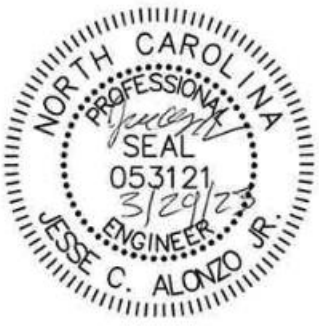
Bid Documents
Specifications

PBS North Carolina
Bryan Center HVAC Replacement

March 31, 2023

SCO ID #: 22-24543-01A
Code: 42112 Item: 301
M&C Project #: 05394-0011

1730 Varsity Drive, Suite 500
Raleigh, NC 27606
License # F-1222



Advertisement For Bids

Sealed proposals will be received until 2:00pm on May 3, 2023, in the Main Boardroom at the Bryan Center, 10 UNC-TV Drive, Research Triangle Park, NC and immediately thereafter publicly opened and read for the furnishing of labor, material, and equipment for the construction of:

PBS North Carolina
Bryan Center HVAC Replacement Project
Research Triangle Park, NC
SCO ID No.: 22-24543-01A Code: 42112 Item: 301

Bids will be received for **single prime bid** contracts. All Proposals will be lump sum.

Complete plans and specifications for this project can be obtained from McKim & Creed beginning on April 3, 2023. Electronic copies are available to Prime Bidders only by contacting McKim & Creed via e-mail to Allison Jurgens at ajurgens@mckimcreed.com.

Bid documents will also be available for examination in the plan rooms of iSqFt, CMD Group, Construct Connect, Dodge Data and Analytics, NC Institute of Minority Economic Development (114 W. Parrish St., 4th Floor, Durham, NC), and Hispanic Contractors Association of the Carolinas (877-227-1680).

The State reserves the unqualified right to reject any and all proposals.

Minority contractors are encouraged to participate in the bidding process.

The bidder must include completed minority business subcontractor documentation form(s) with their proposal or the bid may be considered non-responsive and invalid.

Pre-Bid Meeting

A public meeting will be held for all interested bidders at 10:00am on April 13, 2023, in the Main Boardroom at the Bryan Center, 10 UNC-TV Drive, Research Triangle Park, NC. The meeting will also address project specific questions.

Phil Malsch
Facility Manager, RTP Site
PBS North Carolina
10 UNC-TV Drive
Research Triangle Park, NC 27709

N O T I C E TO B I D D E R S

Sealed proposals will be received until 2:00pm on May 3, 2023, in the Main Boardroom at the Bryan Center, 10 UNC-TV Drive (off of TW Alexander Drive), Research Triangle Park, NC and immediately thereafter publicly opened and read for the furnishing of labor, material and equipment for the construction of:

PBS North Carolina
Bryan Center HVAC Replacement
Research Triangle Park, NC
SCO ID No.: 22-24543-01A Code: 42112 Item: 301

The project scope of work includes installation of 2 Owner-provided chillers and 2 Owner-provided cooling towers, refrigerant monitoring system, 2 condenser water pumps, 4 Owner-provided air handlers and return fans, and 120 linear feet of underground piping.

Bids will be received for single prime contract. All proposals shall be lump sum.

Pre-Bid Meeting

A public meeting will be held for all interested bidders at 10:00am on April 13, 2023, in the Main Boardroom at the Bryan Center, 10 UNC-TV Drive (off of TW Alexander Drive), Research Triangle Park, NC.

In accordance with General Statute GS 133-3, Specifications may list one or more preferred brands as an alternate to the base bid in limited circumstances. Specifications containing a preferred brand alternate under this section must identify the performance standards that support the preference. Performance standards for the preference must be approved in advance by the owner in an open meeting. Any alternate approved by the owner shall be approved only where (i) the preferred alternate will provide cost savings, maintain or improve the functioning of any process or system affected by the preferred item or items, or both, and (ii) a justification identifying these criteria is made available in writing to the public.

Complete plans, specifications and contract documents will be available for examination in the plan rooms of: iSqFt, CMD Group, Construct Connect, Dodge Data and Analytics, the offices of the Designer: McKim & Creed, Venture IV Building, Suite 500, 1730 Varsity Drive, Raleigh, NC 27606, and in Minority Plan Rooms: NC Institute of Minority Economic Development (114 W. Parrish St., 4th Floor, Durham, NC), and Hispanic Contractors Association of the Carolinas (877-227-1680). Electronic copies can be made available to Prime Bidders only beginning April 3, 2023 by contacting McKim & Creed via e-mail to Allison Jurgens at ajurgens@mckimcreed.com.

The bidder shall include with the bid proposal the form Identification of Minority Business Participation identifying the minority business participation it will use on the project and shall include either Affidavit A or Affidavit B as applicable. Forms and instructions are included within the Proposal Form in the bid documents. Failure to complete these forms is grounds for rejection of the bid. (GS143-128.2c Effective 1/1/2002)

All contractors are hereby notified that they must have proper license as required under the state laws governing their respective trades. Contractors for this project have been pre-qualified, and a list of pre-qualified contractors is located advertisement for bid section of the project sepcifications.

General contractors are notified that Chapter 87, Article 1, General Statutes of North Carolina, will be observed in receiving and awarding general contracts. General contractors submitting bids on this project must have license classification for General Contractor (Unlimited).

