

**Bidding Documents for**  
**Columbus County**  
**Building B**  
**HVAC Repairs**



**Coastal Architecture**  
4206 Bridges Street, Suite C  
Morehead City, North Carolina 28557  
Phone: 252-247-2127  
Email: [Lee@CoastalArchitecture.net](mailto:Lee@CoastalArchitecture.net)  
[www.coastalarchitecture.net](http://www.coastalarchitecture.net)

Project No.  
23031



**Whiteville,**  
**North Carolina**

Issued: January 22, 2024

**Bidding Documents**

**for the Construction of**

**COLUMBUS COUNTY BUILDING B HVAC REPAIRS**

**WHITEVILLE, NORTH CAROLINA**

**PREPARED BY:**

**Coastal Architecture  
4206 Bridges Street, Suite C  
Morehead City, NC 28557  
(252) 247-2127 - Phone  
[Lee@coastalarchitecture.net](mailto:Lee@coastalarchitecture.net)  
[www.coastalarchitecture.net](http://www.coastalarchitecture.net)**

**Burke Design Group  
3305-109 Durham Drive  
Raleigh, NC 27603  
(919) 771-1916 – Phone  
[ben@bdg-nc.com](mailto:ben@bdg-nc.com)**

**Architect's Project Number: 23031**

**Date of Issue: January 22, 2024**

## TABLE OF CONTENTS

### BIDDING DOCUMENTS FOR

### COLUMBUS COUNTY BUILDING B HVAC REPAIRS

### WHITEVILLE, NORTH CAROLINA

## SPECIFICATIONS

### DIVISION 0 - BIDDING REQUIREMENTS AND GENERAL CONDITIONS

Sections	----	Table of Contents
	----	Invitation to Bid
	----	Form of Proposal
	----	MBE Forms
	----	General Conditions of the Contract for Construction (AIA-A201)
	----	Standard Form of Agreement (AIA-A101)
00800		Supplementary General Conditions and General Requirements
00820		Special Conditions
00830		Description of Bid Alternates

### DIVISION 1 - GENERAL REQUIREMENTS

Sections	01010	Summary of Work – <i>See also M-1</i>
	01020	Allowances
	01027	Applications for Payment
	01045	Cutting and Patching
	01050	Field Engineering
	01090	Abbreviations and Symbols
	01200	Project Meetings
	01310	Schedules and Reports
	01340	Submittals and Substitutions
	01370	Schedule of Values
	01500	Temporary Facilities and Controls
	01620	Product Handling
	01710	Cleaning
	01720	Project Record Documents

### DIVISION 2 - SITE WORK

Sections	NOT APPLICABLE
----------	----------------

### DIVISION 3 - CONCRETE

Sections	NOT APPLICABLE
----------	----------------

### DIVISION 4 - MASONRY

Sections	NOT APPLICABLE
----------	----------------

### DIVISION 5 - METALS

Sections	NOT APPLICABLE
----------	----------------

### DIVISION 6 - CARPENTRY

Sections	NOT APPLICABLE
----------	----------------

### DIVISION 7 - THERMAL AND MOISTURE PROTECTION

Sections NOT APPLICABLE

DIVISION 8 - DOORS AND WINDOWS

Sections NOT APPLICABLE

DIVISION 9 - FINISHES

Sections NOT APPLICABLE

DIVISION 10 - SPECIALTIES

Sections NOT APPLICABLE

DIVISION 11 - EQUIPMENT

Sections NOT APPLICABLE

DIVISION 12 - FURNISHINGS

Sections NOT APPLICABLE

DIVISION 13 - SPECIAL CONSTRUCTION

Sections NOT APPLICABLE

DIVISION 14 - CONVEYING SYSTEMS

Sections NOT APPLICABLE

DIVISION 15A - PLUMBING

Sections NOT APPLICABLE

DIVISION 15B - MECHANICAL

Sections SEE DRAWINGS

15900 Instrumentation and Control for HVAC

15990 Testing, Adjusting and Balancing

DIVISION 16 - ELECTRICAL

Sections NOT APPLICABLE

## INVITATION TO BIDS

BIDS for the renovations of the Columbus County Building B HVAC Repairs, will be received by the Owner until 2:00PM on Wednesday February 21, 2024 and then opened and publicly posted.

The CONTRACT DOCUMENTS may be obtained from Architects website, [www.coastalarchitecture.net](http://www.coastalarchitecture.net) or purchased from the Architect for a sum of \$150.00 each per set.

The Owner reserves the unqualified right to reject any and/or all bids.

Bids will be received in:

**Commissioners Chambers**  
127 W Webster Street  
Whiteville, NC

**A 5% Bid Bond will be required, and a 100% Performance and Payment Bond will be required as part of the bid.**

There will be a pre-bid meeting on site on Monday February 12, 2024, at 11:00AM.  
All bidders are encouraged to attend.



**WITNESS:**

\_\_\_\_\_  
Name of Firm or Corporation making Bid

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

\_\_\_\_\_  
(Proprietorship or Partnership)

Title: \_\_\_\_\_  
(Owner, Partner, or Corporate President or  
Vice President only)

**ATTEST:**

Address: \_\_\_\_\_

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

Title: \_\_\_\_\_ License No.: \_\_\_\_\_  
(Corporate Secretary or  
Assistant Secretary only)

(Corporate Seal)

Addenda Received and Used in Computing Bids: (Initial as Appropriate)

Addendum No.1 \_\_\_\_\_

Addendum No.2 \_\_\_\_\_

Addendum No.3 \_\_\_\_\_

Addendum No.4 \_\_\_\_\_

**End of Proposal Form**





# State of North Carolina AFFIDAVIT A – Listing of Good Faith Efforts

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

(Name of Bidder)

Affidavit of \_\_\_\_\_

I have made a good faith effort to comply under the following areas checked:

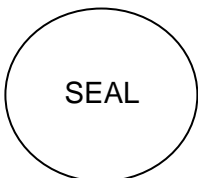
**Bidders must earn at least 50 points from the good faith efforts listed for their bid to be considered responsive.** (1 NC Administrative Code 30 I.0101)

- 1 – (10 pts)** Contacted minority businesses that reasonably could have been expected to submit a quote and that were known to the contractor, or available on State or local government maintained lists, at least 10 days before the bid date and notified them of the nature and scope of the work to be performed.
- 2 --(10 pts)** Made the construction plans, specifications and requirements available for review by prospective minority businesses, or providing these documents to them at least 10 days before the bids are due.
- 3 – (15 pts)** Broken down or combined elements of work into economically feasible units to facilitate minority participation.
- 4 – (10 pts)** Worked with minority trade, community, or contractor organizations identified by the Office of Historically Underutilized Businesses and included in the bid documents that provide assistance in recruitment of minority businesses.
- 5 – (10 pts)** Attended prebid meetings scheduled by the public owner.
- 6 – (20 pts)** Provided assistance in getting required bonding or insurance or provided alternatives to bonding or insurance for subcontractors.
- 7 – (15 pts)** Negotiated in good faith with interested minority businesses and did not reject them as unqualified without sound reasons based on their capabilities. Any rejection of a minority business based on lack of qualification should have the reasons documented in writing.
- 8 – (25 pts)** Provided assistance to an otherwise qualified minority business in need of equipment, loan capital, lines of credit, or joint pay agreements to secure loans, supplies, or letters of credit, including waiving credit that is ordinarily required. Assisted minority businesses in obtaining the same unit pricing with the bidder's suppliers in order to help minority businesses in establishing credit.
- 9 – (20 pts)** Negotiated joint venture and partnership arrangements with minority businesses in order to increase opportunities for minority business participation on a public construction or repair project when possible.
- 10 - (20 pts)** Provided quick pay agreements and policies to enable minority contractors and suppliers to meet cash-flow demands.

The undersigned, if apparent low bidder, will enter into a formal agreement with the firms listed in the Identification of Minority Business Participation schedule conditional upon scope of contract to be executed with the Owner. Substitution of contractors must be in accordance with GS143-128.2(d) Failure to abide by this statutory provision will constitute a breach of the contract.

The undersigned hereby certifies that he or she has read the terms of the minority business commitment and is authorized to bind the bidder to the commitment herein set forth.

Date: \_\_\_\_\_ Name of Authorized Officer: \_\_\_\_\_  
Signature: \_\_\_\_\_  
Title: \_\_\_\_\_



State of \_\_\_\_\_, County of \_\_\_\_\_  
Subscribed and sworn to before me this \_\_\_\_\_ day of \_\_\_\_\_ 20\_\_\_\_  
Notary Public \_\_\_\_\_  
My commission expires \_\_\_\_\_

# State of North Carolina --AFFIDAVIT B-- Intent to Perform Contract with Own Workforce.

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

Affidavit of \_\_\_\_\_

(Name of Bidder)

I hereby certify that it is our intent to perform 100% of the work required for the \_\_\_\_\_ contract.

(Name of Project)

In making this certification, the Bidder states that the Bidder does not customarily subcontract elements of this type project, and normally performs and has the capability to perform and will perform all elements of the work on this project with his/her own current work forces; and

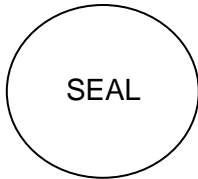
The Bidder agrees to provide any additional information or documentation requested by the owner in support of the above statement. The Bidder agrees to make a Good Faith Effort to utilize minority suppliers where possible.

The undersigned hereby certifies that he or she has read this certification and is authorized to bind the Bidder to the commitments herein contained.

Date: \_\_\_\_\_ Name of Authorized Officer: \_\_\_\_\_

Signature: \_\_\_\_\_

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



State of \_\_\_\_\_, County of \_\_\_\_\_

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

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

My commission expires \_\_\_\_\_

# State of North Carolina - AFFIDAVIT C - Portion of the Work to be Performed by HUB Certified/Minority Businesses

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

**(Note this form is to be submitted only by the apparent lowest responsible, responsive bidder.)**

If the portion of the work to be executed by HUB certified/minority businesses as defined in GS143-128.2(g) and 128.4(a),(b),(e) is equal to or greater than 10% of the bidders total contract price, then the bidder must complete this affidavit.  
This affidavit shall be provided by the apparent lowest responsible, responsive bidder within **72 hours** after notification of being low bidder.

Affidavit of \_\_\_\_\_ I do hereby certify that on the \_\_\_\_\_  
(Name of Bidder)

\_\_\_\_\_ (Project Name)  
Project ID# \_\_\_\_\_ Amount of Bid \$ \_\_\_\_\_

I will expend a minimum of \_\_\_\_\_% of the total dollar amount of the contract with minority business enterprises. Minority businesses will be employed as construction subcontractors, vendors, suppliers or providers of professional services. Such work will be subcontracted to the following firms listed below. Attach additional sheets if required

Name and Phone Number	*Minority Category	**HUB Certified Y/N	Work Description	Dollar Value

\*Minority categories: Black, African American (B), Hispanic (H), Asian American (A) American Indian (I), Female (F) Socially and Economically Disadvantaged (D)

**\*\* HUB Certification with the state HUB Office required to be counted toward state participation goals.**

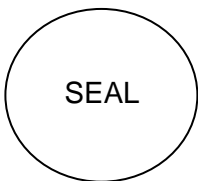
Pursuant to GS143-128.2(d), the undersigned will enter into a formal agreement with Minority Firms for work listed in this schedule conditional upon execution of a contract with the Owner. Failure to fulfill this commitment may constitute a breach of the contract.

The undersigned hereby certifies that he or she has read the terms of this commitment and is authorized to bind the bidder to the commitment herein set forth.

Date: \_\_\_\_\_ Name of Authorized Officer: \_\_\_\_\_

Signature: \_\_\_\_\_

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



State of \_\_\_\_\_, County of \_\_\_\_\_

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

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

My commission expires \_\_\_\_\_

# State of North Carolina AFFIDAVIT D – Good Faith Efforts

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

**(Note this form is to be submitted only by the apparent lowest responsible, responsive bidder.)**

If the goal of 10% participation by HUB Certified/ minority business **is not** achieved, the Bidder shall provide the following documentation to the Owner of his good faith efforts:

Affidavit of \_\_\_\_\_ I do hereby certify that on the \_\_\_\_\_  
(Name of Bidder)

Project ID# \_\_\_\_\_ (Project Name) Amount of Bid \$ \_\_\_\_\_

I will expend a minimum of \_\_\_\_\_% of the total dollar amount of the contract with HUB certified/ minority business enterprises. Minority businesses will be employed as construction subcontractors, vendors, suppliers or providers of professional services. Such work will be subcontracted to the following firms listed below. (Attach additional sheets if required)

Name and Phone Number	*Minority Category	**HUB Certified Y/N	Work Description	Dollar Value

\*Minority categories: Black, African American (**B**), Hispanic (**H**), Asian American (**A**) American Indian (**I**), Female (**F**) Socially and Economically Disadvantaged (**D**)

**\*\* HUB Certification with the state HUB Office required to be counted toward state participation goals.**

Examples of documentation that may be required to demonstrate the Bidder's good faith efforts to meet the goals set forth in these provisions include, but are not necessarily limited to, the following:

- A. Copies of solicitations for quotes to at least three (3) minority business firms from the source list provided by the State for each subcontract to be let under this contract (if 3 or more firms are shown on the source list). Each solicitation shall contain a specific description of the work to be subcontracted, location where bid documents can be reviewed, representative of the Prime Bidder to contact, and location, date and time when quotes must be received.
- B. Copies of quotes or responses received from each firm responding to the solicitation.
- C. A telephone log of follow-up calls to each firm sent a solicitation.
- D. For subcontracts where a minority business firm is not considered the lowest responsible sub-bidder, copies of quotes received from all firms submitting quotes for that particular subcontract.
- E. Documentation of any contacts or correspondence to minority business, community, or contractor organizations in an attempt to meet the goal.
- F. Copy of pre-bid roster
- G. Letter documenting efforts to provide assistance in obtaining required bonding or insurance for minority business.
- H. Letter detailing reasons for rejection of minority business due to lack of qualification.
- I. Letter documenting proposed assistance offered to minority business in need of equipment, loan capital, lines of credit, or joint pay agreements to secure loans, supplies, or letter of credit, including waiving credit that is ordinarily required.

Failure to provide the documentation as listed in these provisions may result in rejection of the bid and award to the next lowest responsible and responsive bidder.

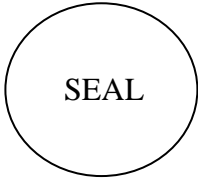
Pursuant to GS143-128.2(d), the undersigned will enter into a formal agreement with Minority Firms for work listed in this schedule conditional upon execution of a contract with the Owner. Failure to fulfill this commitment may constitute a breach of the contract.

The undersigned hereby certifies that he or she has read the terms of this commitment and is authorized to bind the bidder to the commitment herein set forth.

Date: \_\_\_\_\_ Name of Authorized Officer: \_\_\_\_\_

Signature: \_\_\_\_\_

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



State of \_\_\_\_\_, County of \_\_\_\_\_

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

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

My commission expires \_\_\_\_\_

## **GUIDELINES FOR RECRUITMENT AND SELECTION OF MINORITY BUSINESSES FOR PARTICIPATION IN STATE CONSTRUCTION CONTRACTS**

In accordance with G.S. 143-128.2 (effective January 1, 2002) these guidelines establish goals for minority participation in single-prime bidding, separate-prime bidding, construction manager at risk, and alternative contracting methods, on State construction projects in the amount of \$300,000 or more. The legislation provides that the State shall have a verifiable ten percent (10%) goal for participation by minority businesses in the total value of work for each project for which a contract or contracts are awarded. These requirements are published to accomplish that end.

### **SECTION A: INTENT**

It is the intent of these guidelines that the State of North Carolina, as awarding authority for construction projects, and the contractors and subcontractors performing the construction contracts awarded shall cooperate and in good faith do all things legal, proper and reasonable to achieve the statutory goal of ten percent (10%) for participation by minority businesses in each construction project as mandated by GS 143-128.2. Nothing in these guidelines shall be construed to require contractors or awarding authorities to award contracts or subcontracts to or to make purchases of materials or equipment from minority-business contractors or minority-business subcontractors who do not submit the lowest responsible, responsive bid or bids.

### **SECTION B: DEFINITIONS**

1. Minority - a person who is a citizen or lawful permanent resident of the United States and who is:
  - a. Black, that is, a person having origins in any of the black racial groups in Africa;
  - b. Hispanic, that is, a person of Spanish or Portuguese culture with origins in Mexico, South or Central America, or the Caribbean Islands, regardless of race;
  - c. Asian American, that is, a person having origins in any of the original peoples of the Far East, Southeast Asia and Asia, the Indian subcontinent, the Pacific Islands;
  - d. American Indian, that is, a person having origins in any of the original peoples of North America; or
  - e. Female
2. Minority Business - means a business:
  - a. In which at least fifty-one percent (51%) is owned by one or more minority persons, or in the case of a corporation, in which at least fifty-one percent (51%) of the stock is owned by one or more minority persons or socially and economically disadvantaged individuals; and
  - b. Of which the management and daily business operations are controlled by one or more of the minority persons or socially and economically disadvantaged individuals who own it.
3. Socially and economically disadvantaged individual - means the same as defined in 15 U.S.C. 637. "Socially disadvantaged individuals are those who have been subjected to racial or ethnic prejudice or cultural bias because of their identity as a member of a group without regard to their individual qualities". "Economically disadvantaged individuals are those socially disadvantaged individuals whose ability to compete in the free enterprise system has been impaired due to diminished capital and credit opportunities as compared to others in the same business area who are not socially disadvantaged".
4. Public Entity - means State and all public subdivisions and local governmental units.
5. Owner - The State of North Carolina, through the Agency/Institution named in the contract.
6. Designer - Any person, firm, partnership, or corporation, which has contracted with the State of North Carolina to perform architectural or engineering, work.
7. Bidder - Any person, firm, partnership, corporation, association, or joint venture seeking to be awarded a public contract or subcontract.

