdc coil, 15mA coil current (@24Vdc).
 4. Form "C" contacts.
 5. LED status indicator.
- B. Model: PAM-SD (or approved equal)

2.10 MONITORING MODULES:

- A. Addressable (field programmable).
- B. Supervised.
- C. Lexan coverplate.
- D. Field assignable personality codes as follows:
 1. Normally open alarm - Latching
 2. Normally open alarm - Delayed latching
 3. Normally open active - Non-latching
 4. Normally open active - Latching

2.11 FIRE ALARM REMOTE ANNUNCIATOR PANELS (FAA):

- A. Fire Alarm Remote Annunciator panels (FAA) are existing to remain in service.
- B. The FAA in the Main Lobby shall be relocated as shown on the plans and reconnected to the existing FACP panel. Provide new wire, conduit, and Wiremold as required. .
- C. Remote Annunciator panels have the following features:
 1. Microprocessor based with EPROM memory buffer.
 2. Trouble buzzer.
 3. Back-Lit, color touch screen liquid crystal display (LCD) screen (alpha/numeric).
 4. Indicator LED's:
 - a. Normal
 - b. Alarm
 - c. Supervisory

- d. Trouble
- 5. Password enabled control of all panel control functions.
- 6. Panel control functions shall be configured as follows

Control Switch	Software Configured Setting
Back scroll	Enabled
Next/ Acknowledge scroll	Enabled
Trouble silence (for Local buzzer only)	Enabled
Alarm Silence (Silences horns and extinguishes strobes)	Enabled
Reset	Disabled (May Override by Password)
Drill/All Call	Disabled (May Override by Password)

- D. The FAA shall display system events as specified in part 1.
- E. The FAA shall be compatible with the FACP panel communications protocol.
- F. The FAA shall display all points that report to its host FACP panel.
- G. The FAA shall receive supervised 24VDC power from the host FACP panel.

2.12 SYSTEM WIRING:

- A. General:
 - 1. Survivability and pathway configurations:
 - a. Unless otherwise specified herein, all circuits covered under this specification shall have a pathway survivability level of 0 (pathway defined by NFPA-72 as *“any circuit, conductor, optic fiber, radio carrier, or other means for transmitting system information to remain operational during fire conditions”*).
 - 2. All cables installed underground or below building foundations shall be U.L. listed for exposure to wet locations (West Penn Aquaseal or approved equal).

3. All signaling circuit cables shall be provided as follows.
 - a. NEC Type FPLP for all non-riser type cables (U.L. listed for fire alarm use).
 - b. NEC FPLR (not applicable to this project).
 - c. Minimum size shall be #18AWG.
 4. All floor-to-floor cables serving notification appliances, and 24VDC powered devices shall be provided as follows (manufacturer's requirements shall take priority):
 - a. NEC Type FPLR riser type cables, manufactured specifically for fire alarm system applications.
 - b. Minimum size shall be #14AWG.
 5. All horizontal circuits serving notification appliances, and 24VDC powered devices shall be provided as follows (manufacturer's requirements shall take priority):
 - a. NEC Type FPLP, manufactured specifically for fire alarm system applications (non-riser type cables).
 - b. 600V, THWN insulated wiring.
 - c. Minimum size shall be #14AWG.
 6. Separation shall be maintained for circuits utilizing copper conductors as required per NFPA 70, Article 760.
- B. Initiation device signaling circuit pathways shall be Class B.
1. Floor-to-floor initiation device signaling circuit cable shall be FPLP type as classified by NEC Article 760.
- C. Remote annunciator signaling circuit pathway shall be Class B.
1. Remote annunciator signaling circuit cable shall be FPLP type as classified by NEC Article 760.
- D. Notification appliance circuit pathways shall be Class B.
- E. All circuits shall be protected (power limited) as required per NFPA 70 to allow notification circuits to be installed in the same conduit as initiation and signaling circuits.
- F. Fire Alarm circuits may be solid or stranded as recommended by the equipment manufacturer for each specific application.

2.13 GROUNDING OF LOW VOLTAGE SURGE SUPPRESSION DEVICES:

- A. Install a #12AWG THHN green insulated equipment grounding conductor in all fire alarm conduits serving low voltage surge suppressors. Connect the grounding conductor to each surge suppressor's grounding terminal and to the ground lug in the power supply or control panel enclosure serving the fire alarm devices connected to the associated fire alarm circuit(s).