Under GS 87-1, a contractor that superintends or manages construction of any building, highway, public utility, grading, structure or improvement shall be deemed a "general contractor" and shall be so licensed. Therefore a single prime project that involves other trades will require the single prime contractor to hold a proper General Contractors license. On public buildings being bid single prime, where the total value of the general construction does not exceed 25% of the total construction value, contractors under GS87-Arts 2 and 4 (Plumbing, Mechanical & Electrical) may bid and contract directly with the Owner as the SINGLE PRIME CONTRACTOR and may subcontract to other properly licensed trades. GS87-1.1-Rules .0210

Each proposal shall be accompanied by a cash deposit or a certified check drawn on some bank or trust company, insured by the Federal Deposit Insurance Corporation, of an amount equal to not less than five percent (5%) of the proposal, or in lieu thereof a bidder may offer a bid bond of five percent (5%) of the bid executed by a surety company licensed under the laws of North Carolina to execute the contract in accordance with the bid bond. Said deposit shall be retained by the owner as liquidated damages in event of failure of the successful bidder to execute the contract within ten days after the award or to give satisfactory surety as required by law.

A performance bond and a payment bond will be required for one hundred percent (100%) of the contract price.

Payment will be made based on ninety-five percent (95%) of monthly estimates and final payment made upon completion and acceptance of work.

No bid may be withdrawn after the scheduled closing time for the receipt of bids for a period of 30 days.

The owner reserves the right to reject any or all bids and to waive informalities.

Designer:
McKim & Creed
1730 Varsity Drive, Suite 500 Building IV
Raleigh, NC 27606
919-233-8091

Owner:
PBS North Carolina

TABLE OF CONTENTS

DIVISION 26 – ELECTRICAL

INSTRUCTIONS TO BIDDERS

AND

GENERAL CONDITIONS OF THE CONTRACT

STANDARD FORM FOR CONSTRUCTION PROJECTS

STATE CONSTRUCTION OFFICE

NORTH CAROLINA

DEPARTMENT OF ADMINISTRATION

Form OC-15

This document is intended for use on State capital construction projects and shall not be used on any project that is not reviewed and approved by the State Construction Office. Extensive modification to the General Conditions by means of "Supplementary General Conditions" is strongly discouraged. State agencies and institutions may include special requirements in "Division 1 – General Requirements" of the specifications, where they do not conflict with the General Conditions.

Twenty Fourth Edition January 2013

INSTRUCTIONS TO BIDDERS

For a proposal to be considered it must be in accordance with the following instructions:

1. **PROPOSALS**

Proposals must be made in strict accordance with the Form of Proposal provided therefor, and all blank spaces for bids, alternates, and unit prices applicable to bidder's work shall be properly filled in. When requested alternates are not bid, the proposer shall so indicate by the words "No Bid". Any blanks shall also be interpreted as "No Bid".The bidder agrees that bid on Form of Proposal detached from specifications will be considered and will have the same force and effect as if attached thereto. Photocopied or faxed proposals will not be considered. Numbers shall be stated both in writing and in figures for the base bids and alternates. If figures and writing differ, the written number will supersede the figures.

Any modifications to the Form of Proposal (including alternates and/or unit prices) will disqualify the bid and may cause the bid to be rejected.

The bidder shall fill in the Form of Proposal as follows:

a. If the documents are executed by a sole owner, that fact shall be evidenced by the word "Owner" appearing after the name of the person executing them.

b. If the documents are executed by a partnership, that fact shall be evidenced by the word "Co-Partner" appearing after the name of the partner executing them.

c. If the documents are executed on the part of a corporation, they shall be executed by either the president or the vice president and attested by the secretary or assistant secretary in either case, and the title of the office of such persons shall appear after their signatures. The seal of the corporation shall be impressed on each signature page of the documents.

d. If the proposal is made by a joint venture, it shall be executed by each member of the joint venture in the above form for sole owner, partnership or corporation, whichever form is applicable.

e. All signatures shall be properly witnessed.

f. If the contractor's license of a bidder is held by a person other than an owner, partner or officer of a firm, then the licensee shall also sign and be a party to the proposal. The title "Licensee" shall appear under his/her signature.

Proposals should be addressed as indicated in the Advertisement for Bids and be delivered, enclosed in an opaque sealed envelope, marked "Proposal" and bearing the title of the work, name of the bidder, and the contractor's license number of the bidder. Bidders should clearly mark on the outside of the bid envelope which contract(s) they are bidding.

Bidder shall 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 or an affidavit indicating work under contract will be self-performed, as required by G.S. 143-128.2(c) and G.S. 143-128.2(f). Failure to comply with these requirements is grounds for rejection of the bid.

For projects bid in the single-prime alternative, the names and license numbers of major subcontractors shall be listed on the proposal form.

It shall be the specific responsibility of the bidder to deliver his bid to the proper official at the selected place and prior to the announced time for the opening of bids. Later delivery of a bid for any reason, including delivery by any delivery service, shall disqualify the bid.

Unit prices quoted in the proposal shall include overhead and profit and shall be the full compensation for the contractor's cost involved in the work. See General Conditions, Article 19c-1.