8. Contract - A mutually binding legal relationship or any modification thereof obligating the seller to furnish equipment, materials or services, including construction, and obligating the buyer to pay for them.
9. Contractor - Any person, firm, partnership, corporation, association, or joint venture which has contracted with the State of North Carolina to perform construction work or repair.
10. Subcontractor - A firm under contract with the prime contractor or construction manager at risk for supplying materials or labor and materials and/or installation. The subcontractor may or may not provide materials in his subcontract.

## **SECTION C: RESPONSIBILITIES**

1. Office for Historically Underutilized Businesses, Department of Administration (hereinafter referred to as HUB Office).

The HUB Office has established a program, which allows interested persons or businesses qualifying as a minority business under G.S. 143-128.2, to obtain certification in the State of North Carolina procurement system. The information provided by the minority businesses will be used by the HUB Office to:

- a. Identify those areas of work for which there are minority businesses, as requested.
- b. Make available to interested parties a list of prospective minority business contractors and subcontractors.
- c. Assist in the determination of technical assistance needed by minority business contractors.

In addition to being responsible for the certification/verification of minority businesses that want to participate in the State construction program, the HUB Office will:

- (1) Maintain a current list of minority businesses. The list shall include the areas of work in which each minority business is interested.
- (2) Inform minority businesses on how to identify and obtain contracting and subcontracting opportunities through the State Construction Office and other public entities.
- (3) Inform minority businesses of the contracting and subcontracting process for public construction building projects.
- (4) Work with the North Carolina trade and professional organizations to improve the ability of minority businesses to compete in the State construction projects.
- (5) The HUB Office also oversees the minority business program by:
  - a. Monitoring compliance with the program requirements.
  - b. Assisting in the implementation of training and technical assistance programs.
  - c. Identifying and implementing outreach efforts to increase the utilization of minority businesses.
  - d. Reporting the results of minority business utilization to the Secretary of the Department of Administration, the Governor, and the General Assembly.

2. State Construction Office

The State Construction Office will be responsible for the following:

- a. Furnish to the HUB Office a minimum of twenty-one days prior to the bid opening the following:
  - (1) Project description and location;
  - (2) Locations where bidding documents may be reviewed;
  - (3) Name of a representative of the owner who can be contacted during the advertising period to advise who the prospective bidders are;
  - (4) Date, time and location of the bid opening.
  - (5) Date, time and location of prebid conference, if scheduled.
- b. Attending scheduled prebid conference, if necessary, to clarify requirements of the general statutes regarding minority-business participation, including the bidders' responsibilities.

- c. Reviewing the apparent low bidders' statutory compliance with the requirements listed in the proposal, that must be complied with, if the bid is to be considered as responsive, prior to award of contracts. The State reserves the right to reject any or all bids and to waive informalities.
- d. Reviewing of minority business requirements at Preconstruction conference.
- e. Monitoring of contractors' compliance with minority business requirements in the contract documents during construction.
- f. Provide statistical data and required reports to the HUB Office.
- g. Resolve any protest and disputes arising after implementation of the plan, in conjunction with the HUB Office.

### 3. Owner

Before awarding a contract, owner shall do the following:

- a. Develop and implement a minority business participation outreach plan to identify minority businesses that can perform public building projects and to implement outreach efforts to encourage minority business participation in these projects to include education, recruitment, and interaction between minority businesses and non-minority businesses.
- b. Attend the scheduled prebid conference.
- c. At least 10 days prior to the scheduled day of bid opening, notify minority businesses that have requested notices from the public entity for public construction or repair work and minority businesses that otherwise indicated to the Office for Historically Underutilized Businesses an interest in the type of work being bid or the potential contracting opportunities listed in the proposal. The notification shall include the following:
  - 1. A description of the work for which the bid is being solicited.
  - 2. The date, time, and location where bids are to be submitted.
  - 3. The name of the individual within the owner's organization who will be available to answer questions about the project.
  - 4. Where bid documents may be reviewed.
  - 5. Any special requirements that may exist.
- d. Utilize other media, as appropriate, likely to inform potential minority businesses of the bid being sought.
- e. Maintain documentation of any contacts, correspondence, or conversation with minority business firms made in an attempt to meet the goals.
- f. Review, jointly with the designer, all requirements of G.S. 143-128.2(c) and G.S. 143-128.2(f) – (i.e. bidders' proposals for identification of the minority businesses that will be utilized with corresponding total dollar value of the bid and affidavit listing good faith efforts, or affidavit of self-performance of work, if the contractor will perform work under contract by its own workforce) - prior to recommendation of award to the State Construction Office.
- g. Evaluate documentation to determine good faith effort has been achieved for minority business utilization prior to recommendation of award to State Construction Office.
- h. Review prime contractors' pay applications for compliance with minority business utilization commitments prior to payment.
- i. Make documentation showing evidence of implementation of Owner's responsibilities available for review by State Construction Office and HUB Office, upon request

### 4. Designer

Under the single-prime bidding, separate prime bidding, construction manager at risk, or alternative contracting method, the designer will:

- a. Attend the scheduled prebid conference to explain minority business requirements to the prospective bidders.
- b. Assist the owner to identify and notify prospective minority business prime and subcontractors of potential contracting opportunities.
- c. Maintain documentation of any contacts, correspondence, or conversation with minority business firms made in an attempt to meet the goals.
- d. Review jointly with the owner, all requirements of G.S. 143-128.2(c) and G.S.143-128.2(f) – (i.e. bidders' proposals for identification of the minority businesses that will be utilized with



corresponding total dollar value of the bid and affidavit listing Good Faith Efforts, or affidavit of self-performance of work, if the contractor will perform work under contract by its own workforce) - prior to recommendation of award.

- e. During construction phase of the project, review “MBE Documentation for Contract Payment” – (Appendix E) for compliance with minority business utilization commitments. Submit Appendix E form with monthly pay applications to the owner and forward copies to the State Construction Office.
- f. Make documentation showing evidence of implementation of Designer’s responsibilities available for review by State Construction Office and HUB Office, upon request.

5. Prime Contractor(s), CM at Risk, and Its First-Tier Subcontractors

Under the single-prime bidding, the separate-prime bidding, construction manager at risk and alternative contracting methods, contractor(s) will:

- a. Attend the scheduled prebid conference.
- b. Identify or determine those work areas of a subcontract where minority businesses may have an interest in performing subcontract work.
- c. At least ten (10) days prior to the scheduled day of bid opening, notify minority businesses of potential subcontracting opportunities listed in the proposal. The notification will include the following:
  - (1) A description of the work for which the subbid is being solicited.
  - (2) The date, time and location where subbids are to be submitted.
  - (3) The name of the individual within the company who will be available to answer questions about the project.
  - (4) Where bid documents may be reviewed.
  - (5) Any special requirements that may exist, such as insurance, licenses, bonds and financial arrangements.

If there are more than three (3) minority businesses in the general locality of the project who offer similar contracting or subcontracting services in the specific trade, the contractor(s) shall notify three (3), but may contact more, if the contractor(s) so desires.

- d. During the bidding process, comply with the contractor(s) requirements listed in the proposal for minority participation.
- e. Identify on the bid, the minority businesses that will be utilized on the project with corresponding total dollar value of the bid and affidavit listing good faith efforts as required by G.S. 143-128.2(c) and G.S. 143-128.2(f).
- f. Make documentation showing evidence of implementation of PM, CM-at-Risk and First-Tier Subcontractor responsibilities available for review by State Construction Office and HUB Office, upon request.
- g. Upon being named the apparent low bidder, the Bidder shall provide one of the following: (1) an affidavit (Affidavit C) that includes a description of the portion of work to be executed by minority businesses, expressed as a percentage of the total contract price, which is equal to or more than the applicable goal; (2) if the percentage is not equal to the applicable goal, then documentation of all good faith efforts taken to meet the goal. Failure to comply with these requirements is grounds for rejection of the bid and award to the next lowest responsible and responsive bidder.
- h. The contractor(s) shall identify the name(s) of minority business subcontractor(s) and corresponding dollar amount of work on the schedule of values. The schedule of values shall be provided as required in Article 31 of the General Conditions of the Contract to facilitate payments to the subcontractors.
- i. The contractor(s) shall submit with each monthly pay request(s) and final payment(s), “MBE Documentation for Contract Payment” – (Appendix E), for designer’s review.
- j. During the construction of a project, at any time, if it becomes necessary to replace a minority business subcontractor, immediately advise the owner, State Construction Office, and the Director of the HUB Office in writing, of the circumstances involved. The prime contractor shall make a good faith effort to replace a minority business subcontractor with another minority business subcontractor.

- k. If during the construction of a project additional subcontracting opportunities become available, make a good faith effort to solicit subbids from minority businesses.
- l. It is the intent of these requirements apply to all contractors performing as prime contractor and first tier subcontractor under construction manager at risk on state projects.

6. Minority Business Responsibilities

While minority businesses are not required to become certified in order to participate in the State construction projects, it is recommended that they become certified and should take advantage of the appropriate technical assistance that is made available. In addition, minority businesses who are contacted by owners or bidders must respond promptly whether or not they wish to submit a bid.

**SECTION 4: DISPUTE PROCEDURES**

It is the policy of this state that disputes that involves a person's rights, duties or privileges, should be settled through informal procedures. To that end, minority business disputes arising under these guidelines should be resolved as governed under G.S. 143-128(g).

**SECTION 5:** These guidelines shall apply upon promulgation on state construction projects. Copies of these guidelines may be obtained from the Department of Administration, State Construction Office, (physical address) 301 North Wilmington Street, Suite 450, NC Education Building, Raleigh, North Carolina, 27601-2827, (mail address) 1307 Mail Service Center, Raleigh, North Carolina, 27699-1307, phone (919) 807-4100, Website: [www.nc-sco.com](http://www.nc-sco.com)

**SECTION 6:** In addition to these guidelines, there will be issued with each construction bid package provisions for contractual compliance providing minority business participation in the state construction program.

## MINORITY BUSINESS CONTRACT PROVISIONS (CONSTRUCTION)

### APPLICATION:

The **Guidelines for Recruitment and Selection of Minority Businesses for Participation in State Construction Contracts** are hereby made a part of these contract documents. These guidelines shall apply to all contractors regardless of ownership. Copies of these guidelines may be obtained from the Department of Administration, State Construction Office, (physical address) 301 North Wilmington Street, Suite 450, NC Education Building, Raleigh, North Carolina, 27601-2827, (mail address) 1307 Mail Service Center, Raleigh, North Carolina, 27699-1307, phone (919) 807-4100, Website: <http://www.nc-sco.com>

### MINORITY BUSINESS SUBCONTRACT GOALS:

The goals for participation by minority firms as subcontractors on this project have been set at 10%.

The bidder must identify on its bid, the minority businesses that will be utilized on the project with corresponding total dollar value of the bid and affidavit (Affidavit A) listing good faith efforts **or** affidavit (Affidavit B) of self-performance of work, if the bidder will perform work under contract by its own workforce, as required by G.S. 143-128.2(c) and G.S. 143-128.2(f).

The lowest responsible, responsive bidder must provide Affidavit C, that includes a description of the portion of work to be executed by minority businesses, expressed as a percentage of the total contract price, which is equal to or more than the applicable goal.

**OR**

Provide Affidavit D, that includes a description of the portion of work to be executed by minority businesses, expressed as a percentage of the total contract price, **with documentation of Good Faith Effort, if the percentage is not equal to the applicable goal.**

**OR**

Provide Affidavit B, which includes sufficient information for the State to determine that the bidder does not customarily subcontract work on this type project.

**The above information must be provided as required. Failure to submit these documents is grounds for rejection of the bid.**

## **MINIMUM COMPLIANCE REQUIREMENTS:**

All written statements, affidavits or intentions made by the Bidder shall become a part of the agreement between the Contractor and the State for performance of this contract. Failure to comply with any of these statements, affidavits or intentions, or with the minority business Guidelines shall constitute a breach of the contract. A finding by the State that any information submitted either prior to award of the contract or during the performance of the contract is inaccurate, false or incomplete, shall also constitute a breach of the contract. Any such breach may result in termination of the contract in accordance with the termination provisions contained in the contract. It shall be solely at the option of the State whether to terminate the contract for breach.

In determining whether a contractor has made Good Faith Efforts, the State will evaluate all efforts made by the Contractor and will determine compliance in regard to quantity, intensity, and results of these efforts. Good Faith Efforts include:

- (1) Contacting minority businesses that reasonably could have been expected to submit a quote and that were known to the contractor or available on State or local government maintained lists at least 10 days before the bid or proposal date and notifying them of the nature and scope of the work to be performed.
- (2) Making the construction plans, specifications and requirements available for review by prospective minority businesses, or providing these documents to them at least 10 days before the bid or proposals are due.
- (3) Breaking down or combining elements of work into economically feasible units to facilitate minority participation.
- (4) Working with minority trade, community, or contractor organizations identified by the Office for Historically Underutilized Businesses and included in the bid documents that provide assistance in recruitment of minority businesses.
- (5) Attending any prebid meetings scheduled by the public owner.
- (6) Providing assistance in getting required bonding or insurance or providing alternatives to bonding or insurance for subcontractors.
- (7) Negotiating in good faith with interested minority businesses and not rejecting them as unqualified without sound reasons based on their capabilities. Any rejection of a minority business based on lack of qualification should have the reasons documented in writing.
- (8) Providing assistance to an otherwise qualified minority business in need of equipment, loan capital, lines of credit, or joint pay agreements to secure loans, supplies, or letters of credit, including waiving credit that is ordinarily required. Assisting minority businesses in obtaining the same unit pricing with the bidder's suppliers in order to help minority businesses in establishing credit.
- (9) Negotiating joint venture and partnership arrangements with minority businesses in order to increase opportunities for minority business participation on a public construction or repair project when possible.
- (10) Providing quick pay agreements and policies to enable minority contractors and suppliers to meet cash-flow demands.

**APPENDIX E**

**MBE DOCUMENTATION FOR CONTRACT PAYMENTS**

Prime Contractor/Architect: \_\_\_\_\_

Address & Phone: \_\_\_\_\_

Project Name: \_\_\_\_\_

Pay Application #: \_\_\_\_\_ Period: \_\_\_\_\_

The following is a list of payments made to Minority Business Enterprises on this project for the above-mentioned period.

MBE FIRM NAME	* INDICATE TYPE OF MBE	AMOUNT PAID THIS MONTH	TOTAL PAYMENTS TO DATE	TOTAL AMOUNT COMMITTED

\*Minority categories: Black, African American (B), Hispanic (H), Asian American (A), American Indian (I), Female (F), Social and Economically Disadvantage (D)

Date: \_\_\_\_\_ Approved/Certified By: \_\_\_\_\_

Name

\_\_\_\_\_

Title

\_\_\_\_\_

Signature

***SUBMIT WITH EACH PAY REQUEST & FINAL PAYMENT***

**APPENDIX E**

**MBE DOCUMENTATION FOR CONTRACT PAYMENTS**

Prime Contractor/Architect: \_\_\_\_\_

Address & Phone: \_\_\_\_\_

Project Name: \_\_\_\_\_

Pay Application #: \_\_\_\_\_ Period: \_\_\_\_\_

The following is a list of payments made to Minority Business Enterprises on this project for the above-mentioned period.

MBE FIRM NAME	* INDICATE TYPE OF MBE	AMOUNT PAID THIS MONTH	TOTAL PAYMENTS TO DATE	TOTAL AMOUNT COMMITTED

\*Minority categories: Black, African American (B), Hispanic (H), Asian American (A), American Indian (I), Female (F), Social and Economically Disadvantage (D)

Date: \_\_\_\_\_ Approved/Certified By: \_\_\_\_\_

Name

\_\_\_\_\_

Title

\_\_\_\_\_

Signature

**SUBMIT WITH EACH PAY REQUEST & FINAL PAYMENT**

**GENERAL CONDITIONS**

AIA Document A201 – 2017 – General Conditions of the Contract for Construction is referenced in these contract documents and is to be part of this contract.

This document can be obtained by contacting:

AIA North Carolina  
115 West Morgan Street  
Raleigh, North Carolina 27601  
919-833-6656 phone  
919-833-2015 fax order line

**STANDARD FORM OF AGREEMENT**

AIA Document A101 – 2017 – Standard Form of Agreement Between Owner and Contractor *where the basis of payment is a Stipulated Sum Price* is referenced in these contract documents and is to be part of this contract.

This document can be obtained by contacting:

AIA North Carolina  
115 West Morgan Street  
Raleigh, North Carolina 27601  
919-833-6656 phone  
919-833-2015 fax order line



**SECTION 00800 - SUPPLEMENTARY GENERAL CONDITIONS AND GENERAL REQUIREMENTS**

**SUPPLEMENTS TO AIA DOCUMENT A-201: 2017 Edition**

The following supplements modify, delete from or add to the "General Conditions of the Contract for Construction", AIA Document A-201, 2007. Where any Article of the General Conditions is modified or any Paragraph, Subparagraph or Clause thereof is modified or deleted by these Supplementary Conditions, the unaltered provisions of that Article, Paragraph, Subparagraph or Clause shall remain in effect. If in the event any articles of the Construction Contract are in direct conflict with Articles of the General Conditions, the Contract shall override for that portion that may be in conflict.