2.14 BATTERIES:

- A. System batteries shall be sealed lead acid type listed for use with Fire Alarm systems.
- B. All batteries furnished shall be new (unused) and shall be installed within one (1) year from the date of manufacturer.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION:

- A. The Contractor is responsible for assuring that conduit size and wire quantity, size, and type is suitable for the equipment supplied. The Contractor shall review the proper installation of each type of device with the equipment supplier.
- B. All wiring shall be installed in new conduit in unfinished spaces and above ceilings, and unless noted otherwise shall be installed in new wiremold where located below finished ceilings in finished spaces.
- C. Furnish and install the system in accordance with the plans and specifications, all applicable codes and the manufacturer's recommendations.
- D. All wiring shall be installed in strict compliance with all the provisions of NEC - Article 760, Part III - Power-Limited Fire Alarm (PLFA) Circuits, or if required may be reclassified as non-power limited and wired in accordance with NEC-Article 760, Part II Non-Power-Limited Fire Alarm (NPLFA) Circuits.
- E. For ceiling device installations in suspended tile ceilings, adjustable T-bars & extra deep boxes shall be provided to accommodate specific ceiling types and to provide ample capacity and space for wiring pulling and circuit terminations.
- F. The Contractor shall clean all dirt and debris from the inside and the outside of the fire alarm equipment after completion of the installation.
- G. Make all fire alarm wiring continuous from control panel (or power extender panel) to device terminals.
- H. T-taps are not allowed without approval (submit formal request for specific T-tap applications early in submittal phase and prior to submittal of layout drawings)
- I. Protect detectors during construction period as required by NFPA-72.

- J. Smoke detectors shall be mounted only in an orientation for which they have been listed.
 - 1. Smoke detectors shall not be located any closer than 3'-0" from any ceiling type HVAC supply or return air grille and shall not be located anywhere within the direct path of any side-wall type HVAC supply air grilles. Separation shall be greater where higher air velocities dictate and smoke detection performance is likely to be impaired. All devices requiring relocation after installation that were not brought to the attention of the Engineer shall be relocated at the Contractor's expense.
- K. Final locations of all visual notification appliances and combination visual/audible notification appliances shall be adjusted as required up to 3' maximum from the nearest obstruction (casework, smart board projectors, etc.) to provide unobstructed direct visibility of all visual appliances in the field of view. Review Architectural drawings (where applicable) prior to rough-in phase and report all discrepancies to the Engineer in writing. All devices requiring relocation after installation that were not brought to the attention of the Engineer shall be relocated at the Contractor's expense
- L. Installation and testing of all fire alarm system devices and equipment shall be performed by a qualified electronics contractor licensed specifically for signal systems installation. This Contractor shall be a factory trained representative of the equipment manufacturer and shall be licensed and authorized to install and maintain the fire alarm system approved for the installation.

3.2 CONTROL MODULES

- A. Control modules shall be installed within 18 inches of their associated devices to be controlled and in a readily accessible location.
- B. Verify locations of interface points with all systems in the field prior to conduit rough-in.
- C. Provide control module interfaces for systems including but not limited to the following:
 - 1. HVAC unit controllers
 - 2. Smoke door holders
 - 3. Other (as noted on the drawings)

3.3 MONITORING MODULES

- A. Monitoring modules shall be installed within 24 inches of their associated devices to be controlled and in a readily accessible location.
- B. Verify locations of interface points with all systems in the field prior to conduit rough-in.

- C. Provide monitoring module interfaces for systems as shown or as noted on the drawings.
- D. The contractor shall be responsible for assigning the proper "personality code" for each monitoring module depending on the application.

3.4 PROGRAMMING

- A. The system installer shall provide complete programming for all systems whether programming is factory installed or installed in the field by the system installer.
- B. The system installer shall derive all user specified programming information (building designations, room descriptions, etc.) from the actual room names and numbers *not the construction drawings*.
- C. All programming changes required by the Owner to render the system usable and functional by the Owner's standards shall be made at the contractor's expense.

3.5 LABELING:

- A. Control panels, remote amplifier panels (FAAP), local operator consoles (FAA) , and power extender panels (FPE) shall be permanently labeled with their respective panel designations in accordance with general Division 26 labeling requirements.
- B. Initiation devices and addressable monitoring and control modules shall be labeled with the SLC loop and address using machine generated stick-on labels.
- C. Duct smoke detector test switches and remote alarm indicators shall be labeled with their associated air handler and "SUPPLY" or "RETURN" air duct designation using machine generated stick-on labels.
- D. All Fire Alarm panels powered with 120V A.C. power shall be permanently labeled with the following information in accordance with general Division 26 labeling requirements
 - 1. Room name/number containing the 120V panelboard feeding the fire alarm panel.
 - 2. Host 120V branch circuit panelboard and branch circuit number designation.

3.6 120V BRANCH CIRCUIT BREAKER LOCK-OUT, MARKING, AND LABELING:

- A. All 120V branch circuit breaker handles serving fire alarm panels shall be provided with a "lock-out" type accessory per NFPA-72 requirements with a pad lock (keyed alike - furnish ten keys to the Owner) that allows the circuit breaker to be locked in the "ON" position and allow the circuit breaker to trip in an overload condition.
- B. All 120V branch circuit breaker handles serving fire alarm panels shall be permanently marked with red color per NFPA-72 requirements.