2. EXAMINATION OF CONDITIONS

It is understood and mutually agreed that by submitting a bid the bidder acknowledges that he has carefully examined all documents pertaining to the work, the location, accessibility and general character of the site of the work and all existing buildings and structures within and adjacent to the site, and has satisfied himself as to the nature of the work, the condition of existing buildings and structures, the conformation of the ground, the character, quality and quantity of the material to be encountered, the character of the equipment, machinery, plant and any other facilities needed preliminary to and during prosecution of the work, the general and local conditions, the construction hazards, and all other matters, including, but not limited to, the labor situation which can in any way affect the work under the contract, and including all safety measures required by the Occupational Safety and Health Act of 1970 and all rules and regulations issued pursuant thereto. It is further mutually agreed that by submitting a proposal the bidder acknowledges that he has satisfied himself as to the feasibility and meaning of the plans, drawings, specifications and other contract documents for the construction of the work and that he accepts all the terms, conditions and stipulations contained therein; and that he is prepared to work in cooperation with other contractors performing work on the site.

Reference is made to contract documents for the identification of those surveys and investigation reports of subsurface or latent physical conditions at the site or otherwise affecting performance of the work which have been relied upon by the designer in preparing the documents. The owner will make copies of all such surveys and reports available to the bidder upon request.

Each bidder may, at his own expense, make such additional surveys and investigations as he may deem necessary to determine his bid price for the performance of the work. Any on-site investigation shall be done at the convenience of the owner. Any reasonable request for access to the site will be honored by the owner.

3. BULLETINS AND ADDENDA

Any addenda to specifications issued during the time of bidding are to be considered covered in the proposal and in closing a contract they will become a part thereof. It shall be the bidder’s responsibility to ascertain prior to bid time the addenda issued and to see that his bid includes any changes thereby required.

Should the bidder find discrepancies in, or omission from, the drawings or documents or should he be in doubt as to their meaning, he shall at once notify the designer who will send written instructions in the form of addenda to all bidders. Notification should be no later than seven (7) days prior to the date set for receipt of bids. Neither the owner nor the designer will be responsible for any oral instructions.

All addenda should be acknowledged by the bidder(s) on the Form of Proposal. However, even if not acknowledged, by submitting a bid, the bidder has certified that he has reviewed all issued addenda and has included all costs associated within his bid.

4. **BID SECURITY**

Each proposal shall be accompanied by a cash deposit or a certified check drawn on some bank or trust company insured by the Federal Deposit Insurance Corporation, or a bid bond in an amount equal to not less than five percent (5%) of the proposal, said deposit to be retained by the owner as liquidated damages in event of failure of the successful bidder to execute the contract within ten (10) days after the award or to give satisfactory surety as required by law (G.S. 143-129).

Bid bond shall be conditioned that the surety will, upon demand, forthwith make payment to the obligee upon said bond if the bidder fails to execute the contract. The owner may retain bid securities of any bidder(s) who may have a reasonable chance of award of contract for the full duration of time stated in the Notice to Bidders. Other bid securities may be released sooner, at the discretion of the owner. All bid securities (cash or certified checks) shall be returned to the bidders promptly after award of contracts, and no later then seven (7) days after expiration of the holding period stated in the Notice to Bidders. Standard Form of Bid Bond is included in these specifications and shall be used.

5. **RECEIPT OF BIDS**

Bids shall be received in strict accordance with requirements of the General Statutes of North Carolina. Bid security shall be required as prescribed by statute. Prior to the closing of the bid, the bidder will be permitted to change or withdraw his bid. Guidelines for opening of public construction bids are available from the State Construction Office.

6. **OPENING OF BIDS**

Upon opening, all bids shall be read aloud. Once bidding is closed, there shall not be any withdrawal of bids by any bidder and no bids may be returned by the designer to any bidder. After the opening of bids, no bid may be withdrawn, except under the provisions of General Statute 143-129.1, for a period of thirty days unless otherwise specified. Should the successful bidder default and fail to execute a contract, the contract may be awarded to the next lowest and responsible bidder. The owner reserves the unqualified right to reject any and all bids. Reasons for rejection may include, but shall not be limited to, the following:

a. If the Form of Proposal furnished to the bidder is not used or is altered.

b. If the bidder fails to insert a price for all bid items, alternate and unit prices requested.

c. If the bidder adds any provisions reserving the right to accept or reject any award.

d. If there are unauthorized additions or conditional bids, or irregularities of any kind which tend to make the proposal incomplete, indefinite or ambiguous as to its meaning.

e. If the bidder fails to complete the proposal form where information is requested so the bid may be properly evaluated by the owner.

f. If the unit prices contained in the bid schedule are unacceptable to the owner and the State Construction Office.

g. If the bidder fails to comply with other instructions stated herein.

7. **BID EVALUATION**

The award of the contract will be made to the lowest responsible bidder as soon as practical. The owner may award on the basis of the base bid and any alternates the owner chooses.

Before awarding a contract, the owner may require the apparent low bidder to qualify himself to be a responsible bidder by furnishing any or all of the following data:

a. The latest financial statement showing assets and liabilities of the company or other information satisfactory to the owner.

b. A listing of completed projects of similar size.

c. Permanent name and address of place of business.

d. The number of regular employees of the organization and length of time the organization has been in business under present name.

e. The name and home office address of the surety proposed and the name and address of the responsible local claim agent.

f. The names of members of the firms who hold appropriate trade licenses, together with license numbers.

g. If prequalified, contractor info will be reviewed and evaluated comparatively to submitted prequalification package.

Failure or refusal to furnish any of the above information, if requested, shall constitute a basis for disqualification of any bidder.

In determining the lowest responsible, responsive bidder, the owner shall take into consideration the bidder's compliance with the requirements of G.S. 143-128.2(c), the past performance of the bidder on construction contracts for the State with particular concern given to completion times, quality of work, cooperation with other contractors, and cooperation with the designer and owner. Failure of the low bidder to furnish affidavit and/or documentation as required by G.S. 143-128.2(c) shall constitute a basis for disqualification of the bid.