**ARTICLE 1:**

Add the following definitions:

- "Product" includes materials, systems, and equipment.
- "Provide" shall mean furnish and install complete in place, operational and ready for use.
- "Building Code" and "Code" refer to regulations of governmental agencies having jurisdiction
- "Or approved equal" and "equal to" shall mean substitute products by manufacturers other than those specified in the project manual, addenda, and on the drawings and which may be incorporated in the work after review and concurrence by the designer and the Owner.
- "Approved", "required", and "as directed" refer to and indicate the work or materials that may be approved, required or directed by the Architect acting as the agent for the "Owner
- "Indicated" and "shown" shall mean as detailed, or called for and reasonably implied in the contract documents.
- "Latest edition" shall mean the current printed document issued up to 30 calendar days prior to date of receipt of bids, unless specified otherwise.
- "Drawings" or "plans" mean the drawings enumerated in the contract documents, as well as all the information in the detail manual when applicable, addenda, and designer prepared field drawings and clarification drawings.
- "Specifications" mean this project manual and addenda thereto.
- "Similar" means in its general sense and not necessarily identical.
- "Shown", "indicated", "detailed", "noted", "scheduled" and terms of similar import, refer to the requirements contained in the Contract Documents.

**ARTICLE 2:**

2.2.5 Add: Drawings and Specification furnished to contractors:

Final Plans, Specifications and any Addendum will be posted on the Architect's website.

**ARTICLE 3:**

3.1.1 Add: The General Contractor shall be the "Project Expediter" and shall be responsible for proper coordination of all work.

- 3.12.11 Add: Product Data, and Samples - Each contractor shall submit electronic copies of all shop drawings, and any required samples for approval.
- 3.12.12 Add: The contractor shall make any corrections required by the Architect and file with him electronic copies, when requested. Additional copies shall be furnished to other trades and prime contractors where necessary to coordinate their work.
- 3.12.13 Add: The Contractor shall keep at the site a current set of shop drawings that bear the stamped approval of the Architect or Engineer.
- 3.15.1 Add: Prior to final inspection and acceptance of the building, the General Contractor shall clean the building, including but not limited to, glass, hardware, fixtures, equipment, masonry, clean floors as specified, and completely prepare the building for use by the Owner with no cleaning required by the Owner.

**ARTICLE 5:**

**ARTICLE 7:**

- 7.2.1 Add: The allowances for overhead and profit combined shall not exceed fifteen (15)% of net cost except where the change involves a subcontractor; allowances shall not exceed fifteen (15)% for the subcontractor and five (5)% for the prime contractor. No allowances shall be made for overhead and profit. In the case of deductible change orders, the contractor shall include not less than seven (7)% profit, but no allowance for overhead.

At the time of signing a change order, the contractor shall certify as follows, "I certify that my bonding company will be notified forthwith that my contract has been increased or decreased by the amount of this change order, and that a copy of the approved change order will be mailed upon receipt by me to my surety".

All requests for Change Orders must be in writing and be supported by a breakdown showing method of arriving at net costs. Breakdown shall include materials, labor, taxes, profit & overhead.

**ARTICLE 8:**

- 8.1.2 Add: The Contractor shall commence work to be performed under this agreement on a date to be specified in a written Notice to Proceed and shall fully complete work hereunder within **90** consecutive calendar days from said date. For each day in excess of the above number of days, the Contractor(s) shall pay to the Owner the sum of as \$150.00 per consecutive calendar day liquidated damages, reasonably estimated in advance to cover losses to be incurred by the Owner by reason of failure of said Contractor(s) to complete work within the time specified, such time being in the essence of this Contract and a material consideration thereof.

- 8.2.1 Add: In planning his construction schedule within the agreed Contract Time, it shall be assumed that the Contractor has anticipated the amount of adverse weather conditions normal to site of the Work for the season or seasons of the year involved. Only those weather delays attributable to other than normal weather conditions will be considered by the Architect, which affect the critical path schedule.

**ARTICLE 9:**

- 9.2 Add: Schedule of Values shall separate labor and material for each phase of the work.

The phases of work shall be broken down per each section of the specifications. Where a section includes two or more major items of work, they shall also be broken out separately including labor and material.

Each item in the Schedule of Values and Application for Payment shall be complete including its total cost and proportionate share of general overhead and profit margin.

At the Contractor's option, temporary facilities and other major cost items that are not direct cost of actual work-in-place may be shown as separate line items in the Schedule of Values or distributed as general overhead expense.

Submit five (5) copies, within 10 days of Notice to Proceed.

9.3.1 Add: Type of Form: Application and Certificate for Payment AIA Document G 702 and Continuation Sheet G 702A, latest edition. (The contractor may purchase these certificates from the American Institute of Architects, 1735 New York Avenue, NW, Washington, D.C.).

Number of copies: Five (5) unless otherwise noted. Must have original signatures.

Cut off for each application shall be the 25th of each month.

Application shall be in Architect's office no later than the last day of each month and shall be signed and notarized.

Retainage: Each certificate shall show, and the Owner will retain 5% of the amount of each estimate until final completion and acceptance of all work covered by the contract.

9.6.1 Add: The Owner shall make payment of each certificate no later than the last day of the following month.

**ARTICLE 11:**

Add: All Certificates of Insurance required by the Contract Documents shall contain a provision that coverage's afforded under the policies will not be canceled, reduced in amount or coverage's eliminated until at least thirty (30) days after mailing written notice, by certified mail, return receipt requested, to the insured and the Owner of such alteration or cancellation.

Full contract amount shall appear on each document as necessary.

Effective date on each document shall be the same as the contract document date.

Expiration date shall be sufficient to complete the project.

An authorized individual agent, licensed to do business in North Carolina, shall countersign each policy.

The title "Licensed Resident Agent" shall appear after the signature.

11.1 Add:

Shall be furnished and maintained by contractor as outlined with the following adjustments and additions.

General Liability shall include: Comprehensive forms, premises- operations, independent contractor's protective, products and completed operations broad form property damaged, and explosion and collapse hazard.

Automobile liability shall include: Comprehensive form, owned, hired, and non-owned.

Worker's Compensation and Employer's Liability in accordance with North Carolina Statutory requirements.

11.1.2 Limits shall be as follows:

Combined Single Limit

General Liability - For Bodily Injury and Property Damage

Each Occurrence = \$1,000,000

General Aggregate = \$2,000,000

Auto Liability - For Bodily Injury and Property Damage

Combined Single Limit = \$300,000

Employer Liability for each accident = \$100,000

Subcontractor's Insurance Coverage - The Contractor shall either:

1. Require each of his subcontractors to procure and to maintain during the life of his subcontract, Subcontractor's Comprehensive General Liability, Automobile Liability, and Property Insurance of the type and the same amount as specified in paragraph above; or
2. Insure the activity of his subcontractors in his own policy.

11.3 Revise To: Contractor to Purchase and Supply Builders Risk Insurance

11.4.1 Performance bond and payment bond will be required for 100% of the contract price.

### **ARTICLE 13: MISCELLANEOUS PROVISIONS**

The Project Expediter shall provide temporary power required for construction for all trades and disciplines unless otherwise stated in the specifications.

The Contractor will pay for electricity and water usage. The Contractor shall assure that temporary power and water are used in a responsible manner.

### **ARTICLE 15:**

15.1.5.1 Add: When Contract Time has been extended, as provided under this Paragraph 4.3.7.1, such extension of time shall not be considered as justifying extra compensation to the Contractor for Administrative costs or other such reasons.

15.1.5.2 Add: Since all work is inside – no weather days will be allowable.

15.1.2 Add: Mediation will be the first step in solving claims. Arbitration shall be used to settle disputes or claims only if both parties agree to arbitration, otherwise, all disputes and claims shall be settled by normal legal means.

If arbitration is agreed by both parties, then after appointment of the arbitrator or arbitrators, the parties to the arbitration shall have the right to take depositions and to obtain discovery regarding the subject matter of the arbitration and, to that end, to use and exercise all of the same rights, remedies, and procedures, and be subject to all of the same duties, liabilities, and obligations in the arbitration with respect to the subject matter thereof, as if the matter of the arbitration were pending in a civil action before a Superior Court of the State.

END OF SECTION 00800

## **SECTION 00820 – SPECIAL CONDITIONS**

1. **General:** The existing facility shall remain secure during the construction period. All contractors shall conduct their operations so as to cause the least possible interference with the normal operations of the facility. All contractors shall limit use of the site for access and storage of materials to those areas approved by the Owner. All access to the area of work must be through designated areas approved by the Owner. Contractors shall not be allowed access to any area other than the immediate area of work.
2. **On Site Parking:** Parking is not permitted on the Owner's property except for construction vehicles used in the performance of the work and only where approved by the Owner.
3. **Building Security:** The present level of security for the existing facility shall not be reduced in any way, due to work of this contract.
4. **Personnel Safety:** Contractor shall provide barricades and similar types of safety items required to protect anyone in the area of work from the hazards of construction activities. Roadways, walks, paths, entrances, exits, etc. shall remain unobstructed and shall be maintained in a safe and satisfactory manner. The Contractor shall assume responsibility and payments for the existing barricades in place.
5. Access to the building and site shall be only normal office hours unless otherwise approved in advance. No work on Sunday, Easter or Christmas will be permitted.
6. No smoking will be permitted on site at any time.
7. The Contractor will be responsible for all permits (application and costs).
8. The Contractor will be responsible for all dump fees and land fill fees.

END OF SECTION 00820

## **SECTION 01010 - SUMMARY OF WORK**

### PART 1 - GENERAL

#### 1.1 DESCRIPTION

- A. The Contractor shall, unless otherwise specified, supply all labor, transportation, materials, apparatus, fuel, water, energy, light and tools necessary for entire, proper and substantial completion of his work and shall install, maintain, and remove all equipment for the construction, other utensils or things and shall be responsible for the safe, proper and lawful construction, maintenance and use of same and shall construct in the best and most workmanlike manner a complete structure and everything properly incidental thereto as shown on plans, stated in specifications or reasonably implied there from, all in accordance with the Contract Documents.
- B. Contract type
- The work will be accomplished under:
1. The Single Prime Contract will be Stipulated Sum Contract covering general, mechanical, plumbing and electrical construction. All General Condition items will be clearly identified in the contract and will be a fixed amount.
- C. Scope of Work - scope of the work is, but not limited to as follows:
1. Repairs to HVAC System (See also sheet M-1)
  2. All related work
  3. Selective Demo
  4. Repairs to any damages caused by construction.

PART 2 & 3 - NOT USED.

**END OF SECTION 01010**

## **SECTION 01020 - ALLOWANCES**

### PART 1 - GENERAL

#### 1.1 DESCRIPTION

- A. General: All allowances considered in the Contract Price shall be clearly identified in the Contract and approved before signing. If the actual cost is more than, or less than the allowance, the Contract Price will be adjusted up or down accordingly when the actual cost is determined. Adjustments in the Allowances will be made by Change Order. Unless specified otherwise, the allowance amounts include the net cost of materials, and shipping charges.
  
- B. Contingency Cash Allowance: The Contractor's overhead, profit, shipping costs and taxes shall be included in the Base Bid Contract Price, but not in the allowance. All allowances agreed upon shall clearly indicate materials only or materials and labor included as the case may be. For allowance listed as materials only, the Contractor shall include in his base bid price all labor and associated installation costs. The contractor shall submit to the Architect for approval all bills for materials under Cash Allowances.

#### 1.2 CONTINGENCY CASH ALLOWANCE

- A. Contingency Cash Allowance \$75,000.00 Portions of this allowance can only be authorized for use by the Architect/Engineer approval.  
Please note: The Contractor shall include profit and overhead in their base bid and not within the allowance figure. Therefore, when portions of this allowance is used and deducted from this allowance figure, no additional overhead and profit will be allowed.

PARTS 2 & 3 - NOT USED.

**END OF SECTION 01020**



## **SECTION 01027 – APPLICATIONS FOR PAYMENT**

### **PART 1 – GENERAL**

#### **1.1 DESCRIPTION**

- A. Work included: Comply with procedures described in this Section when applying for progress payment and final payment under the Contract.
- B. Related work
  - 1. Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions, and Sections in Division 1 of these Specifications.

#### **1.2 QUALITY ASSURANCE**

- A. Prior to start of construction, secure the Architect's approval of the Schedule of Values required to be submitted under Paragraph 9.2 of the General conditions, and further described in Section 01370 of these Specifications.
- B. During progress of the work the Schedule of Value are to remain unchanged as approved by the Architect. Changes in the Contract Sum due to Change Orders or other modifications of the Contract shall be added to the Schedule of Values as Change Orders.
- C. Base requests for payment on the approved schedule of values.

#### **1.3 SUBMITTALS**

- 1. Make this preliminary submittal to the Architect at the last regular job meeting of each month.
- 2. Make submittal of request for payment by filling in the agreed data on AIA Document G702, "Application and Certificate for Payment," plus continuation sheet or sheets.
- 3. Sign and notarize the Application and Certificate for Payment.
- 4. Submit (5) originals of the Application and Certificate for Payment
- 5. Cut off period is the 25<sup>th</sup> of the month.
- 6. Submittals are due in the Architect's office by the 28<sup>th</sup> of each month.
- 7. For allowance items furnish all invoices, receipts, time records, etc. with all requests for payment.

END OF SECTION 01027

## **SECTION 01045 – CUTTING AND PATCHING**

### **PART 1 – GENERAL**

#### **1.1 DESCRIPTION**

- A. Work included: This Section establishes general requirements pertaining to cutting (including excavating), fitting, and patching of the work required to:
  - 1. Make the several parts fit properly.
  - 2. Uncover work to provide for installing, inspecting, or both, of ill-timed work.
  - 3. Remove and replace work not conforming to requirements of the Contract Documents.
  - 4. Remove and replace defective work.
  
- B. Related work
  - 1. Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions, and Sections in Division 1 of these Specifications.
  - 2. In addition to other requirements specified, upon the Architect's request uncover work to provide for inspection by the Architect of covered work, and remove samples of installed materials for testing.
  - 3. Do not cut or alter work performed under separate contracts without the Architect's written permission.

#### **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 the work of this Section.

#### **1.3 SUBMITTALS**

- A. Request for Architect's consent
  - 1. Prior to cutting which effects structural safety, submit written request to the Architect for permission to proceed with cutting.
  - 2. Should conditions of the work, or schedule, indicate a required change of materials or methods for cutting and patching, so notify the Architect and secure his written permission and any required Change Order prior to proceeding.
  
- B. Notices to the Architect
  - 1. Prior to cutting and patching performed pursuant to the Architect's instructions, submit cost estimate to the Architect. Secure the Architect's approval of cost estimates and type of reimbursement before proceeding with cutting and patching.
  - 2. Submit written notice to the Architect designating the time the work will be uncovered, to provide for the Architect's observation.

### **PART 2 – PRODUCTS**

#### **2.1 MATERIALS**

- A. For replacement of items removed, use materials complying with pertinent Sections of these Specifications.

## PART 3 – EXECUTION

### 3.1 SURFACE CONDITIONS

- A. Inspection
  - 1. Inspect existing conditions, including elements subject to movement or damage during cutting, excavating, patching, and backfilling.
  - 2. After uncovering the work, inspect conditions affecting installation of new work.
- B. Discrepancies
  - 1. If uncovered conditions are not as anticipated, immediately notify the Architect and secure needed directions.
  - 2. Do not proceed until unsatisfactory conditions are corrected.

### 3.2 PREPARATION PRIOR TO CUTTING

- A. Provide required protection including, but not necessarily limited to, shoring, bracing, and support to maintain structural integrity of the work.

### 3.3 PERFORMANCE

- A. Perform required excavating and backfilling as required under pertinent other Sections of these Specifications.
  - 1. Perform cutting and demolition by methods, which will prevent damage to other portions of the work and provide proper surfaces to receive installation of repair and new work.
  - 2. Perform fitting and adjusting of products to provide finished installation complying with the specified tolerances and finishes.

END OF SECTION 01045

## **SECTION 01050 - FIELD ENGINEERING**

### **PART 1 - GENERAL**

#### **1.1 DESCRIPTION**

- A. Work included: Provide such field engineering services as are required for proper completion of the Work including, but not necessarily limited to:
  - 1. Establishing and maintaining lines and levels.
  - 2. Structural design of shores, forms, and similar items provided by the Contractor as a part of his means and methods of construction.
  
- B. Related work:
  - 1. Additional requirements for field engineering also may be described in other Section of these Specifications.
  - 2. See also General Conditions.

#### **1.2 SUBMITTALS**

- A. Comply with pertinent provisions of Section 01340.
  
- B. Upon request of the Architect, submit:
  - 1. Certification, signed by the Contractor's retained field engineer, certifying that elevations and locations of improvements are in conformance or non-conformance with requirements of the Contract Documents.

#### **1.3 PROCEDURES**

- A. In addition to procedures directed by the Contractor for proper performance of the Contractor's responsibilities:
  - 1. Locate and protect control points before starting work on the site.
  - 2. Preserve permanent reference points during progress of the Work.
  - 3. Do not change or relocate reference points or items of the Work without specific approval from the Architect.
  - 4. Promptly advise the Architect when a reference point is lost or destroyed or requires relocation because of other changes in the Work.
    - a. Upon direction of the Architect, require the field engineer to replace reference stakes or markers.
    - b. Locate such replacements according to the original survey control.
  
- B. The Contractor shall employ a locator service to locate and mark all underground utilities as required.