- C. The 120V panelboard index circuit designations for all 120V branch circuit panelboards serving fire alarm panels shall be identified typically "FIRE ALARM CIRCUIT-FACP", FIRE ALARM CIRCUIT-FPE", etc. per NFPA-72 requirements.

3.7 TESTING, GUARANTEE, SERVICE:

- A. Provide initial certification testing of the system in accordance with the procedures outlined in NFPA 72. The minimum required tests for new equipment, devices, and circuits shall be as follows:
1. Verify the absence of unwanted voltages between circuit conductors and ground.
 2. Test all conductors for short circuits utilizing an insulation testing device.
 3. Verify the control unit is in the normal condition as detailed in the manufacturer's operating and maintenance manual.
 4. Perform the following tests for all system batteries in strict accordance with NFPA-72:
 - a. Charger test.
 - b. Discharge test.
 - c. Load voltage test.
 5. Test both primary power and secondary power. Verify, by test, the secondary power system is capable of operating the system for the period and in the manner specified.
 6. Test each initiating and notification circuit. One connection each should be opened at not less than 10 percent of the initiating and notification devices.
 7. Test each initiating and notification device for alarm operation and proper response at the control unit.
 8. Test smoke detectors and carbon monoxide detectors with listed aerosols acceptable to the manufacturer or other such testing methods which are approved by the manufacturer.
 9. Test heat detectors with U.L. listed heat generating test equipment.
 10. Test the system for all specified functions in accordance with the manufacturer's operating and maintenance manual.
 11. Verify that each alarm notification device functions as specified. Determine that the system is operable under trouble conditions as specified.
 12. Duct Smoke Detector Testing:

- a. Use ignitable smoke emitters (by Regin, STI, or equal) to smoke test all duct detectors by introducing test smoke into the air ducts.
13. Field verification of auxiliary function interfaces:
- a. Field-verify and pretest each and every interface with auxiliary systems (air handler shut-down, elevator recall, kitchen hood suppression systems, etc.) at least three (3) weeks prior to acceptance testing.
 - b. Submit a report to the Engineer at least seven (7) calendar days prior to scheduled acceptance testing with final confirmation of proper functioning of each auxiliary system. Each and every auxiliary system shall be listed in line item format with "PASS"/" FAIL" condition documented.
14. Provide all labor required for making one post-acceptance testing field adjustment to all audible notification appliance dB settings as directed by the Owner, Engineer, or Authority Having Jurisdiction (final scope of adjustments to be established by the Engineer following acceptance testing).
15. Provide all other testing required by NFPA 72 but not specified herein.
- B. Test a minimum of 10% of existing devices and circuits that were directly or indirectly affected by renovations.
- C. Document all testing in accordance with the National Fire Alarm Code. Submitted documentation shall include but shall not be limited to the following items:
1. Fully completed Partial NFPA-72 Record of Completion form (2016 Edition).
 2. Fully completed Partial NFPA-72 Inspection and Testing form (2016 Edition).
- D. Upon completion, the Contractor shall conduct a functional test of the entire system for the Authority Having Jurisdiction, Owner and Engineer.
1. Additional testing and demonstration for the Authority Having Jurisdiction, Owner and Engineer shall be provided as required until the system is demonstrated to be free of unexplained alarms, troubles, faults, or any abnormalities.
- E. In the event that additional software programming is necessary to complete the tests, the system shall be completely retested as outlined in this section at the contractor's expense.
- F. All components, parts and assemblies supplied by the manufacturer shall be guaranteed by the manufacturer against defects in materials and workmanship for a period of three (3) years. The equipment manufacturer shall provide normal labor service as required during this period at no cost to the Owner and shall respond to any call within two (2) hours 24 hours a day, seven days per week.

- G. The equipment manufacturer shall have a local branch office or authorized factory distributor staffed with trained, full-time employees who are capable of performing testing, inspection, repair and maintenance services for the life of the fire alarm system.

3.8 COMPLETION:

- A. Upon completion of the work, remove excess debris, materials, equipment, apparatus, tools and the like and leave the premises clean, neat and orderly.
- B. Certification:
 - 1. The contractor shall certify in a letter to the Engineer that the complete system has been checked in accordance with the required NFPA-72 testing standards and has been installed in accordance with the contract documents and that all items have been labeled.
- C. Training: Not applicable.
- D. Two (2) weeks prior to the final completion, provide to the Owner (through the engineer) a complete printout of the system programming along with flash drive copy of the program. The flash drive shall include all manufacturer's software necessary to perform maintenance and adds. Software shall be installed on the Owner's computer as directed by Owner. Moves and changes to the system shall be provided to the Owner two (2) weeks prior to the final completion.

3.9 SPARE PARTS: Not applicable

3.10 KEYS

- A. Keys and locks for all equipment shall be identical where possible. Provide not less than six keys of each type required. Identify keys by an appropriate number stamped on each key or on a metal tag attached thereto. Provide a key numbering chart in the operation and maintenance manual furnished.

END OF SECTION 28 3111