Should the owner adjudge that the apparent low bidder is not the lowest responsible, responsive bidder by virtue of the above information, said apparent low bidder will be so notified and his bid security shall be returned to him.

8. **PERFORMANCE BOND**

The successful bidder, upon award of contract, shall furnish a performance bond in an amount equal to 100 percent of the contract price. See Article 35, General Conditions.

9. **PAYMENT BOND**

The successful bidder, upon award of contract, shall furnish a payment bond in an amount equal to 100 percent of the contract price. See Article 35, General Conditions.

10. **PAYMENTS**

Payments to the successful bidders (contractors) will be made on the basis of monthly estimates. See Article 31, General Conditions.

11. **PRE-BID CONFERENCE**

Prior to the date set for receiving bids, the Designer may arrange and conduct a Pre-Bid Conference for all prospective bidders. The purpose of this conference is to review project requirements and to respond to questions from prospective bidders and their subcontractors or material suppliers related to the intent of bid documents. Attendance by prospective bidders shall be as required by the "Notice to Bidders".

12. **SUBSTITUTIONS**

In accordance with the provisions of G.S. 133-3, material, product, or equipment substitutions proposed by the bidders to those specified herein can only be considered during the bidding phase until ten (10) days prior to the receipt of bids when submitted to the Designer with sufficient data to confirm material, product, or equipment equality. Proposed substitutions submitted after this time will be considered only as potential change order.

Submittals for proposed substitutions shall include the following information:

a. Name, address, and telephone number of manufacturer and supplier as appropriate.

b. Trade name, model or catalog designation.

c. Product data including performance and test data, reference standards, and technical descriptions of material, product, or equipment. Include color samples and samples of available finishes as appropriate.

d. Detailed comparison with specified products including performance capabilities, warranties, and test results.

e. Other pertinent data including data requested by the Designer to confirm product equality.

If a proposed material, product, or equipment substitution is deemed equal by the Designer to those specified, all bidders of record will be notified by Addendum**.**

GENERAL CONDITIONS OF THE CONTRACT

The use or reproduction of this document or any part thereof is authorized for and limited to use on projects of the State of North Carolina, and is distributed by, through and at the discretion of the State Construction Office, Raleigh, North Carolina, for that distinct and sole purpose.

TABLE OF CONTENTS

ARTICLE 1 - DEFINITIONS

a. The **contract documents** consist of the Notice to Bidders; Instructions to Bidders; General Conditions of the Contract; special conditions if applicable; Supplementary General Conditions; the drawing and specifications, including all bulletins, addenda or other modifications of the drawings and specifications incorporated into the documents prior to their execution; the proposal; the contract; the performance bond; the payment bond; insurance certificates; the approval of the attorney general; and the certificate of the Office of State Budget and Management. All of these items together form the contract.

b. The **owner** is the State of North Carolina through the agency named in the contract.

c. The **designer(s)** are those referred to within this contract, or their authorized representatives. The Designer(s), as referred to herein, shall mean architect and/or engineer. They will be referred to hereinafter as if each were of the singular number, masculine gender.

d. The **contractor**, as referred to hereinafter, shall be deemed to be either of the several contracting parties called the "Party of the First Part" in either of the several contracts in connection with the total project. Where, in special instances hereinafter, a particular contractor is intended, an adjective precedes the word "contractor," as "general," "heating," etc. For the purposes of a single prime contract, the term Contractor shall be deemed to be the single contracting entity identified as the “Party of the First Part” in the single Construction Contract. Any references or adjectives that name or infer multiple prime contractors shall be interpreted to mean the single prime Contractor.

e. A **subcontractor**, as the term is used herein, shall be understood to be one who has entered into a direct contract with a contractor, and includes one who furnishes materials worked to a special design in accordance with plans and specifications covered by the contract, but does not include one who only sells or furnishes materials not requiring work so described or detailed.

f. **Written notice** shall be defined as notice in writing delivered in person to the contractor, or to a partner of the firm in the case of a partnership, or to a member of the contracting organization, or to an officer of the organization in the case of a corporation, or sent to the last known business address of the contracting organization by registered mail.

g. **Work**, as used herein as a noun, is intended to include materials, labor, and workmanship of the appropriate contractor.

h. The **project** is the total construction work to be performed under the contract documents by the several contractors.

i. **Project Expediter,** as used herein, is an entity stated in the contract documents, designated to effectively facilitate scheduling and coordination of work activities. See Article 14(f) for responsibilities of a Project Expediter. **For the purposes of a single prime contract, the single prime contractor shall be designated as the Project Expediter.**

j. **Change order**, as used herein, shall mean a written order to the contractor subsequent to the signing of the contract authorizing a change in the contract. The change order shall be signed by the contractor, designer and the owner, and approved by the State Construction Office, in that order (Article 19).

k. **Field Order,** as used herein, shall mean a written approval for the contractor to proceed with the work requested by owner prior to issuance of a formal Change Order. The field order shall be signed by the contractor, designer, owner, and State Construction Office.

l. **Time of completion**, as stated in the contract documents, is to be interpreted as consecutive calendar days measured from the date established in the written Notice to Proceed, or such other date as may be established herein (Article 23).