**PART 2 & 3 - NOT USED.**

**END OF SECTION 01050**

## **SECTION 01090 - ABBREVIATIONS AND SYMBOLS**

### **PART 1 - GENERAL**

#### **1.1 REFERENCE TO APPLICABLE STANDARDS**

- A. Wherever reference is made to Codes, Standards Specifications or other data published by regulating agencies or accepted organizations, it shall be understood that such reference is made to the latest edition, (including addenda) published prior to the date of Contract Documents, except as noted specifically otherwise by date in the contract documents.
- B. Abbreviations and symbols used in the Specifications can be grouped into three (3) basic categories:
1. Abbreviations of reference symbols.
  2. Abbreviations of words and phrases.
  3. Symbols.
- C. Among those, which may be used in the Contract Documents, are the following (with respective abbreviation used):

AA	Aluminum Association
AAMA	Architectural Aluminum Manufacturers Association
AASHTO	American Association of State Highway and Transportation Officials
ABMA	American Boiler Manufacturers Association
ACI	American Concrete Institute
ACRI	Air Conditioning and Refrigeration Institute
ADC	Air Diffusion Council
AFI	Air Filter Institute
AGA	American Gas Association
AGCA	Associated General Contractors of America, Inc.
AIA	American Institute of Architects
AIMA	Acoustical and Insulating Materials Association
AISC	American Institute of Steel Construction
AISI	American Iron and Steel Institute
AITC	American Institute of Timber Construction
ALS	American Lumber Standards
AMCA	Air Moving and Conditioning Association
ANSI	American National Standards Institute, Inc.
APA	American Plywood Association
API	American Petroleum Institute
ARI	Air Conditioning and Refrigeration Institute
ASAHC	American Society of Architectural Hardware Consultants
ASCE	American Society of Civil Engineers
ASHRAE	American Society of Heating, Refrigeration and Air Conditioning Engineers
ASME	American Society of Mechanical Engineers
ASTM	American Society for testing and Materials
ATI	Asphalt Tile Institute
AWI	Architectural Woodwork Institute
AWPA	American Wood Preservers Association
AWPI	American Wood Preservers Institute
AWS	American Welding Society
BHMA	Builders Hardware Manufacturers Association
BIA	Brick Institute of America
BRI	Building Research Institute
CABRA	Copper and Brass Research Association

CAGI	Compressed Air and Gas Institute
CE	Corps of Engineers (Army)
CRSI	Concrete Reinforcing Steel Institute
CSI	Construction Specifications Institute
CTI	Cooling Tower Institute
DFPA	Douglas Fir Plywood Association
ETL	Electrical Testing Laboratories
FGMA	Flat Glass Marketing Association
FHA	Federal Housing Administration
FM	Factory Mutual Engineering Division, Association of Factory Mutual Fire Insurance Companies
FPL	Forest Products Laboratory
FS	Federal Specifications
FTI	Facing Tile Institute
GA	Gypsum Association
GTA	Glass Tempering Association
HPMA	Hardwood Plywood Manufacturers Association
IBRM	Institute of Boiler and Radiator Manufacturers
IEEE	Institute of Electrical and Electronics Engineering
IES	Illuminating Engineering Society
JAN	Joint Army-Navy Specifications
MAC	Masonry Advisory Council
MIA	Marble Institute of America
MLMA	Metal Lath Manufacturers Association
MS	Military Specifications
MSS	Manufacturers Standardization Society of the Valves and Fitting Industries
MSTD	Military Standard
NAAMM	National Association of Architectural Metal Manufacturers
NAFM	National Association of Fan Manufacturers
NAPF	National Association of Plastic Manufacturers
NBHA	National Builders Hardware Association
NBS	National Bureau of Standards
NCMA	National Concrete Masonry Association
NEC	National Electric Code (NFPA Pamphlet No. 70)
NEMA	National Electric Manufacturers Association
NEMI	National Elevator Manufacturing Industry, Inc.
NFC	National Fire Code
NFPA	National Fire Protection Association
NFPA	National Forest Products Association
NHLA	National Hardwood Lumber Association
NHPMA	Northern Hardwood and Pine Manufacturers Association
NPA	National Particleboard Association
NPCA	National Paint and Coatings Association
NRMCA	National Ready Mixed Concrete Association
NSC	National Safety Council
NSF	National Sanitation Foundation
NTMA	The National Terrazzo and Mosaic Association, Inc.
NWMA	National Woodwork Manufacturers Association
OSHA	Occupational Safety and Health Administration
PCA	Portland Cement Association
PCI	Prestressed Concrete Institute
PEI	Porcelain Enamel Institute, Inc.
PS	Product Standard, U.S. Department of Commerce
RIS	Redwood Inspection Service
RTI	Resilient Tile Institute
SAE	Society of Automotive Engineers
SBI	Steel Boiler Institute

SCMA	Southern Cypress Manufacturers Association
SDI	Steel Deck Institute
SDI	Steel Door Institute
SJI	Steel Joint Institute
SMACCNA	Sheet Metal and Air Conditioning Contractors National Association
SMFMA	Sprayed Mineral Fiber Manufacturers Association, Inc.
SPIB	Southern Pine Inspection Bureau
SSPC	Steel Structures Painting Council
SWFPA	Structural Wood Fiber Products Association
TCA	Tile Council of America
TEMA	Tubular Exchange Manufacturing Association
TIMA	Thermal Insulation Manufacturers Association
TPI	Truss Plate Institute
UL	Underwriter's Laboratories, Inc.
UPC	Uniform Plumbing Code
WRI	Wire Reinforcement Institute
WWPA	Western Wood Products Association

1.2 ABBREVIATIONS OF WORDS AND PHRASES

- A. Abbreviations of words and phrases applicable to this Project; other than listed above for reference standards, shall be as per Architect's interpretation on request..

1.3 SYMBOLS

- A. Symbols representing construction materials and the equipment applicable to this Project shall be as shown on the Drawings.

PART 2 & 3 - NOT USED.

END OF SECTION 01090

## **SECTION 01200 - PROJECT MEETINGS**

### **PART 1 - GENERAL**

#### **1.1 DESCRIPTION**

- A. Work included: To enable orderly review during progress of the Work, and to provide for systematic discussion of problems, the Owner will conduct project meetings throughout the construction period.
- B. Related work:
  - 1. The Contractor's relations with his subcontractors and materials suppliers, and discussions relative thereto, are the Contractor's responsibility and normally are not part of project meetings content. If subcontractor's issues are of a concern, it can be communicated at this meeting, but management of the subcontractor will remain the responsibility of the Contractor.

#### **1.2 SUBMITTALS**

- A. Agenda items: To the maximum extent practicable, advise the Owner at least 24 hours in advance of project meetings regarding items to be included in or added to the agenda.
- B. Minutes:
  - 1. The Architect will compile minutes of each project meeting, and will furnish one copy to Contractor, Architect and required copies to the Owner.
  - 2. Recipients of copies may make and distribute such other copies as they wish.

#### **1.3 QUALITY ASSURANCE**

- A. For those persons designated by the Contractor to attend and participate in project meetings, provide required authority to commit the Contractor to solutions agreed upon in the project meetings.

### **PART 2 - PRODUCTS**

(No products are required in this Section)

### **PART 3 - EXECUTION**

#### **3.1 GENERAL**

- A. Except as noted below for Pre-construction Meeting, project meetings will be held monthly, unless project dictates differently.
- B. Coordinate as necessary to establish mutually acceptable schedule for meetings.

#### **3.2 PRECONSTRUCTION MEETING**

- A. Pre-construction Meeting will be held as soon as possible after the written Notice to Proceed.
  - 1. Provide attendance by authorized representatives of the Contractors and major subcontractors.
  - 2. The Owner will advise other interested parties, including the Architect, and request their attendance.



- B. Minimum agenda: Data will be distributed and discussed on at least the following items:
1. Organizational arrangement of Contractor's forces and personnel, and those of subcontractors, materials suppliers.
  2. Channels and procedures for communication.
  3. Construction schedule, including sequence of critical work.
  4. Contract Documents, including distribution of required copies of original Documents and revisions.
  5. Processing of Shop Drawings and revisions.
  6. Processing of Bulletins, field decisions, and Change Orders.
  7. Rules and regulations governing performance of the Work
  8. Procedures for safety and first aid, security, quality control, housekeeping, and related matters.

### 3.3 PROJECT MEETINGS

- A. Attendance:
1. To the maximum extent practical, assign the same person or persons to represent the Contractor at project meetings throughout progress of the Work.
  2. Subcontractors, materials suppliers, and others may be invited to attend those project meetings in which their aspect of the Work is involved.
- B. Minimum agenda:
1. Review progress of the Work since last meeting, including status of submittals for approval.
  2. Identify problems, which impede planned progress.
  3. Develop corrective measures and procedures to regain planned schedule.
  4. Complete other current business.

END OF SECTION 01200

## **SECTION 01310 - SCHEDULES AND REPORTS**

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General Conditions and other Division 1 specifications sections, apply to work of this section.

#### 1.2 DESCRIPTION

- A. Post Award Requirements
  - 1. Draft of Construction Schedule: Within two weeks of Date of Commencement of the Work, Contractor shall complete draft of time-scaled CPM Construction Schedule. (Bar chart is acceptable.)
  - 2. Level of Detail: Except for procurement and General Conditions requirements, differentiate activities on schedule so that no single activity shown requires more than twenty-one (21) calendar days to complete.
- B. Schedule of Values
  - 1. Within seven (7) days after completion of CPM Construction Schedule and before first pay request, Contractor shall submit Schedule of Values (see Section 01370) for review by the Architect allocating a dollar value for each activity on Construction Schedule. Dollar value for each activity will include cost broken into labor, materials, and pro rata contribution to overhead and profit. Subcontract sums will be identified on the Schedule of Values and broken down as described above.
- C. Approval
  - 1. Approval of Construction Schedule and Schedule of Values will be signified by the Architect and Contractor's joint signatures on one copy of each document. Thereafter, Project will be monitored with Construction Schedule, which Contractor shall use in planning, organizing, directing, coordinating, and executing the Work and which shall be the basis for evaluating the progress of the Work.
- D. Schedule Revisions
  - 1. General: Revisions to approved Construction Schedule must be approved in writing by Architect and Contractor.
  - 2. Contractor: Submit requests for revisions to schedule to Architect together with written rationale and description of logic for rescheduling work to maintain Specific Contractual Milestone Dates.
    - a. Proposed revisions acceptable to the Architect will be incorporated into next update of Construction Schedule by the Contractor.
  - 3. Owner: Changes initiated by Owner and implemented by Change Orders which have potential to affect critical dates will require Contractor to prepare revised schedule for the Architect's concurrence. The Architect's approved revisions will be incorporated into the Construction Schedule. Adjustments in scheduled completion dates, either for intermediate activities or for Contract as a whole, will be considered only to extent that there is not sufficient float to absorb the revisions accepted.
- E. Recovery Schedule
  - 1. General: Should updated Construction Schedule show Contractor to be fourteen (14) or more days behind schedule at any time during construction, the Architect may require Contractor to prepare Recovery Schedule, displayed in

- CPM format, which will display Contractor's plan for returning to schedule within subsequent pay period.
2. Schedule Preparation: Within seven (7) days after notice from the Architect, prepare and submit to the Architect a Recovery Schedule, incorporating best available information from Subcontractors and others which will permit return to Construction Schedule within subsequent pay period. Prepare Recovery Schedule to same level of detail as Construction Schedule.
  3. Schedule Assessment: Seven (7) days prior to expiration of Recovery Schedule, confer with the Architect to assess effectiveness of Recovery Schedule. As a result of this conference, the Architect will direct Contractor as follows:
    4. Behind Schedule: If the Architect determines Contractor is still behind schedule, the Architect will direct Contractor to prepare another Recovery Schedule for subsequent pay period.
    5. On Schedule: If the Architect determines Contractor has successfully complied with provisions of Recovery Schedule, the Architect will direct Contractor to return to use of Construction Schedule.

F. Project Management Software

1. The Architect or Engineer is not obligated to use the Contractor's choice of management software such as Procore etc.

PARTS 2 & 3 - NOT USED.

END OF SECTION 01310

## **SECTION 01340 - SUBMITTALS AND SUBSTITUTIONS**

### **PART 1 - GENERAL**

#### **1.1 DESCRIPTION**

- A. Work included: Make submittals required by the Contract Documents, and revise and resubmit as necessary to establish compliance with the specified requirements.
- B. Related work:
  - 1. Documents affecting work of this Section include but are not necessarily limited to General Conditions Amendments to General Conditions, Supplementary Conditions, and Sections in Division 1 of these Specifications.
  - 2. Individual requirements for submittals also may be received in pertinent Sections of these Specifications.
- C. Work not included:
  - 1. Unrequired submittals will not be reviewed by the Architect/Owner.
  - 2. The Contractor may require his subcontractors to provide drawings, setting diagrams, and similar information to help coordinate the Work, but such data shall remain between the Contractor and his subcontractors and will not be reviewed by the Architect/Owner.

#### **1.2 SUBMITTALS**

- A. Make submittals of Shop Drawings, Samples, substitution requests, 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 CONFORMS IN ALL RESPECTS to the specified requirements.
  - 3. By affixing his signature to each submittal, the Contractor certifies that THIS COORDINATION HAS BEEN PERFORMED.
  - 4. The Contractor shall stamp the shop drawings as "Approved" or "Approved as Noted" before submitting to Architect/Owner for review.

#### **1.3 QUALITY ASSURANCE**

- A. "Equals" and "Substitutions"
  - 1. The Contract is based on the standards of quality established in the Contract Documents. Requests for substitutions will be considered when submitted according to the procedures set forth below.
    - a. Particularly with regard to MAJOR materials, equipment or methods proposed for the Work as set forth in the Contract Documents, Contractor's request(s) for approvals of "equals" not specifically named in the Contract Documents MUST BE SUBMITTED IN WRITING with supporting documentation, and in the hands of the Architect/Owner prior to contract award. Telephone requests for consideration of proposed "equals" will not be accepted.
    - b. On other items of Work, Contractor may request consideration of substitution, when submitted in writing with supporting documentation within thirty (30) days following the Notice to Proceed.

- B. Where the phrase "or equal" or "equal as approved by Architect/Owner" occurs in the Contract Documents, do not assume that the Contractor's choice of materials, equipment, or methods will be approved as equal unless the item has been specifically approved for this Work by the Architect/Owner.
- C. Do not substitute materials, equipment, or methods unless such substitution has been specifically approved in writing for this Work by the Architect/Owner.

## PART 2 - PRODUCTS

### 2.1 SHOP DRAWINGS

- A. Scale and Measurements: Make Shop Drawings accurately to a scale sufficiently large to show all pertinent aspects of the item and its methods of connection to the Work.
- B. Types of prints required:
  - 1. Submit Shop Drawings in electronic format.
- C. Review comments of the Architect/Owner will be shown in red on prints and returned to the Contractor. The Contractor may make and distribute such copies as are required for his purposes.
- D. Please note ALL shop drawings MUST be approved and stamped by the Contractor before submitting to the Architect. Any unreviewed and not approved by the Contractor shop drawings will be returned to the Contractor unreviewed.

### 2.2 MANUFACTURER'S LITERATURE

- A. Where contents of submitted literature from the manufacturers includes data not pertinent to the submittal, clearly show which portions of the contents are being submitted for review.

### 2.3 SAMPLES

- A. Provide Sample or Samples identical to the precise article proposed to be provided. Identify as described under "Identification of Submittals" below.
- B. Number of Samples required:
  - 1. Unless otherwise specified, submit one sample in the quantity, which is required to be returned, plus one which will be retained by the Architect/Owner.
  - 2. By prearrangement in specific cases, a single Sample may be submitted for review and, when approved, be installed in the Work at a location agreed upon by the Architect/Owner.

## PART 3 - EXECUTION

### 3.1 IDENTIFICATION OF SUBMITTALS

- A. Consecutively number all submittals. M-1, M-2, .....etc. for Mechanical (HVAC)
  - 1. When material is resubmitted of any reason, transmit under a new letter of transmittal and with a shop drawing number. (M-1r)
  - 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 for the duration of the Work, showing current status of all submittals at all times. Make the submittal log available to the Architect/Owner 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.
  - 1. Partial submittals may be rejected as not complying with the provisions of the Contract.

### 3.3 TIMING OF SUBMITTALS

- A. Make submittals far enough in advance of schedule dated for installation to provide time required for reviews, for securing necessary approvals, for possible revisions and resubmittals, and for placing orders and securing delivery. All submittals shall be submitted within sixty (60) days of the notice to proceed.

### 3.4 ARCHITECT/OWNER REVIEW

- A. Review by the Architect/Owner does not relieve the Contractor from responsibility for errors, which may exist in the submitted data.
- B. Revisions
  - 1. Make revisions required by Architect/Owner.
  - 2. If the Contractor considers any required revision to be a change, he shall so notify the Architect/Owner as provided in the General Conditions.
  - 3. Make only those revisions directed or approved by the Architect/Owner.
- C. Reimbursement of Architect/Owner's Costs
  - 1. In the event substitutions are proposed to the Architect/Owner after the Contract has been awarded, the Architect/Owner will record all time used by him and by his consultants in evaluation of each such proposed substitution.
  - 2. Whether or not the Architect/Owner approves a proposed substitution, the Contractor, promptly upon receipt of the Architect/Owner's billing, reimburse the Architect/Owner at the rate of two and one-half times the direct cost to the Architect/Owner and his consultants for all the time spent by them in evaluating the proposed substitution.