m. **Liquidated damages,** as stated in the contract documents [, is an amount reasonably estimated in advance to cover the consequential damages associated with the Owner's economic loss in not being able to use the Project for its intended purposes at the end of the contract's completion date as amended by change order, if any, by reason of failure of the contractor(s) to complete the work within the time specified. Liquidated damages does not include the Owner's extended contract administration costs (including but not limited to additional fees for architectural and engineering services, testing services, inspection services, commissioning services, etc.), such other damages directly resulting from delays caused solely by the contractor, or consequential damages that the Owner identified in the bid documents that may be impacted by any delay caused soley by the Contractor (e.g., if a multi-phased project-subsequent phases, delays in start other projects that are dependent on the completion of this Project, extension of leases and/or maintenance agreements for other facilities).

n. **Surety**, as used herein, shall mean the bonding company or corporate body which is bound with and for the contractor, and which engages to be responsible for the contractor and his acceptable performance of the work.

o. **Routine written communications between the Designer and the Contractor** are any communication other than a "request for information" provided in letter, memo, or transmittal format, sent by mail, courier, electronic mail, or facsimile. Such communications can not be identified as "request for information".

p. **Clarification or Request for information (RFI)** is a request from the Contractor seeking an interpretation or clarification by the Designer relative to the contract documents. The RFI, which shall be labeled (RFI), shall clearly and concisely set forth the issue or item requiring clarification or interpretation and why the response is needed. The RFI must set forth the Contractor's interpretation or understanding of the contract documents requirements in question, along with reasons for such an understanding.

q. **Approval** means written or imprinted acknowledgement that materials, equipment or methods of construction are acceptable for use in the work**.**

r. **Inspection** shall mean examination or observation of work completed or in progress to determine its compliance with contract documents.

s. **"Equal to" or "approved equal"** shall mean materials, products, equipment, assemblies, or installation methods considered equal by the bidder in all characteristics (physical, functional, and aesthetic) to those specified in the contract documents. Acceptance of equal is subject to approval of Designer and owner.

t. **"Substitution" or "substitute"** shall mean materials, products, equipment, assemblies, or installation methods deviating in at least one characteristic (physical, functional, or aesthetic) from those specified, but which in the opinion of the bidder would improve competition and/or enhance the finished installation. Acceptance of substitution is subject to the approval of the Designer and owner.

u. **Provide** shall mean furnish and install complete in place, new, clean, operational, and ready for use.

v. **Indicated and shown** shall mean provide as detailed, or called for, and reasonably implied in the contract documents.

w. **Special inspector** is one who inspects materials, installation, fabrication, erection or placement of components and connections requiring special expertise to ensure compliance with the approved construction documents and referenced standards.

x. **Commissioning** is a quality assurance process that verifies and documents that building components and systems operate in accordance to the owner's project requirements and the project design documents.

y. **Designer Final Inspection** is the inspection performed by the design team to determine the completeness of the project in accordance with approved plans and specifications. This inspection occurs prior to SCO final inspection.

z. **SCO Final Inspection** is the inspection performed by the State Construction Office to determine the completeness of the project in accordance with NC Building Codes and approved plans and specifications.

aa. **Beneficial Occupancy** is requested by the owner and is occupancy or partial occupancy of the building after all life safety items have been completed as determined by the State Construction Office. Life safety items include but not limited to fire alarm, sprinkler, egress and exit lighting, fire rated walls, egress paths and security.

bb. Final Acceptance is the date in which the State Construction Office accepts the construction as totally complete. This includes the SCO Final Inspection and certification by the designer that all punch lists are completed.

ARTICLE 2 - INTENT AND EXECUTION OF DOCUMENTS

a. The drawings and specifications are complementary, one to the other, and that which is shown on the drawings or called for in the specifications shall be as binding as if it were both called for and shown. The intent of the drawings and specifications is to establish the scope of all labor, materials, transportation, equipment, and any and all other things necessary to provide a bid for a complete job. In case of discrepancy or disagreement in the contract documents, the order of precedence shall be: Form of Contract, specifications, large-scale detail drawings, small-scale drawings.

b. The wording of the specifications shall be interpreted in accordance with common usage of the language except that words having a commonly used technical or trade meaning shall be so interpreted in preference to other meanings.

c. The contractor shall execute each copy of the proposal, contract, performance bond and payment bond as follows:

   1. If the documents are executed by a sole owner, that fact shall be evidenced by the word "Owner" appearing after the name of the person executing them.

   2. If the documents are executed by a partnership, that fact shall be evidenced by the word "Co-Partner" appearing after the name of the partner executing them.

3. If the documents are executed on the part of a corporation, they shall be executed by either the president or the vice president and attested by the secretary or assistant secretary in either case, and the title of the office of such persons shall appear after their signatures. The seal of the corporation shall be impressed on each signature page of the documents.

4. If the documents are made by a joint venture, they shall be executed by each member of the joint venture in the above form for sole owner, partnership or corporation, whichever form is applicable to each particular member.

5. All signatures shall be properly witnessed.

6. If the contractor's license is held by a person other than an owner, partner or officer of a firm, then the licensee shall also sign and be a party to the contract. The title "Licensee" shall appear under his/her signature.

7. The bonds shall be executed by an attorney-in-fact. There shall be attached to each copy of the bond a certified copy of power of attorney properly executed and dated.

8. Each copy of the bonds shall be countersigned by an authorized individual agent of the bonding company licensed to do business in North Carolina. The title "Licensed Resident Agent" shall appear after the signature.

9. The seal of the bonding company shall be impressed on each signature page of the bonds.

10. The contractor's signature on the performance bond and the payment bond shall correspond with that on the contract. The date of performance and payment bond shall not be prior to the date of the contract.

ARTICLE 3 - CLARIFICATIONS AND DETAIL DRAWINGS

a. In such cases where the nature of the work requires clarification by the designer, such clarification shall be furnished by the designer with reasonable promptness by means of written instructions or detail drawings, or both. Clarifications and drawings shall be consistent with the intent of contract documents, and shall become a part thereof.

b. The contractor(s) and the designer shall prepare, if deemed necessary, a schedule fixing dates upon which foreseeable clarifications will be required. The schedule will be subject to addition or change in accordance with progress of the work. The designer shall furnish drawings or clarifications in accordance with that schedule. The contractor shall not proceed with the work without such detail drawings and/or written clarifications.

ARTICLE 4 - COPIES OF DRAWINGS AND SPECIFICATIONS

The designer or Owner shall furnish free of charge to the contractors electronic copies of plans and specifications. If requested by the contractor, paper copies of plans and specifications shall be furnished free of charge as follows:

a. General contractor - Up to twelve (12) sets of general contractor drawings and specifications, up to six (6) sets of which shall include drawings and specifications of all other contracts, plus a clean set of black line prints on white paper of all appropriate drawings, upon which the contractor shall clearly and legibly record all work-in-place that is at variance with the contract documents.

b. Each other contractor - Up to six (6) sets of the appropriate drawings and specifications, up to three (3) sets of which shall include drawings and specifications of all other contracts, plus a clean set of black line prints on white paper of all appropriate drawings, upon which the contractor shall clearly and legibly record all work-in-place that is at variance with the contract documents.

c. Additional sets shall be furnished at cost, including mailing, to the contractor upon request by the contractor. This cost shall be stated in the bidding documents.

d. For the purposes of a single-prime contract, the contractor shall receive up to 30 sets of drawings and specifications, plus a clean set of black line prints on white paper of all appropriate drawings, upon which the contractor shall clearly and legibly record all work-in-place that is at variance with the contract documents.

ARTICLE 5 - SHOP DRAWINGS, SUBMITTALS, SAMPLES, DATA

a. Within 15 consecutive calendar days after the notice to proceed, each prime contractor shall submit a schedule for submission of all shop drawings, product data, samples, and similar submittals through the Project Expediter to the Designer. This schedule shall indicate the items, relevant specification sections, other related submittal, data, and the date when these items will be furnished to the designer.

b. The Contractor(s) shall review, approve and submit to the Designer all Shop Drawings, Coordination Drawings, Product Data, Samples, Color Charts, and similar submittal data required or reasonably implied by the Contract Documents. Required Submittals shall bear the Contractor's stamp of approval, any exceptions to the Contract Documents shall be noted on the submittals, and copies of all submittals shall be of sufficient quantity for the Designer to retain up to three (3) copies of each submittal for his own use plus additional copies as may be required by the Contractor. Submittals shall be presented to the Designer in accordance with the schedule submitted in paragraph (a). so as to cause no delay in the activities of the Owner or of separate Contractors.

c. The Designer shall review required submittals promptly, noting desired corrections if any, and retaining three (3) copies (1 for the Designer, 1 for the owner and 1 for SCO) for his use. The remaining copies of each submittal shall be returned to the Contractor not later than twenty (20) days from the date of receipt by the Designer, for the Contractor's use or for corrections and resubmittal as noted by the Designer. When resubmittals are required, the submittal procedure shall be the same as for the original submittal**s.**

d. Approval of shop drawings/submittals by the Designer shall not be construed as relieving the Contractor from responsibility for compliance with the design or terms of the contract documents nor from responsibility of errors of any sort in the shop drawings, unless such lack of compliance or errors first have been called in writing to the attention of the Designer by the Contractor.

ARTICLE 6 - WORKING DRAWINGS AND SPECIFICATIONS AT THE JOB SITE

a. The contractor shall maintain, in readable condition at his job office, one complete set of working drawings and specifications for his work including all shop drawings. Such drawings and specifications shall be available for use by the designer, his authorized representative, owner or State Construction Office.

b. The contractor shall maintain at the job office, a day-to-day record of work-in-place that is at variance with the contract documents. Such variations shall be fully noted on project drawings by the contractor and submitted to the designer upon project completion and no later than 30 days after final acceptance of the project.

c. The contractor shall maintain at the job office a record of all required tests that have been performed, clearly indicating the scope of work inspected and the date of approval or rejection.

ARTICLE 7 - OWNERSHIP OF DRAWINGS AND SPECIFICATIONS

All drawings and specifications are instruments of service and remain the property of the owner. The use of these instruments on work other than this contract without permission of the owner is prohibited. All copies of drawings and specifications other than contract copies shall be returned to the owner upon request after completion of the work.