END OF SECTION 01340

## **SECTION 01370 - SCHEDULE OF VALUES**

### PART 1 - GENERAL

#### 1.1 DESCRIPTION

- A. Work included: Provide a detailed breakdown of the agreed Contract sum showing values allocated to each of the various parts of the Work, as specified herein and in other provisions of the Contract Documents.
- B. Related work:
  - 1. Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Amendments to General Conditions, Supplementary Conditions, and Sections in Division 1 of these Specifications.
  - 2. Schedule of values may be described on the continuation sheet of AIA document G702 accompanying applications for payment.
  - 3. Schedule of values is required under Paragraph 9.2 of the General Conditions.

#### 1.2 QUALITY ASSURANCE

- A. Use required means to assure arithmetical accuracy of the sums described.
- B. When so required by the Architect/Engineer, provide copies of the subcontracts or other data acceptable to the Architect/Engineer, substantiating the sums described.

#### 1.3 SUBMITTALS

- A. Prior to first application for payment, submit a proposed schedule of values to the Architect/Owner. See Section 01310.
  - 1. Meet with the Architect/Engineer and determine additional data, if any, required to be submitted.
    - a. Mobilization, Submittal Review, Material Delivery, Execution of the Work, and Punchlisting shall be included in the schedule.
    - b. Mobilization shall be billed on a monthly basis equally distributed throughout construction contract time.
    - c. Materials and Labor breakdowns should be provided for each portion of work.
  - 2. Secure the Architect/Engineer's approval of the schedule of values prior to submitting first application for payment.

PART 2 & 3 - NOT USED.

END OF SECTION 01370

## **SECTION 01500 - TEMPORARY FACILITIES AND CONTROLS**

### PART 1 - GENERAL

#### 1.1 DESCRIPTION

- A. Work included: Provide temporary facilities and controls needed for the Work including, but not necessarily limited to:
  - 1. Temporary utilities such as heat, water, electricity, facsimile machine and telephone
  - 2. Sanitary facilities
  - 3. Enclosures such as tarpaulins, barricades, and canopies
  - 4. Project sign
- B. Related work:
  - 1. Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Amendments to General Conditions, Supplementary Conditions, and Sections in Division 1 of these Specifications.
  - 2. Except that equipment furnished by subcontractors shall comply with requirements of pertinent safety regulations, such equipment normally furnished by the individual trades in execution of their own portions of the Work are not part of this Section.
  - 3. Permanent installation and hookup of the various utility lines are described in other Sections.

#### 1.2 PRODUCT HANDLING

- A. Maintain temporary facilities and controls in proper and safe condition throughout progress of the Work.

#### 1.3 LOCAL REGULATIONS

- A. Comply with all local ordinances including local and temporary facilities, parking and storage.

### PART 2 - PRODUCTS

#### 2.1 UTILITIES

- A. Electricity:
  - 1. The Contractor to provide necessary temporary wiring and, upon completion of the Work, remove such temporary facility.
  - 2. Provide area distribution boxes so located that the individual trades may furnish and use 100' maximum length extension cords to obtain power and lighting at points where needed for work, inspection, and safety.
  - 3. Owner will pay electric bill for reasonable usage of electricity.



- A. Heating: Provide and maintain temporary heat necessary for proper conduct of operations needed in the Work.

## 2.2 SANITARY FACILITIES

- 1. Provide temporary sanitary facilities in the quantity required for use by all personnel.
- 2. Always maintain in a sanitary condition.

## 2.2 ENCLOSURES

- A. Provide and maintain for the duration of construction all scaffolds, tarpaulins, canopies, warning signs, steps, platforms, bridges, and other temporary construction necessary for proper completion of the Work in compliance with pertinent safety and other regulations.
  - 1. All apparatus, equipment, temporary and permanent construction shall meet all local and State labor laws and safety regulations applicable thereto.

## 2.4 PROJECT SIGN

- A. Project signs shall only be installed where approved by Architect/Owner.
- A. Upon completion of the Work, demount the project signs.
- B. Except as otherwise specifically approved by the Architect/Owner, do not permit other signs or advertising on the job site.

## PART 3 - EXECUTION

### 3.1 MAINTENANCE AND REMOVAL

- A. Maintain temporary facilities and controls as long as needed for safe and proper completion of the Work.
- B. Remove such temporary facilities and controls as rapidly as progress of the Work will permit, or as directed by the Architect/Owner.

### 3.2 TRAFFIC COORDINATION

- A. Any construction related activities, such as receiving, loading, unloading, or other activities which may be an interruption to normal vehicular traffic flow on the site shall be coordinated in advance by the Contractor with the Owner or public authority having jurisdiction.

END OF SECTION 01500

## **SECTION 01620 - PRODUCT HANDLING**

### PART 1 - GENERAL

#### 1.1 DESCRIPTION

- A. Work Included: Protect products scheduled for use in the Work by means including, but not necessarily limited to, those described in this Section.
- B. Related work:
  - 1. Documents affecting work of this Section include, but are not necessarily limited to the General Conditions, Supplementary Conditions, and Sections in Division 1 of these Specifications.
  - 2. Additional procedures also may be prescribed in other Sections of these Specifications.

#### 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 MANUFACTURER'S RECOMMENDATIONS

- A. Except as otherwise approved by the Architect/Owner, determine and comply with manufacturer's recommendations on product handling, storage and protection.

#### 1.4 PACKAGING

- A. Deliver products to the job site in the manufacturer's original containers with labels intact and legible.
  - 1. Maintain packaged materials with seals unbroken and labels intact until time of use.
  - 2. 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.
- B. The Architect/Owner may reject as non-complying, material and products that do not bear identification satisfactory to the Architect/Owner 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. Provide protection for finished floor surfaces in traffic are prior to allowing equipment or materials to be moved over such surfaces.
- C. 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 replacement sand repairs to the approval of the Architect/Owner, and at no additional cost to the Owner.
- B. Additional time required to secure replacements and to make repairs will not be considered by the Architect/Owner to justify an extension in the Contract Time of Completion.

END OF SECTION 01620

## **SECTION 01710 - CLEANING**

### PART 1 - GENERAL

#### 1.1 DESCRIPTION

- A. Work included: Throughout the construction period, maintain the building and site in a standard of cleanliness as described in this Section.
- B. Related work:
  - 1. Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Amendments to General Conditions, Supplementary Conditions, and Sections in Division 1 of these Specifications.
  - 2. In addition to standards described in this Section, comply with requirements for cleaning as described in pertinent other Sections of these Specifications.

#### 1.2 QUALITY ASSURANCE

- A. Conduct daily inspection to verify that requirements for cleanliness are being met.
- B. In addition to the standards described in this Section. Comply with pertinent requirements of governmental agencies having jurisdiction.

### PART 2 - PRODUCTS

#### 2.1 COMPATIBILITY

- A. Use only the cleaning materials and equipment, which are compatible with the surface being cleaned, as recommended by the manufacturer of the material.

### PART 3 - EXECUTION

#### 3.1 PROGRESS CLEANING

- A. General:
  - 1. Retain stored items in an orderly arrangement allowing maximum access, not impeding traffic or drainage, and providing required protection of materials.
  - 2. Do not allow accumulation of scrap, debris, waste material, and other items not required for construction of this Work.
  - 3. At least twice each month, 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 ecology.
  - 5. The building shall be cleaned daily of all debris and waste material resulting from the construction operations.

END OF SECTION 01710

## **SECTION 01720 - PROJECT RECORD DOCUMENTS**

### **PART 1 - GENERAL**

#### **1.1 RECORD DRAWINGS**

- A. Contractors shall maintain a set of Record Drawings at the project site. These shall be kept legible and current, and shall be available at all times for the inspection of the Architect/Owner. All differences or changes in the contract work, or work added, shall be recorded daily on these Record Drawings in a contrasting color.
- B. The Architect/Owner shall approve the Record Drawings.
- C. Receipt and approval of Record Drawings are prerequisites for final payment.

#### **1.2 MANUALS**

- A. Each Contractor shall submit to the Architect/Owner before final acceptance electronic copies of all installation, operating instructions, and maintenance instructions on the equipment and materials furnished under his contract. Each set shall be organized into electronic folders. Label folders designating the name of the project, the names of the Owner, the name of the Contractor, and the equipment or materials included in the manual.

#### **1.3 GUARANTEES AND WARRANTIES**

- A. Contractors shall submit to the Architect/Owner before final acceptance three originals of all warranties, guarantees, and surety bonds. All such documents shall show the name and location of the project and the name of the Owner.

PART 2 & 3 - NOT USED.

END OF SECTION 01720

## **SECTION 15900 - INSTRUMENTATION AND CONTROL FOR HVAC**

### **PART 1 – GENERAL**

#### **1.01 BUILDING AUTOMATION SYSTEM - GENERAL DESCRIPTION**

- A. Provide a new Building Automation System (BAS) to integrate and control all mechanical equipment associated with this project.
1. The Building Automation System shall be as indicated on the drawings and described in these specifications. System must be fully integrated and coordinated with mechanical equipment DDC controllers furnished and installed in the equipment manufacturer's factory as specified in those sections. The intent of the BAS is to integrate all mechanical equipment into one system for global monitoring, control, and alarming associated with the building. It is the BAS manufacturer's responsibility to provide all the design, engineering, and field coordination required to ensure all equipment sequence of operations are met as specified and the designated BAS operators have the capability of managing the building mechanical system to ensure occupant comfort while maintaining energy efficiency.
  2. The BAS shall meet open standard protocol communication standards (As defined in System Communications Section) to ensure the system maintains "interoperability" to avoid proprietary arrangements that will make it difficult for the Owner to consider other BAS manufacturers in future projects.
  3. Direct Digital Control (DDC) technology shall be used to provide the functions necessary for control of mechanical systems and terminal devices on this project.
  4. Approved vendors, products and web services shall comply with SOC2 Type I as defined by the AICPA. SOC2 Type 1 compliance is a certification that confirms that a service provider has established and implemented effective controls to secure their clients' data in accordance with the Trust Services Criteria (TSC).
    - a. SOC2 Type 1 compliance provides assurance to customers that the service provider has established and implemented effective security controls and is committed to protecting their data.
    - b. To achieve SOC2 Type 1 compliance, the manufacturer shall have completed an independent audit to assess design and implementation of their controls, policies, and procedures.
  5. The BAS shall accommodate simultaneous multiple user operation. Access to the control system data should be limited only by the security permissions of the operator role. Multiple users shall have access to all valid system data. An operator shall be able to log onto any workstation on the control system and have access to all appropriate data.

#### **1.03 APPROVED CONTROL SYSTEM MANUFACTURERS**

A. Approved BAS Manufacturers:

1. Trane Tracer®
2. Johnson Controls
3. Schneider

230900

### **PART 2 - PRODUCTS**

## 2.01 MATERIALS:

- A. Use new products that the manufacturer is currently manufacturing and that have been installed in a minimum of 25 installations. Do not use this installation as a product test site unless explicitly approved in writing by the owner or the owner's representative. Spare parts shall be available for at least five years after completion of this contract.

## 2.02 SYSTEM COMMUNICATION

### A. System Communications

1. Each workstation, building controller, and equipment controller communication interface shall utilize the BACnet™ protocol with an Ethernet (IEEE 802.3), Wi-Fi (IEEE 802.11), RS485 (EIA-485), or Zigbee® (802.15.4) physical interface and an appropriate data link technology as defined in ANSI®/ASHRAE® Standard 135-2012. (e.g. BACnet over IP, BACnet over IPv6, BACnet SC, BACnet over MS/TP, BACnet Zigbee).
2. All system controllers shall be BTL listed as a BACnet Building Controller (B-BC) as defined in ANSI®/ASHRAE® Standard 135-2012.
3. All documented status and control points, schedule, alarm, and data-log services or objects shall be available as standard object types as defined in ANSI®/ASHRAE® Standard 135-2012.
4. Each System Controller shall communicate with a network of Custom Application and Application Specific Controllers utilizing one or more of the interfaces documented within Field Bus Communications below.
5. All Operator Workstations (B-OWS, B-AWS) and Building Controllers (B-BC) shall support BACnet Secure Connect (BACnet SC), a secure and encrypted datalink layer specifically designed for those networks.

### B. Field Bus Communications

1. BACnet™
  - a. All equipment and plant controllers shall be BTL listed as a BACnet Application Specific Controller (B-ASC) or a BACnet Advanced Application Controller (B-AAC) as defined in ANSI®/ASHRAE® Standard 135-2012.
  - b. All communication shall conform to ANSI®/ASHRAE® Standard 135-2012.
  - c. System Controller shall function as a BACnet router to each unit controller providing a globally unique BACnet Device ID for all BACnet controllers within the system.
  - d. BACnet Zigbee®
    - i. Communication between System Controller and equipment/plant controllers shall utilize BACnet Zigbee as defined in ANSI®/ASHRAE® Standard 135-2012.
    - ii. Each equipment controller wireless communication interface shall self-heal to maintain operation in the event of network communication failure.
    - iii. Each zone sensor wireless communication interface shall be capable of many-to-one sensors per controller to support averaging, monitoring, and multiple zone applications. Sensing options shall include temperature, relative humidity, CO2, and occupancy.
  - e. BACnet MS/TP

- i. Communication between System Controller and RTUs and WCIs shall utilize BACnet MS/TP as defined in ANSI®/ASHRAE® Standard 135-2012.

## 2.03 OPERATOR INTERFACE

### A. Provide Building Operator Web Interface

1. Manufacturer shall provide a user interface with time-of-day schedules, data collection, dashboards, reports and building summary, system applications, and self-expiring timed overrides. Manufacturer shall provide a published user and applications guide(s) that detail the system application operation, configuration, setup and troubleshooting.
2. The building operator web interface shall be accessible via a web browser without requiring any “plug-ins” (i.e. JAVA Runtime Environment (JRE), Adobe Flash).
3. User Roles
  - a. The system shall include pre-defined “roles” that allow a system administrator to quickly assign permissions to a user.
  - b. User logon/logoff attempts shall be recorded.
  - c. The system shall protect itself from unauthorized use by automatically logging off following the last keystroke. The delay time shall be user definable.
4. On-Line Help and Training
  - a. Provide a context sensitive, on line help system to assist the operator in operation and configuration of the system.
  - b. On-line help shall be available for all system functions and shall provide the relevant data for each particular screen.
5. Equipment and Application Pages
  - a. The building operator web interface shall include standard pages for all equipment and applications. These pages shall allow an operator to obtain information relevant to the operation of the equipment and/or application, including:
    - i. Animated Equipment Graphics for each major piece of equipment and floor plan in the System. This includes:
      - Each RTU, VAV Terminal and Fan. These graphics shall show all points dynamically as specified in the points list.
      - Animation capabilities shall include the ability to show a sequence of images reflecting the position of analog outputs, such as valve or damper positions. Graphics shall be capable of launching other web pages.
    - ii. Alarms relevant to the equipment or application without requiring a user to navigate to an alarm page and perform a filter.
    - iii. Historical Data (As defined in Trend Logs section of CONTROLLER SOFTWARE) for the equipment or application without requiring a user to navigate to a Data Log page and perform a filter.
  - b. VAV Air System. An operator shall be able to view and control (where applicable) the following parameters via the building operator web interface:
    - i. System Mode
    - ii. System Occupancy
    - iii. VAV box minimum and maximum flow

- iv. VAV box drive open and close overrides
  - v. VAV box occupancy status
  - vi. VAV box Airflow to space
  - vii. Space temperature
6. System Graphics. Building operator web interface shall be graphically based and shall include at least one graphic per piece of equipment or occupied zone, graphics for each chilled water and hot water system, and graphics that summarize conditions on each floor of each building area included in this contract. Indicate thermal comfort on floor plan summary graphics using colors to represent zone temperature relative to zone set point.
- a. Graphic imagery – graphics shall use 3D images for all standard and custom graphics. The only allowable exceptions will be photo images, maps, schematic drawings, and selected floor plans.
  - b. Animation. Graphics shall be able to animate by displaying different Image lies for changed object status.
  - c. Alarm Indication. Indicate areas or equipment in an alarm condition using color or other visual indicator.
7. Graphics Library. Furnish a library of standard HVAC equipment such as chillers, air handlers, terminals, fan coils, unit ventilators, rooftop units, and VAV boxes, in 3-dimensional graphic depictions. The library shall be furnished in a file format compatible with the graphics generation package program.
8. Manual Control and Override
- a. Point Control. Provide a method for a user to view, override, and edit if applicable, the status of any object and property in the system. The point status shall be available by menu, on graphics or through custom programs.
  - b. Temporary Overrides. The user shall be able to perform a temporary override wherever an override is allowed, automatically removing the override after a specified period of time.
  - c. Override Owners. The system shall convey to the user the owner of each override for all priorities that an override exists.
  - d. Provide a specific icon to show timed override or operator override, when a point, unit controller or application has been overridden manually.
9. Scheduling. - The scheduling application shall provide graphical representation of the day, week, month and exception events.
10. Alarm/Event Notification
- a. Alarm/Event Log. The operator shall be able to view all logged system alarms/events from any building operator web interface.
    - i. The operator shall be able to sort and filter alarms from events. Alarms shall be sorted in a minimum of 4 categories based on severity.
    - ii. The operator shall be able to acknowledge and add comments to alarms
    - iii. Alarm/event messages shall use full language, easily recognized descriptors.
  - b. Alarm Suppression. Alarms shall be able to be suppressed based on load/source relationships to present the likely root cause to the building operator as described in ASHRAE Guideline 36. Load/Source relationships shall be configurable by the user through a web interface.



## 11. Reports and Logs.

- a. The building operator web interface shall provide a reporting package that allows the operator to select reports.
- b. The building operator web interface shall provide the ability to schedule reports to run at specified intervals of time.
- c. The following standard reports shall be available without requiring a user to manually configure the report:
  - i. All Points in Alarm Report: Provide an on demand report showing all current alarms.
  - ii. All Points in Override Report: Provide an on demand report showing all overrides in effect.
  - iii. Commissioning Report: Provide a one-time report that lists all equipment with the unit configuration and present operation.
  - iv. Points report: Provide a report that lists the current value of all points
- d. The controls vendor shall provide a hardening report that summarizes the port configuration details to ensure sites have not been exposed to the Internet in alignment with Cyber Security best practices.

### B. Provide Mobile App Interface

1. Provide mobile (smart phone or tablet) interfaces to the building automation system, compatible with iOS and Android™ operating systems.
2. Controls manufacturer shall provide a phone/tablet interface with the ability to view/override status and setpoints, view/change schedules, view/acknowledge/comment on alarms, and view graphics for all spaces and equipment.
3. This phone/tablet interface shall resize itself appropriately for the size of the interface (i.e. no "pinching and zooming" required).
4. This phone/tablet interface shall function remotely from the facility while following IT security best practices (e.g. no ports exposed to the internet).
5. The operator interface shall support system access on a mobile device via a mobile app to:
  - a. Alarm log
  - b. System Status
  - c. Equipment status
  - d. Space Status
  - e. Standard Equipment graphics
  - f. Override set points
  - g. Override occupancy
  - h. Acknowledge Alarms
  - i. Add Comment(s) to Alarms

## 2.04 BUILDING CONTROLLER SOFTWARE

- A. Manufacturer shall provide standard applications to deliver HVAC system control. Standard applications include Time of Day Scheduling with Optimal Start/Stop, VAV Air Systems Control, Chiller Plant Control, Historical Trend Logs and Trim and Respond. Manufacturer

shall provide system optimization strategies for functions such as fan pressure optimization and ventilation optimization.

- B. Furnish the following applications software for building and energy management. All software applications shall reside and run in the system controllers. Editing of applications shall occur at the building operator interface.

1. VAV Air Systems Applications

- a. The BAS shall provide air system applications that coordinate air handlers (AHU)/rooftop units (RTU) and Variable Air Volume Terminal equipment.
- b. The air system applications shall perform the following functions:
  - i. Startup and shutdown the air handler safely. Ensure the VAV boxes are open sufficiently when the air handler is running, to prevent damage to the ductwork and VAV boxes due to high air pressure.
  - ii. Fan Pressure Optimization (ASHRAE 90.1, Guideline 36) - Minimize energy usage by controlling system static pressure to the lowest level while maintaining zone airflow requirements. Trim and respond reset logic shall reset setpoint within the range of min and max values based on zone requests.
  - iii. During commissioning, and with the engineer/owner, the controls contractor shall confirm the performance of Fan Pressure Optimization by conducting a field functional test that demonstrates critical zone reset.
  - iv. Ventilation Optimization (ASHRAE 62) – properly ventilate all spaces while minimizing operating energy costs, using measured outdoor air flow. Dynamically calculate the system outdoor air requirement based on “real time” conditions in the spaces (i.e., number of occupants, CO2 levels, etc.) minimizing the amount of unconditioned outdoor air that must be brought into the building.
  - v. Discharge Air Temperature Reset (ASHRAE 90.1, Guideline 36) - Minimize energy usage by controlling discharge air temperature in response to building loads and outdoor air temperature. Trim and respond reset logic shall reset setpoint within the range of min and max values based on zone requests.
- c. The Air Systems application shall provide a user interface that includes status of current system operation with real time data of key operating parameters. Key operating parameters for Guideline 36 include:
  - i. Duct Static Pressure
  - ii. Duct Static Optimization Setpoint
  - iii. Outdoor Airflow
  - iv. Ventilation Optimization Setpoint
  - v. Duct Static Optimization Maximum VAV Damper/Source VAV Box
  - vi. Ventilation Optimization Maximum VAV Vent Ratio/Source VAV box
  - vii. Discharge Air Temperature
  - viii. Discharge Air Temperature Optimization Setpoint
  - ix. Duct Static Optimization System Requests
  - x. Discharge Air Temperature Optimization System Requests
- d. The air system application status screens shall explain what optimization calculations are occurring, critical parameters, and source equipment members. The optimization status, inputs, and results shall be displayed for VAV Ventilation Optimization (calculating proper outside air intake), VAV Discharge Air Temperature Optimization (calculating proper discharge air temperature) and VAV Duct Static Pressure Optimization (calculating proper fan static pressure).

- e. The air systems applications shall provide a user interface that enables configuration changes made by swipe and type fields, selection list, and check box entry for feature definition:
    - i. VAV Auxiliary Night Heat
    - ii. VAV Source Temperature Distribution
    - iii. Changeover System control
    - iv. Start/Stop Delay operation
    - v. Enable/Disable Optimization Strategies (Duct Static Optimization, Discharge Air Temperature Optimization and Ventilation Optimization)
  
  - f. The operation of VAV Terminal equipment members of the VAV Air System shall be selected by check box to optionally participate in the following functions when for Guideline 36 applications:
    - i. System calculations (min, max, average)
    - ii. Duct Pressure Optimization
    - iii. Ventilation Optimization
    - iv. Drive to Maximum Override
    - v. Common Source Temperature
    - vi. Common Space
    - vii. Discharge Air Temperature Optimization
  
  - g. The air system application vendor shall provide a published applications guide that details the air system application operation, configuration, setup, and troubleshooting. The applications guide documentation shall be maintained under version control, and updated by the manufacture to reflect most recent feature updates as made available. Contents of the guide shall include:
    - i. Description of System Operation
    - ii. Required Components
    - iii. Sequences of Operation
    - iv. Installation
    - v. Controller Setup
    - vi. Required Programming
    - vii. Commissioning
    - viii. Optimization Strategies
    - ix. Special Applications
    - x. Troubleshooting
  
  - h. The air system application shall present in plain user language the current operation with source zone information and reset events.
2. Trend Logs
- a. The system shall harvest trend logs for defined key measurements for each controlled HVAC device and HVAC application. Trend logs shall be captured for a minimum of 5 key operating points for each piece of HVAC equipment and HVAC application and stored for no less than 1 year at 15-minute intervals. Data Logs shall be capable of being configured on an interval or change of value basis.
    - i. Air Handling Unit/Rooftop (VAV)
      - Discharge Air Temperature
      - Discharge Air Temperature Setpoint Active
      - Space Temperature Active
      - Cooling Capacity Status

- Discharge Air Flow
- ii. VAV Box
    - Discharge Air Temperature
    - Space Temperature Active
    - Space Temperature Setpoint Active
    - Air Flow Setpoint Active
    - Discharge Air Flow
3. Trim and Respond
    - a. The BAS shall provide a setpoint reset application program based on 'trim and respond' functionality as outlined in ASHRAE Guideline 36.

## 2.05 BUILDING / SYSTEM CONTROLLERS

- A. There shall be one or more independent, standalone microprocessor based System Controllers to manage the global strategies described in CONTROLLER SOFTWARE section.
  1. The controller shall provide a USB communications port for connection to a PC.
  2. The operating system of the Controller shall manage the input and output communications signals to allow distributed controllers to share real and virtual point information and allow central monitoring and alarms.
  3. All System Controllers shall have a real time clock and shall be able to accept a BACnet time synchronization command for automatic time synchronization.
  4. Data shall be shared between networked System Controllers.
  5. Serviceability – The System Controller shall have a display on the main board that indicates the current operating mode of the controller.
- B. Controls manufacturer shall provide secure remote access to the Building Automation System (BAS). Secure remote access shall not require IP ports to be "exposed" (i.e. port-forwarded or external public IP addresses) to the Internet. Controls manufacturer shall update secure remote access software as necessary to follow cyber security best practices and respond to cyber security events.

## 2.06 ADVANCED APPLICATION CONTROLLERS

- A. The Application Controller shall be a microprocessor-based DDC controller which, through hardware or firmware design, controls specified equipment. The controller is not user programmable, but is customized for operation within the confines of the equipment it is designed to serve.
- B. The Application Controller shall be capable of operating as a stand-alone controller or as a member of a Building Automation System (BAS).
- C. When the Application Controller is operating as a member of a Building Automation System (BAS), the application controller shall operate as follows:

1. Application Controller will receive operation mode commands from the BAS network controller. The BAS commands shall include but not be limited to the follow: Occupied Heat/Cool, Unoccupied Heat/Cool, Morning Warm-up, / Pre-cool, Occupied Bypass).
2. Application Controller will provide equipment status parameters to the BAS through BACnet communication.
3. Application Controller will operate as a stand-alone controller in the event of communication failure with the BAS.
4. In case of communications failure stand-alone operation shall use default values or last known values for remote sensors read over the network such as outdoor air temperature.

D. Software

1. To meet the sequence of operation for each zone control, the controller shall use programs developed and tested by the controller manufacturer that are either factory loaded or customized with use of service tool native to the controller.

E. Environment: Controller hardware shall be suitable for the anticipated ambient conditions.

1. Storage: -55° to 203° F (-48° to 95° C) and 5 to 95% Rh, non-condensing.
2. Operating: -40° to 158° F (-40 to 70° C) and 5 to 95% Rh, non-condensing.
3. Controllers used indoors shall be mounted in a NEMA 1 enclosure at a minimum.
4. Controllers used outdoors and/or in wet ambient shall be mounted within NEMA 4 type waterproof enclosures, and shall be rated for operation at -40° to 158° F [-40° to 70° C].

F. Controller Input/Output: The controller shall have on board capable of performing all functionality needed for the application. Controls provided by the equipment manufacture must supply the required I/O for the equipment.

1. For flexibility in selection and replacement of valves, the controllers shall be capable of supporting all of the following output types; 0-10VDC, 0-5VDC, 4-20mA, Binary.
2. For flexibility in selection and replacement of sensors, the controllers shall be capable of reading sensor input ranges of 0 to10V, 0 to 20mA, Pulse counts, and 200 to 20K ohm.

G. Serviceability – The controller shall provide the following in order to improve serviceability of the controller.

1. Diagnostic LEDs shall indicate correct operation or failures/faults for all of the following: power, sensors, BACnet communications, and I/O communications bus.
2. All binary output shall have LED's indicating the output state.
3. All wiring connectors shall removable without the use of a tool.
4. Software service tool connection through the following methods: direct cable connection to the controller, connection through another controller on BACnet link.

H. Software Retention: All Zone Controller operating parameters, setpoints, BIOS, and sequence of operation code must be stored in non-volatile memory in order to maintain such information for months without power.

- I. Controller shall meet the following Agency Compliance:
  - 1. UL916 PAZX, Open Energy Management Equipment
  - 2. UL94-5V, Flammability
  - 3. FCC Part 15, Subpart B, Class B Limit
  - 4. BACnet Testing Laboratory (BTL) listed

## 2.07 APPLICATION SPECIFIC CONTROLLERS

### A. General Description

- 1. Application Specific Controllers (ASC) shall be microprocessor-based DDC controllers which, through hardware or firmware design, control specified equipment. They are not user programmable, but are customized for operation within the confines of the equipment they are designed to serve.
- 2. Zone Controllers are controllers that operate equipment that control the space temperature of single zone. Examples are controllers for VAV, Fan coil, Blower Coils, Unit Ventilators, Heat Pumps, and Water Source Heat Pumps.

### B. The Application Specific Controller shall be capable of operating as a stand-alone controller or as a member of a Building Automation System (BAS).

### C. When the Application Specific Controller is operating as a member of a Building Automation System (BAS), the application controller shall operate as follows:

- 1. Application Controller will receive operation mode commands from the BAS network controller. The BAS commands shall include but not be limited to the follow: Occupied Heat/Cool, Unoccupied Heat/Cool, Morning Warm-up, / Pre-cool, Occupied Bypass).
- 2. Application Controller will provide equipment status parameters to the BAS through BACnet communication.
- 3. Application Controller will operate as a stand-alone controller in the event of communication failure with the BAS.
- 4. In case of communications failure stand-alone operation shall use default values or last known values for remote sensors read over the network such as outdoor air temperature.

### D. Stand-Alone Operation: Each piece of equipment specified in section "A" shall be controlled by a single controller and provide stand-alone control in the event that a BAS is not present.

### E. Software

- 1. To meet the sequence of operation for each zone control, the controller shall use programs developed and tested by the controller manufacturer that are either factory loaded or downloaded with service tool to the controller.

2. For controlling ancillary devices and for flexibility to change the sequence of operation in the future, the controller shall be capable running custom programs written in a graphical programming language.
- F. Environment: Controller hardware shall be suitable for the anticipated ambient conditions.
1. Storage: -55° to 203° F (-48° to 95° C) and 5 to 95% Rh, non-condensing.
  2. Operating: -40° to 158° F (-40 to 70° C) and 5 to 95% Rh, non-condensing.
  3. Controllers used indoors shall be mounted in a NEMA 1 enclosure at a minimum.
  4. Controllers used outdoors and/or in wet ambient shall be mounted within NEMA 4 type waterproof enclosures, and shall be rated for operation at -40° to 158° F [-40° to 70° C].
- G. Input/Output:
1. For flexibility in selection and replacement of valves, the controllers shall be capable of supporting all of the following valve control types 0-10VDC, 0-5VDC, 4-20mA, 24VAC floating point, 24VAC - 2 position (Normally Open or Normally Closed).
  2. For flexibility in selection and replacement of sensors, the controllers shall be capable of reading sensor input ranges of 0 to 10V, 0 to 20mA, pulse counts, and 200 to 20Kohm.
  3. For flexibility in selection and replacement of binary devices, the controller shall support dry and wetted (24VAC) binary inputs.
  4. For flexibility in selection and replacement devices, the controller's shall have binary output which are able to drive at least 12VA each.
  5. For flexibility in selection and replacement of motors, the controller shall be capable of outputting 24VAC (binary output), DC voltage (0 to 10VDC minimum range) and PWM (in the 80 to 100 Hz range).
  6. For future needs, any I/O that is unused by functionality of equipment control shall be available to be used by custom program on the controller and by another controller on the network.
  7. For future expansion and flexibility, the controller shall have either on board or through expansion, 20 hardware input/output points. Expansion points must communicate with the controller via an internal communications bus. Expansion points must be capable of being mounted up to 650ft. (200 m) from the controller. Expansion points that require the BACnet network for communication with the controller are not allowed.
- H. Serviceability – The controller shall provide the following in order to improve serviceability of the controller.
1. Diagnostic LEDs shall indicate correct operation or failures/faults for all of the following: power, sensors, BACnet communications, and I/O communications bus.
  2. All binary output shall have LED's indicating the output state.
  3. All wiring connectors shall removable without the use of a tool.
  4. Software service tool connection through all of the following methods: direct cable connection to the controller, connection through another controller on BACnet link

5. For safety purposes, the controller shall be capable of being powered by a portable computer for the purposes of configuration, programming, and testing programs so that this work can be accomplished with the power off to the equipment.
6. Capabilities to temporarily override of BACnet point values with built-in time expiration in the controller.
7. BACnet MAC Address shall be set using decimal (0-9) based rotary switches.
  - a. Configuration change shall not be made in a programming environment, but rather by a configuration page utilizing dropdown list, check boxes, and numeric boxes.
8. For ease of troubleshooting, the Controller shall support BACnet data trend logging.
  - a. With a minimum of 20,000 trending points total on controller
  - b. Trends shall be capable of being collected at a minimum sample rate of once every second.
  - c. Shall be capable of trending all BACnet points used by controller
  - d. Trends shall be capable of being scheduled or triggered
- I. Software Retention: All Zone Controller operating parameters, setpoints, BIOS, and sequence of operation code must be stored in non-volatile memory in order to maintain such information for months without power.
- J. Application controller shall meet the following Agency Compliance:
  1. UL916 PAZX, Open Energy Management Equipment
  2. UL94-5V, Flammability
  3. FCC Part 15, Subpart B, Class B Limit
  4. BACnet Testing Laboratory (BTL) listed as BACnet Application Specific Controller (B-ASC)

#### 2.08 APPLICATION CONTROLLER for Packaged Rooftop Units

- A. The Rooftop Unit (RTU) Application Controller shall be a microprocessor-based DDC controller which, through hardware or firmware design, controls specified equipment. The controller is not user programmable, but is customized for operation within the confines of the equipment it is designed to serve.
- B. The Application Controller shall be capable of operating as a stand-alone controller or as a member of a Building Automation System (BAS).
- C. When the Application Controller is operating as a member of a Building Automation System (BAS), the application controller shall operate as follows:
  1. Application Controller will receive operation mode commands from the BAS network controller. The BAS commands shall include but not be limited to the follow: Occupied Heat/Cool, Unoccupied Heat/Cool, Morning Warm-up, / Pre-cool, Occupied Bypass).
  2. Application Controller will provide equipment status parameters to the BAS through BACnet communication.