ARTICLE 8 - MATERIALS, EQUIPMENT, EMPLOYEES

a. The contractor shall, unless otherwise specified, supply and pay for all labor, transportation, materials, tools, apparatus, lights, power, heat, sanitary facilities, water, scaffolding and incidentals necessary for the completion of his work, and shall install, maintain and remove all equipment of the construction, other utensils or things, and 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 job and everything incidental thereto, as shown on the plans, stated in the specifications, or reasonably implied therefrom, all in accordance with the contract documents.

b. All materials shall be new and of quality specified, except where reclaimed material is authorized herein and approved for use. Workmanship shall at all times be of a grade accepted as the best practice of the particular trade involved, and as stipulated in written standards of recognized organizations or institutes of the respective trades except as exceeded or qualified by the specifications.

c. Upon notice, the contractor shall furnish evidence as to quality of materials.

d. Products are generally specified by ASTM or other reference standard and/or by manufacturer's name and model number or trade name. When specified only by reference standard, the Contractor may select any product meeting this standard, by any manufacturer. When several products or manufacturers are specified as being equally acceptable, the Contractor has the option of using any product and manufacturer combination listed. However, the contractor shall be aware that the cited examples are used only to denote the quality standard of product desired and that they do not restrict bidders to a specific brand, make, manufacturer or specific name; that they are used only to set forth and convey to bidders the general style, type, character and quality of product desired; and that equivalent products will be acceptable. Request for substitution of materials, items, or equipment shall be submitted to the designer for approval or disapproval; such approval or disapproval shall be made by the designer prior to the opening of bids. Alternate materials may be requested after the award if it can clearly be demonstrated that it is an added benefit to the owner and the designer and owner approves.

e. The designer is the judge of equality for proposed substitution of products, materials or equipment.

g. If at any time during the construction and completion of the work covered by these contract documents, the language, conduct, or attire of any workman of the various crafts be adjudged a nuisance to the owner or designer, or if any workman be considered detrimental to the work, the contractor shall order such parties removed immediately from grounds.

ARTICLE 9 - ROYALTIES, LICENSES AND PATENTS

It is the intention of the contract documents that the work covered herein will not constitute in any way infringement of any patent whatsoever unless the fact of such patent is clearly evidenced herein. The contractor shall protect and save harmless the owner against suit on account of alleged or actual infringement. The contractor shall pay all royalties and/or license fees required on account of patented articles or processes, whether the patent rights are evidenced hereinafter.

ARTICLE 10 - PERMITS, INSPECTIONS, FEES, REGULATIONS

a. The contractor shall give all notices and comply with all laws, ordinances, codes, rules and regulations bearing on the conduct of the work under this contract. If the contractor observes that the drawings and specifications are at variance therewith, he shall promptly notify the designer in writing. See Instructions to Bidders, Paragraph 3, Bulletins and Addenda. Any necessary changes required after contract award shall be made by change order in accordance with Article 19. If the contractor performs any work knowing it to be contrary to such laws, ordinances, codes, rules and regulations, and without such notice to the designer, he shall bear all cost arising therefrom. Additional requirements implemented after bidding will be subject to equitable negotiations.

b. All work under this contract shall conform to the North Carolina State Building Code and other State, local and national codes as are applicable. The cost of all required inspections and permits shall be the responsibility of the contractor and included within the bid proposal. All water taps, meter barrels, vaults and impact fees shall be paid by the contractor unless otherwise noted.

d. Projects constructed by the State of North Carolina or by any agency or institution of the State are not subject to inspection by any county or municipal authorities and are not subject to county or municipal building codes. The contractor shall, however, cooperate with the county or municipal authorities by obtaining building permits. Permits shall be obtained at no cost.

e. Projects involving local funding (community colleges) are subject also to county and municipal building codes and inspection by local authorities. The contractor shall pay the cost of these permits and inspections.

ARTICLE 11 - PROTECTION OF WORK, PROPERTY AND THE PUBLIC

a. The contractors shall be jointly responsible for the entire site and the building or construction of the same and provide all the necessary protections, as required by the owner or designer, and by laws or ordinances governing such conditions. They shall be responsible for any damage to the owner's property, or of that of others on the job, by them, their personnel, or their subcontractors, and shall make good such damages. They shall be responsible for and pay for any damages caused to the owner. All contractors shall have access to the project at all times.

b. The contractor shall provide cover and protect all portions of the structure when the work is not in progress, provide and set all temporary roofs, covers for doorways, sash and windows, and all other materials necessary to protect all the work on the building, whether set by him, or any of the subcontractors. Any work damaged through the lack of proper protection or from any other cause, shall be repaired or replaced without extra cost to the owner.

c. No fires of any kind will be allowed inside or around the operations during the course of construction without special permission from the designer and owner.

d. The contractor shall protect all trees and shrubs designated to remain in the vicinity of the operations by building substantial boxes around same. He shall barricade all walks, roads, etc., as directed by the designer to keep the public away from the construction. All trenches, excavations or other hazards in the vicinity of the work shall be well barricaded and properly lighted at night.

e. The contractor shall provide all necessary safety measures for the protection of all persons on the job, including the requirements of the A.G.C. *Accident Prevention Manual in Construction*, as amended, and shall fully comply with all state laws or regulations and North Carolina State Building Code requirements to prevent accident or injury to persons on or about the location of the work. He shall clearly mark or post signs warning of hazards existing, and shall barricade excavations, elevator shafts, stairwells and similar hazards. He shall protect against damage or injury resulting from falling materials and he shall maintain all protective devices and signs throughout the progress of the work.

f. The contractor shall adhere to the rules, regulations and interpretations of the North Carolina Department of Labor relating to Occupational Safety and Health Standards for the Construction Industry (Title 29, Code of Federal Regulations, Part 1926, published in Volume 39, Number 122, Part II, June 24, 1974, *Federal Register*), and revisions thereto as adopted by General Statutes of North Carolina 95-126 through 155.

g. The contractor shall designate a responsible person of his organization as safety officer/inspector to inspect the project site for unsafe health and safety hazards, to report these hazards to the contractor for correction, and whose duties also include accident prevention on the project, and to provide other safety and health measures on the project site as required by the terms and conditions of the contract.The name of the safety inspector shall be made known to the designer and owner at the time of the preconstruction conference and in all cases prior to any work starting on the project.

h. In the event of emergency affecting the safety of life, the protection of work, or the safety of adjoining properties, the contractor is hereby authorized to act at his own discretion, without further authorization from anyone, to prevent such threatened injury or damage.