3. Application Controller will operate as a stand-alone controller in the event of communication failure with the BAS.
  4. In case of communications failure stand-alone operation shall use default values or last known values for remote sensors read over the network such as outdoor air temperature.
- D. Software
1. To meet the sequence of operation for each zone control, the controller shall use programs developed and tested by the controller manufacturer that are either factory loaded or customized with use of service tool native to the controller.
- E. Environment: Controller hardware shall be suitable for the anticipated ambient conditions.
1. Storage: -55° to 203° F (-48° to 95° C) and 5 to 95% Rh, non-condensing.
  2. Operating: -40° to 158° F (-40 to 70° C) and 5 to 95% Rh, non-condensing.
  3. Controllers used indoors shall be mounted in a NEMA 1 enclosure at a minimum.
  4. Controllers used outdoors and/or in wet ambient shall be mounted within NEMA 4 type waterproof enclosures, and shall be rated for operation at -40° to 158° F [-40° to 70° C].
- F. Controller Input/Output: The controller shall have on board capable of performing all functionality needed for the application. Controls provided by the equipment manufacture must supply the required I/O for the equipment.
1. For flexibility in selection and replacement of valves, the controllers shall be capable of supporting all of the following output types; 0-10VDC, 0-5VDC, 4-20mA, Binary.
  2. For flexibility in selection and replacement of sensors, the controllers shall be capable of reading sensor input ranges of 0 to10V, 0 to 20mA, Pulse counts, and 200 to 20Kohm.
- G. Serviceability – The controller shall provide the following in order to improve serviceability of the controller.
1. Diagnostic LEDs shall indicate correct operation or failures/faults for all of the following: power, sensors, BACnet communications, and I/O communications bus.
  2. All binary output shall have LED's indicating the output state.
  3. All wiring connectors shall removable without the use of a tool.
  4. Software service tool connection through the following methods: direct cable connection to the controller, connection through another controller on BACnet link.
- H. Software Retention: All Zone Controller operating parameters, setpoints, BIOS, and sequence of operation code must be stored in non-volatile memory in order to maintain such information for months without power.
- I. Controller shall meet the following Agency Compliance:
1. UL916 PAZX, Open Energy Management Equipment
  2. UL94-5V, Flammability

3. FCC Part 15, Subpart B, Class B Limit
4. BACnet Testing Laboratory (BTL) listed

## 2.09 VARIABLE AIR VOLUME TERMINAL UNIT CONTROLLERS

### A. General Description

1. Variable Air Volume (VAV) controllers shall be microprocessor-based DDC controllers which, through hardware or firmware design, control specified equipment. They are typically not user programmable, but are configurable for operation of VAV terminal units.
2. Variable Air Volume (VAV) controllers are controllers that operate equipment that control the space temperature of single zone.

### B. The VAV controller shall be capable of operating as a stand-alone controller or as a member of a Building Automation System (BAS).

### C. When the VAV controller is operating as a member of a Building Automation System (BAS), the application controller shall operate as follows:

1. The VAV controller will receive operation mode commands from the BAS network controller. The BAS commands shall include but not be limited to the following: Occupied Heat/Cool, Unoccupied Heat/Cool, Morning Warm-up, / Pre-cool, Occupied Bypass).
2. The VAV controller will provide equipment status parameters to the BAS through BACnet communication.
3. The VAV controller will operate as a stand-alone controller in the event of communication failure with the BAS.
4. In case of communications failure stand-alone operation shall use default values or last known values for remote sensors read over the network such as outdoor air temperature.

### D. Stand-Alone Operation: Each VAV Terminal Unit shall be controlled by a single controller and provide stand-alone control in the event that a BAS is not present.

### E. The VAV controller shall communicate to the building automation system via one of the following protocols: BACnet™ Zigbee defined in ANSI®/ASHRAE® Standard 135-2020

#### 1. BACnet™ Zigbee

- a. VAV controller wireless communication interface shall self-form and self-heal to maintain operation in the event of network communication failure.
- b. IEEE 802.15.4 radios to minimize risk of interference, reliability, and range.
- c. Operating range shall be a minimum of 200 feet; open range shall be 2,500 ft. (762 m) with less than 2% packet error rate.
- d. To protect against harmful interference, certifications shall include Energy Management Equipment FCC CFR47, Section 15.247 & subpart E, Digital Modulation Transmission with no SAR (FCC ID: TPF-251701)

### F. Each VAV terminal unit shall use a space zone sensor(s) to measure the space condition it is serving.

1. The VAV controller shall use a wireless communication interface to connect to its space zone sensor.

2. Each zone sensor communication interface shall be capable of many-to-one sensors per controller to support averaging, monitoring, and multiple zone applications. Sensing options shall include temperature, relative humidity, CO<sub>2</sub>, and occupancy.
3. Wireless zone sensors
  - a. To check for proper operation, wireless zone temperature sensors shall include a signal strength and battery condition indicators on the zone sensor.
  - b. The wireless zone sensor battery life shall provide at least 15 years life under normal operating conditions and must be readily available Lithium size AA, 1.5V.
  - c. The wireless zone sensor and receiver addresses shall be held in non-volatile memory to ensure operation through system voltage disturbances and to minimize the risk of incorrect association.
  - d. To ensure proper system performance, the wireless zone sensor shall automatically determine when the space temperature is rapidly changing. When the space temperature is readily changing, the space temperature shall be transmitted at least once each 30 seconds. The maximum time between transmissions shall be 15 minutes.
  - e. Zone temperature sensing accuracy shall be +/- 0.5F (+/- 0.28C).

#### G. Software

1. To meet the sequence of operation for each zone control, the controller shall use programs developed and tested by the controller manufacturer that are either factory loaded or downloaded with service tool to the controller.
2. For controlling ancillary devices and for flexibility to change the sequence of operation in the future, the controller shall be capable running custom programs written in a graphical programming language.

#### H. Environment: Controller hardware shall be suitable for the anticipated ambient conditions.

1. Storage: -55° to 203° F (-48° to 95° C) and 5 to 95% Rh, non-condensing.
2. Operating: -40° to 158° F (-40 to 70° C) and 5 to 95% Rh, non-condensing.
3. Controllers used indoors shall be mounted in a NEMA 1 enclosure at a minimum.
4. Controllers used outdoors and/or in wet ambient shall be mounted within NEMA 4 type waterproof enclosures, and shall be rated for operation at -40° to 158° F [-40° to 70° C].

#### I. Input/Output:

1. For flexibility in selection and replacement of valves, the controllers shall be capable of supporting all of the following valve control types 0-10VDC, 0-5VDC, 4-20mA, 24VAC floating point, 24VAC - 2 position (Normally Open or Normally Closed).
2. For flexibility in selection and replacement of sensors, the controllers shall be capable of reading sensor input ranges of 0 to 10V, 0 to 20mA, and 200 to 20Kohm.
3. For flexibility in selection and replacement of binary devices, the controller shall support dry and wetted (24VAC) binary inputs.

4. For flexibility in selection and replacement devices, the controller shall have binary output which are able to drive at least 12VA each.
  5. For flexibility in selection and replacement of motors, the controller shall be capable of outputting 24VAC (binary output), DC voltage (0 to 10VDC minimum range) and PWM (in the 80 to 100 Hz range).
- J. Serviceability – The controller shall provide the following in order to improve serviceability of the controller.
1. Diagnostic LEDs shall indicate correct operation or failures/faults for all of the following: power, sensors, BACnet communications, and I/O communications bus.
  2. All binary output shall have LED's indicating the output state.
  3. All wiring connectors shall removable without the use of a tool.
  4. Software service tool connection through all of the following methods: direct cable connection to the controller, connection through another controller on BACnet link and through the controller's zone sensor.
  5. For safety purposes, the controller shall be capable of being powered by a portable computer for the purposes of configuration, programming, and testing programs so that this work can be accomplished with the power off to the equipment.
  6. Capabilities to temporarily override of BACnet point values with built-in time expiration in the controller.
  7. BACnet MAC Address shall be set using decimal (0-9) based rotary switches.
    - a. Configuration change shall not be made in a programming environment, but rather by a configuration page utilizing dropdown list, check boxes, and numeric boxes.
  8. For ease of troubleshooting, the Controller shall support BACnet data trend logging.
    - a. Trends shall be capable of being collected at a minimum sample rate of once every second.
    - b. Shall be capable of trending all BACnet points used by controller
    - c. Trends shall be capable of being scheduled or triggered
- K. Software Retention: All Zone Controller operating parameters, setpoints, BIOS, and sequence of operation code must be stored in non-volatile memory in order to maintain such information for months without power.
- L. Controller shall meet the following Agency Compliance:
1. UL916 PAZX, Open Energy Management Equipment
  2. UL94-5V, Flammability
  3. FCC Part 15, Subpart B, Class B Limit
  4. AS/NZS CISPR 32:2016
  5. VCCI-CSPR 32:2016
  6. CAN ICES-003(B)/NMB-003(B)

7. To ensure integration to the building automation system the controller must be BTL (BACnet Testing Lab) listed. The following BACnet profiles are in order of most functionality (B-BC) to least functionality (B-ASC).
  - a. BACnet Building Controller (B-BC)
  - b. BACnet Advance Applications Controller (B-AAC)
  - c. BACnet Application Specific Controller (B-ASC)

## 2.10 INPUT/OUTPUT INTERFACE

- A. Hardwired inputs and outputs may tie into the system through building, custom application, or ASCs.
- B. All input points and output points shall be protected such that shorting of the point to itself, to another point, or to ground will cause no damage to the controller. All input and output points shall be protected from voltage up to 24V of any duration, such that contact with this voltage will cause no damage to the controller.
- C. Binary inputs shall allow the monitoring of on/off signals from remote devices. The binary inputs shall provide a wetting current of at least 12 mA to be compatible with commonly available control devices and shall be protected against the effects of contact bounce and noise. Binary inputs shall sense "dry contact" closure without external power (other than that provided by the controller) being applied.
- D. Pulse accumulation input objects. This type of object shall conform to all the requirements of binary input objects and also accept up to 10 pulses per second for pulse accumulation.
- E. Analog inputs shall allow the monitoring of low voltage (0 to 10 VDC), current (4 to 20 mA), or resistance signals (thermistor, RTD). Analog inputs shall be compatible with and field configurable to commonly available sensing devices.
- F. Binary outputs shall provide for on/off operation or a pulsed low-voltage signal for pulse width modulation control. Binary outputs on building and custom application controllers shall have status lights. Outputs shall be selectable for either normally open or normally closed operation.
- G. Analog outputs shall provide a modulating signal for the control of end devices. Outputs shall provide either a 0 to 10VDC or a 4 to 20 mA signal as required to provide proper control of the output device. Analog outputs shall not exhibit a drift of greater than 0.4% of range per year.
- H. Tri-State Outputs. Provide tri-state outputs (two coordinated binary outputs) for control of three-point floating type electronic actuators without feedback. Use of three-point floating devices shall be limited to zone control and terminal unit control applications (VAV terminal units, duct-mounted heating coils, zone dampers, radiation, etc.). Control algorithms shall run the zone actuator to one end of its stroke once every 24 hours for verification of operator tracking.
- I. System Object Capacity. The system size shall be expandable to at least twice the number of input/ output objects required for this project. Additional controllers (along with associated devices and wiring) shall be all that is necessary to achieve this capacity requirement. The operator interfaces installed for this project shall not require any hardware additions or software revisions in order to expand the system.

## 2.11 POWER SUPPLIES

- A. Control transformers shall be UL listed. Furnish Class 2 current-limiting type or furnish overcurrent protection in both primary and secondary circuits for Class 2 service in accordance with NEC requirements. Limit connected loads to 80% of rated capacity.
  - 1. DC power supply output shall match output current and voltage requirements. Unit shall be full-wave rectifier type with output ripple of 5.0 mV maximum peak-to-peak. Regulation shall be 1.0% line and load combined, with 100-microsecond response time for 50% load changes. Unit shall have built-in overvoltage and overcurrent protection and shall be able to withstand a 150% current overload for at least three seconds without trip-out or failure.
    - a. Unit shall operate between 0°C and 50°C (32°F and 120°F). EM/RF shall meet FCC Class B and VDE 0871 for Class B and MIL-STD 810C for shock and vibration.
    - b. Line voltage units shall be UL recognized and CSA approved.

## 2.12 WIRING AND RACEWAYS

- A. General: Provide copper wiring, plenum cable, and raceways as specified in the applicable sections of this specification.
- B. All insulated wire to be copper conductors, UL labeled for 90°C (194°F) minimum service.
- C. Fiber Optic Cable. Optical cables shall be duplex 900 mm tight-buffer construction designed for intra-building environments. The sheath shall be UL Listed OFNP in accordance with NEC Article 770. The optical fiber shall meet the requirements of FDDI, ANSI X3T9.5 PMD for 62.5/125 µm.

## PART 3 - EXECUTION

### 3.01 EXAMINATION

- A. The Contract Documents shall be thoroughly examined for coordination of control devices, their installation, wiring, and commissioning. Coordinate and review mechanical equipment specifications, locations, and identify any discrepancies, conflicts, or omissions that shall be reported to the Architect/Engineer for resolution before rough-in work is started.
- B. The BAS manufacturer shall inspect the jobsite in order to verify that control equipment can be installed as required, and any discrepancies, conflicts, or omissions shall be reported to the Architect/Engineer for resolution before rough-in work is started.

### 3.02 PROTECTION

- A. The BAS installation contractor shall protect all work and material from damage by their work or personnel, and shall be liable for all damage thus caused.
- B. The BAS manufacturer shall be responsible for their work and equipment until final inspection, testing, and acceptance. The BAS installing contractor shall protect their work against theft or damage, and shall carefully store material and equipment received on site that is not immediately installed. The Contractor shall close all open ends of work with temporary covers or plugs during storage and construction to prevent entry of foreign objects.

### 3.03 COORDINATION

- A. Site

1. Where the mechanical work will be installed in close proximity to, or will interfere with, work of other trades, the contractor shall assist in working out space conditions to make a satisfactory adjustment. If the contractor installs his/her work before coordinating with other trades, so as to cause any interference with work of other trades, the contractor shall make the necessary changes in his/her work to correct the condition without extra charge.
  2. Coordinate and schedule work with all other work in the same area, or with work that is dependent upon other work, to facilitate mutual progress.
- B. Submittals. Refer to the "Submittals," section of this specification for requirements.
- C. Test and Balance
1. The contractor shall furnish a single set of all tools necessary to interface to the control system for test and balance purposes.
  2. The tools used during the test and balance process shall be returned to the contractor at the completion of the testing and balancing.
- D. Life Safety
1. Duct smoke detectors required for air handler shutdown shall be supplied under Section 26100 of this specification. The contractor shall interlock smoke detectors to air handlers for shutdown as described in the Sequences of Operation for this project.
  2. Smoke dampers and actuators required for duct smoke isolation are provided under Section 26100. The contractor shall interlock these dampers to the air handlers as described in the Sequences of Operation for this project as applicable.
  3. Fire/smoke dampers and actuators required for fire rated walls are provided under another Section 26100. Control of these dampers shall be by 26100
- E. Coordination with Controls Specified in Other Sections or Divisions. Other sections and/or divisions of this specification include controls and control devices that are to be part of or interfaced to the control system specified in this section. These controls shall be integrated into the system and coordinated by the contractor as follows:
1. All communication media and equipment shall be provided as specified in the "Communication" section of this specification.
  2. Each supplier of a controls product is responsible for the configuration, programming, start-up, and testing of that product to meet the sequences of operation described in this section.
  3. The Contractor shall coordinate and resolve any incompatibility issues that arise between the control products provided under this section and those provided under other sections or divisions of this specification.

### 3.04 GENERAL WORKMANSHIP

- A. Install equipment, piping, wiring/conduit, parallel to building lines (i.e. horizontal, vertical, and parallel to walls) wherever possible.
- B. Provide sufficient slack and flexible connections to allow for vibration of piping and equipment.

- C. Install all equipment in readily accessible locations as defined by National Electric Code (NEC). Control panels shall be attached to structural walls or properly supported in a free-standing configuration, unless mounted in equipment enclosure specifically designed for that purpose. Panels shall be mounted to allow for unobstructed access for service.
- D. Verify integrity of all control wiring to ensure continuity and freedom from shorts and grounds prior to commencing the startup and commissioning procedures.
- E. All control device installation and wiring shall comply with Contract Documents, acceptable industry specifications, and industry standards for performance, reliability, and compatibility. Installation and wiring shall be executed in strict adherence to local codes and standard practices referenced in Contract Documents.

### 3.05 FIELD QUALITY CONTROL

- A. All work, materials, and equipment shall comply with the rules and regulations of applicable local, state, and federal codes and ordinances as identified in Contract Documents.
- B. BAS manufacturer shall continually monitor the field installation for building code compliance and quality of workmanship. All visible piping and or wiring runs shall be installed parallel to building lines and properly supported.
- C. BAS installing Contractor(s) shall arrange for field inspections by local and/or state authorities having jurisdiction over the work.

### 3.06 COMMUNICATION WIRING

- A. All cabling shall be installed in a neat and workmanlike manner. Follow manufacturer's installation recommendations for all communication cabling.
- B. Do not install communication wiring in raceway and enclosures containing Class 1 or other Class 2 wiring.
- C. Maximum pulling, tension, and bend radius for cable installation, as specified by the cable manufacturer shall not be exceeded during installation.
- D. Contractor shall verify the integrity of the entire network following cable installation. Use appropriate test measures for each particular cable.
- E. When a cable enters or exits a building, a lightning arrestor must be installed between the line and ground.
- F. All runs of communication wiring shall be unspliced length when the length is commercially available.
- G. All communication wiring shall be labeled to indicate origin and destination.

### 3.07 FIBER OPTIC CABLE

- A. All cabling shall be installed in a neat and workmanlike manner. Minimum cable and unjacketed fiber bend radii as specified by cable manufacturer shall be maintained.
- B. Maximum pulling tensions as specified by the cable manufacturer shall not be exceeded during installation. Post installation residual cable tension shall be within cable manufacturer's specifications.



- C. Fiber optic cabinets, hardware, and cable entering the cabinet shall be installed in accordance with manufacturers' instructions. Minimum cable and unjacketed fiber bend radii as specified by cable manufacturer shall be maintained.

### 3.08 INSTALLATION OF SENSORS

- A. Sensors required for mechanical equipment operation shall be factory installed and wired as specified in mechanical equipment specifications. BAS manufacturer shall be responsible for coordinating these control devices and ensuring the sequence of operations will be met. Installation and wiring shall be in accordance with the BAS manufacturer's recommendations.
- B. Sensors that require field mounting shall meet the BAS manufacturer's recommendations and be coordinated with the mechanical equipment they will be associated.
- C. Mount sensors rigidly and adequately for the environment the sensor will operate.
- D. Room temperature sensors shall be installed on concealed junction boxes properly supported by the block wall framing. For installation in dry wall ceilings, the low voltage sensor wiring can be installed exposed and must meet applicable National and Local Electrical Codes.
- E. All wires attached to wall mounted sensors shall be sealed off to prevent air from transmitting in the associated conduit and affecting the room sensor readings.
- F. Install duct static pressure tap with tube end facing directly down-stream of air flow.
- G. Install space static pressure sensor with static sensing probe applicable for space installation where applicable.
- H. Sensors used in mixing plenums, and hot and cold decks shall be of the averaging type. Averaging sensors shall be installed in a serpentine manner horizontally across duct. Each bend shall be supported with a capillary clip.
- I. All pipe mounted temperature sensors shall be installed in matched thermowells. Install all liquid temperature sensors with heat conducting fluid in thermal wells for adequate thermal conductance.
- J. Wiring for space sensors shall be concealed in building drywall. EMT conduit is acceptable within mechanical equipment and service rooms.
- K. Install outdoor air temperature sensors on north wall complete with sun shield at manufacturer's recommended location and coordinated with Engineer.

### 3.09 FLOW SWITCH INSTALLATION

- A. Coordinate installation of flow switch with Mechanical Contractor who will be responsible for installing a thread o let in steel piping applications. Copper pipe applications will require the use CxCxF Tee, and no pipe extensions or substitutions will be allowed.
- B. Mount a minimum of 5 pipe diameters upstream and 5 pipe diameters downstream, or two feet, whichever is greater, from pipe fittings and other inline potential obstructions.
- C. Install in accordance with manufacturers' instructions, which will require proper flow direction, horizontal alignment with flow switch mounting on the top of pipe.

### 3.10 WARNING LABELS

- A. Permanent warning labels shall be affixed to all equipment that can be automatically started by the BAS system.
- B. Permanent warning labels shall be affixed to all motor starters and all control panels that are connected to multiple power sources utilizing separate disconnects.

### 3.10 IDENTIFICATION OF HARDWARE AND WIRING

- A. All field wiring and cabling, including that within factory mounted, and wired control panels and devices for mechanical equipment, shall be labeled at each end within 2" of termination with a cable identifier and other descriptive information for troubleshooting, maintenance, and service purposes. BAS manufacturer to coordinate this labeling requirement with mechanical equipment manufacturer as it relates to controls.
- B. Permanently label or code each point of field terminal strips to show the instrument or item served and correlate them to the BAS design drawings.
- C. Identify control panels with minimum 1-cm letters on laminated plastic nameplates.
- D. Identifiers shall match record documents. All plug-in components shall be labeled such that removal of the component does not remove the label.

### 3.11 CONTROLLERS

- A. Provide a separate DDC Controller for individual HVAC mechanical equipment. BAS manufacturer shall furnish and coordinate DDC controllers and control devices and ensure that installation and wiring adhere to BAS manufacturer's design recommendations. For those mechanical equipment units that do not have factory installed controls specified, the BAS manufacturer shall field mount controls and coordinate all installation and termination information to ensure the specified sequence of operations are met.
- B. Building Controllers and Custom Application Controllers shall be selected to provide a minimum of 15% spare I/O point capacity for each point type (analog or digital) found at each location. If input points are not universal, 15% of each type is required. If outputs are not universal, 15% of each type is required. A minimum of one spare is required for each type of point used in each controller.
  - 1. Future use of spare I/O point capacity shall require providing the field instrument and control device, field wiring, engineering, programming, and commissioning. No additional Controller boards or point modules shall be required to implement use of these spare points.

### 3.12 PROGRAMMING

- A. Provide sufficient internal memory for all controllers to ensure specified sequence of operations, alarming, trending, and reporting requirements are achieved. BAS manufacturer shall provide a minimum of 25% spare memory capacity for future use.
- B. Point Naming: System point names shall be modular in design, allowing easy operator interface without the use of a written point index.
- C. Software Programming
  - 1. Provide programming for individual mechanical systems to achieve all aspects of the sequence of operation specified. It is the BAS manufacturer's responsibility to ensure all mechanical equipment functions and operates as specified in sequence of operations.

Provide sufficient programming comments in controller application software to clearly describe each section of the program. The comment statements shall reflect the language used in the sequence of operations.

#### D. BAS Operator's Interface

1. When Operator Workstation is specified, provide color graphics for each piece of mechanical equipment depicting sufficient I/O to monitor and troubleshoot operation. Operator color graphics shall include Chiller Plant, Cooling Tower System, Boiler Plant, Air Handling Units, Rooftop Units, VAV Terminal Boxes, Fan Coil Units, Unit Ventilators, Heat Exchangers, Exhaust Fans, etc. These standard graphics shall depict all points dynamically as specified in the points list and/or indicated in sequence of operation.
2. The BAS manufacturer shall provide all the labor necessary to install, initialize, start up, and trouble-shoot all operator interface software and their functions as described in this section. This includes any operating system software, the operator interface data base, and any third party software installation and integration required for successful operation of the operator interface.
3. As part of this execution phase, the BAS manufacturer shall perform a complete test of the operator interface.

### 3.13 CONTROL SYSTEM CHECKOUT AND TESTING

- A. Start-up testing. All testing in this section shall be performed by the contractor and shall make up part of the necessary verification of an operating control system. This testing shall be completed before the owner's representative is notified of the system demonstration.
  1. The contractor shall furnish all labor and test apparatus required to calibrate and prepare for service all of the instruments, controls, and accessory equipment furnished under this specification.
  2. Verify that all control wiring is properly connected and free of all shorts and ground faults. Verify that terminations are tight.
  3. Enable the control systems and verify calibration of all input devices individually. Perform calibration procedures according to manufacturer's recommendations.
  4. Verify all binary output devices (relays, solenoid valves, two-position actuators and control valves, magnetic starter, etc.) operate properly and normal positions are correct.
  5. Verify all analog output devices (I/Ps, actuators, etc) are functional, that start and span are correct, and that direction and normal positions are correct. The contractor shall check all control valves and automatic dampers to ensure proper action and closure. The contractor shall make any necessary adjustments to valve stem and damper blade travel.
  6. Verify the system operation adheres to the sequences of operation. Simulate and observe all modes of operation by overriding and varying inputs and schedules. Tune all DDC loops and optimal start/stop routines.
  7. Alarms and Interlocks
    - a. Check each alarm separately by including an appropriate signal at a value that will trip the alarm.

- b. Interlocks shall be tripped using field contacts to check the logic, as well as to ensure that the fail-safe condition for all actuators is in the proper direction.
- c. Interlock actions shall be tested by simulating alarm conditions to check the initiating value of the variable and interlock action.

### 3.14 CLEANING

- A. The BAS manufacturer's installing contractor(s) shall clean up all debris resulting from their installation activities on a daily basis. The installation contractors shall remove all cartons, containers, crates, etc. under his control as soon as their contents have been removed. Waste shall be collected and placed in a location designated by the Owner, Construction Manager, General Contractor, and/or Mechanical Contractor.
- B. At the completion of work in any area, the installation contractor shall clean all of their work, equipment, etc., making it free from dust, dirt and debris.
- C. At the completion of work, all equipment furnished under this Section shall be checked for paint damage. Any factory finished paint that has been damaged shall be repaired to match the adjacent areas. Any metal cabinet or enclosure that has been deformed shall be replaced with new material and repainted to match the adjacent areas.

### 3.15 TRAINING

- A. Provide minimum of (8) hours of operator training throughout the contract period. Training shall consist of a minimum of (2) classroom training sessions of (4) hours for each session. The training will be provided for personnel designated by the Owner.
- B. These objectives will be divided into logical groupings; participants may attend one or more of these, depending on level of knowledge required:
  - 1. Day-to-day BAS Operators
  - 2. BAS Troubleshooting & Maintenance
- C. Provide course outline and materials prior to schedule training session. The instructor(s) shall provide one copy of training material per student.
- D. The instructor(s) shall be factory-trained and experienced in teaching this technical material.

END OF SECTION 230900

## **SECTION 15990 - TESTING, ADJUSTING AND BALANCING**

### **PART I - GENERAL**

#### 1.1 RELATED DOCUMENTS

- A. Drawings and General Provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to work of this Section.

#### 1.2 SUMMARY

- A. This Section specifies the Requirements and Procedures of Total Mechanical Systems Testing, Adjusting and Balancing. Requirements include measurement and establishment of the fluid quantities of the Mechanical Systems as required to meet Design Specifications and Recording and reporting the results.
- B. Testing and Balancing must be conducted by an independent, Certified Testing and Balancing firm, registered with either the AABC or the NEBB.
- C. The Test and Balance Contractor shall be a subcontractor to the Mechanical Contractor.

#### 1.3 SECTION INCLUDES

- A. Testing, adjustment and balancing of air systems.
- B. Measurement of final operating condition of HVAC Systems.
- C. Sound measurement of equipment operating conditions.
- D. Vibration measurement of equipment operating conditions.

#### 1.4 SUBMITTALS

- A. Submit under provisions of Section 15500.
- B. Submit name of adjusting and balancing agency for approval within 30 days after Award of Contract.
- C. Field Reports: Submit under provisions of Section 15500.
- D. Field Reports: Indicate deficiencies in systems that would prevent proper testing, adjusting, and balancing of systems and equipment to achieve specified performance.
- E. Prior to commencing work, submit report forms or outlines indicating adjusting, balancing, and equipment data required.
- F. Submit draft copies of report for review prior to final acceptance of Project. Provide final copies for Owner and for inclusion in operating and maintenance manuals.
- G. Provide reports in soft cover, letter size, 3-ring binder manuals, complete with index page and indexing tabs, with cover identification at front and side. Report shall reference the Contract Drawings for location of equipment and devices. Where reference to the contract drawings is not satisfactory, include a set of reduced drawings or sketches with equipment and devices identified to correspond with data sheets.
- H. Include detailed procedures, agenda, sample report forms and copy of AABC National

- Project Performance Guaranty prior to commencing system balance.
- I. Test Reports: Indicate data on AABC National Standards for Total System Balance forms or NEBB forms.

#### 1.5 QUALITY ASSURANCE

- A. Perform total system balance in accordance with AABC National Standards for Field Measurement and Instrumentation, Total System Balance, ASHRAE 111, and NEBB Procedural Standards for Testing, Balancing and Adjusting of Environmental Systems.
- B. Maintain one copy of each document on site.

#### 1.6 SEQUENCING AND SCHEDULING

- A. Sequence work under the provisions of Section 15500.
- B. Sequence work to commence after completion of systems and schedule completion of work before Substantial Completion of Project.
- C. Schedule work under the provisions of Section 15500.
- D. Schedule and provide assistance in final adjustment and test of Smoke Control System with Fire Authority.

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

### **PART III - EXECUTION**

#### 3.1 EXAMINATION

- A. Verify that systems are complete and operable before commencing work. Ensure the following conditions:
  1. Systems are started and operating in a safe and normal condition.
  2. Control systems are installed complete and operable.
  3. Proper thermal overload protection is in place for electrical equipment.
  4. Ductwork Systems:
    - a. Final filters are clean and in place. If required, install temporary media in addition to final filters.
    - b. Duct systems are clean of debris.
    - c. Fans are rotating correctly.
    - d. Dampers are in place and open.
    - e. Air coil fins are cleaned and combed.
    - f. Access doors are closed and duct end caps are in place.
    - g. Air inlets and outlets are installed and connected.
    - h. Duct system leakage is minimized.
- B. Submit Field Reports: Report defects and deficiencies noted during performance of services which prevent system balance.
- C. Beginning of work means acceptance of existing conditions.

### 3.2 PREPARATION

- A. Provide instruments required for testing, adjusting, and balancing operations. Make instruments available to Owner to facilitate spot checks during testing.
- B. Provide additional balancing devices as required.

### 3.3 INSTALLATION TOLERANCES

- A. HVAC Systems: Adjust to within plus or minus 5 percent of design for supply and return systems and plus or minus 10 percent of design for exhaust systems.
- B. Air Outlets and Inlets: Adjust outlets and inlets in space to within plus or minus 10 percent of design.

### 3.4 ADJUSTING

- A. Ensure recorded data represents actual measured or observed conditions.
- B. Permanently mark settings of balancing devices allowing settings to be restored. Set and lock memory stops.
- C. After adjustment, take measurements to verify balance has not been disrupted or that such disruption has been rectified.
- D. Leave systems in proper working order, replacing belt guards, closing access doors, closing doors to electrical switch boxes, and restoring thermostats to specified settings.

### 3.5 AIR SYSTEM PROCEDURE

- A. Adjust equipment and distribution systems to provide required or design air quantities.
- B. Make air quantity measurements in ducts by Pitot tube traverse of entire cross sectional area of duct.
- C. Measure and record air quantities at air inlets and outlets.
- D. Adjust distribution system to obtain uniform space temperatures free from objectionable drafts and noise.
- E. Use volume control devices to regulate air quantities only to extent that adjustments do not create objectionable air motion or sound levels. Adjust air volume by adjusting duct internal devices such as dampers and splitters. Do not utilize opposed blade dampers at air inlets and outlets.
- F. Vary total system air quantities by adjusting sheave position at each fan. Vary branch air quantities by damper regulation.
- G. Measure and record static air pressure conditions at air supply and exhaust units, including filter and coil pressure drops, and total pressure across the fan. Make allowances for 50 percent loading of filters.
- H. Adjust settings and minimum set points for motorized and back draft dampers to design conditions.

- I. Measure and record inlet and outlet temperatures at each air supply unit at full cooling and heating capacity.

### 3.6 REPORT FORMS

#### A. Forms shall include the following:

1. Title Page:
  - a. Name of Testing, Adjusting and Balancing Agency
  - b. Address of Testing, Adjusting and Balancing Agency
  - c. Telephone number of Testing, Adjusting and Balancing Agency
  - d. Project Name
  - e. Project Location
  - f. Project Architect
  - g. Project Engineer
  - h. Project Contractor
  - i. Project Altitude
  - j. Report Date
2. Summary Comments:
  - a. Design versus final performance
  - b. Notable characteristics of system
  - c. Description of systems operation sequence
  - d. Summary of outdoor and exhaust flows to indicate amount of building pressurization
  - e. Nomenclature used throughout report
  - f. Test Conditions
3. Instrument List:
  - a. Instrument
  - b. Manufacturer
  - c. Model Number
  - d. Serial Number
  - e. Range
  - f. Calibration Date
4. Electric Motors:
  - a. Manufacturer
  - b. Model/Frame
  - c. HP/BHP/Efficiency
  - d. Phase, Voltage, Amperage; Nameplate, Actual, No Load
  - e. RPM
  - f. Service Factor
  - g. Starter Size, Rating, Heater Elements
  - h. Sheave Make/Size/Bore
5. V-Belt Drive:
  - a. Identification/Location
  - b. Required Driven RPM
  - c. Driven Sheave, Diameter and RPM
  - d. Belt, Size and Quantity
  - e. Motor Sheave Diameter and RPM
  - f. Center to center distance, maximum, minimum, and actual
6. Equipment Data:
  - a. Identification/number



- b. Manufacturer
  - c. Model number and Serial number
  - d. Capacity
  - e. Service
  - f. Design flow rate, pressure drop, BHP
  - g. Actual flow rate, pressure drop, BHP
  - h. Temperature readings
7. Duct Traverse:
- a. System zone/branch
  - b. Duct size
  - c. Area
  - d. Design velocity
  - e. Design air flow
  - f. Test velocity
  - g. Test air flow
  - h. Duct static pressure
  - i. Air temperature
  - j. Correction factor
8. Air Distribution Test Sheet:
- a. Air terminal number
  - b. Room number/location
  - c. Terminal type
  - d. Terminal size
  - e. Area factor
  - f. Design velocity
  - g. Design air flow
  - h. Test (final) velocity
  - i. Test (final) air flow
  - j. Percent of design air flow

### 3.7 SOUND AND VIBRATION TESTING

- A. Test and adjust Mechanical Systems for sound and vibration in accordance with the detailed instructions of the referenced Standards.
- B. Sound Level Test and Report:
- 1. Location
  - 2. Octave Bands - equipment off
  - 3. Octave Bands - equipment on
- C. Vibration Test and Report:
- 1. Location of Points:
    - a. Fan bearing: drive end
    - b. Fan bearing: opposite end
    - c. Motor bearing: center (if applicable)
    - d. Motor bearing: drive end
    - e. Motor bearing: opposite end
    - f. Casing: (bottom or top)
    - g. Casing: (side)
    - h. Duct after flexible connection: (discharge)
    - i. Duct after flexible connection: (suction)

2. Test Readings:
  - a. Horizontal, velocity and displacement
  - b. Vertical, velocity and displacement
  - c. Axial, velocity and displacement
3. Normally acceptable readings, velocity and acceleration
4. Unusual conditions at time of test
5. Vibration source (if non-complying)

END OF SECTION 15990