Any compensation claimed by the contractor on account of such action shall be determined as provided for under Article 19(b).

i. Any and all costs associated with correcting damage caused to adjacent properties of the construction site or staging area shall be borne by the contractor. These costs shall include but not be limited to flooding, mud, sand, stone, debris, and discharging of waste products.

ARTICLE 12 - SEDIMENTATION POLLUTION CONTROL ACT OF 1973

a. Any land-disturbing activity performed by the contractor(s) in connection with the project shall comply with all erosion control measures set forth in the contract documents and any additional measures which may be required in order to ensure that the project is in full compliance with the Sedimentation Pollution Control Act of 1973, as implemented by Title 15, North Carolina Administrative Code, Chapter 4, Sedimentation Control, Subchapters 4A, 4B and 4C, as amended (15 N.C.A.C. 4A, 4B and 4C).

b. Upon receipt of notice that a land-disturbing activity is in violation of said act, the contractor(s) shall be responsible for ensuring that all steps or actions necessary to bring the project in compliance with said act are promptly taken.

c. The contractor(s) shall be responsible for defending any legal actions instituted pursuant to N.C.G.S. 113A-64 against any party or persons described in this article.

d. To the fullest extent permitted by law, the contractor(s) shall indemnify and hold harmless the owner, the designer and the agents, consultants and employees of the owner and designer, from and against all claims, damages, civil penalties, losses and expenses, including, but not limited to, attorneys' fees, arising out of or resulting from the performance of work or failure of performance of work, provided that any such claim, damage, civil penalty, loss or expense is attributable to a violation of the Sedimentation Pollution Control Act. Such obligation shall not be construed to negate, abridge or otherwise reduced any other right or obligation of indemnity which would otherwise exist as to any party or persons described in this article.

ARTICLE 13 - INSPECTION OF THE WORK

a. It is a condition of this contract that the work shall be subject to inspection during normal working hours and during any time work is in preparation and progress by the designer, designated official representatives of the owner, State Construction Office and those persons required by state law to test special work for official approval. The contractor shall therefore provide safe access to the work at all times for such inspections.

b. All instructions to the contractor will be made only by or through the designer or his designated project representative. Observations made by official representatives of the owner shall be conveyed to the designer for review and coordination prior to issuance to the contractor.

c. All work shall be inspected by designer, special inspector and/or State Construction Office prior to being covered by the contractor. Contractor shall give a minimum two weeks notice unless otherwise agreed to by all parties. If inspection fails, after the first reinspection all costs associated with additional reinspections shall be borne by the contractor.

d. Where special inspection or testing is required by virtue of any state laws, instructions of the designer, specifications or codes, the contractor shall give adequate notice to the designer of the time set for such inspection or test, if the inspection or test will be conducted by a party other than the designer. Such special tests or inspections will be made in the presence of the designer, or his authorized representative, and it shall be the contractor's responsibility to serve ample notice of such tests.

e. All laboratory tests shall be paid by the owner unless provided otherwise in the contract documents except the general contractor shall pay for laboratory tests to establish design mix for concrete, and for additional tests to prove compliance with contract documents where materials have tested deficient except when the testing laboratory did not follow the appropriate ASTM testing procedures.

f. Should any work be covered up or concealed prior to inspection and approval by the designer, special inspector, and/or State Construction Office such work shall be uncovered or exposed for inspection, if so requested by the designer in writing. Inspection of the work will be made upon notice from the contractor. All cost involved in uncovering, repairing, replacing, recovering and restoring to design condition, the work that has been covered or concealed will be paid by the contractor involved.

ARTICLE 14 - CONSTRUCTION SUPERVISION AND SCHEDULE

a. Throughout the progress of the work, each contractor shall keep at the job site**,** a competent superintendent and supervisory staff satisfactory to the designer and the owner. The superintendent and supervisory staff shall not be changed without the consent of the designer and owner unless said superintendent ceases to be employed by the contractor or ceases to be competent as determined by the contractor, designer or owner. The superintendent and other staff designated by the contractor in writing shall have authority to act on behalf of the contractor, and instructions, directions or notices given to him shall be as binding as if given to the contractor. However, directions, instructions, and notices shall be confirmed in writing.

b. The contractor shall examine and study the drawings and specifications and fully understand the project design, and shall provide constant and efficient supervision to the work. Should he discover any discrepancies of any sort in the drawings or specifications, he shall report them to the designer without delay. He will not be held responsible for discrepancies in the drawings and/or specifications, but shall be held responsible to report them should they become known to him.

c. All contractors shall be required to cooperate and consult with each other during the construction of this project. Prior to installation of work, all contractors shall jointly prepare coordination drawings, showing locations of various ductworks, piping, motors, pumps, and other mechanical or electrical equipment, in relation to the structure, walls and ceilings. These drawings shall be submitted to the designer through the Project Expediter for information only**.** Each contractor shall lay out and execute his work to cause the least delay to other contractors. Each contractor shall be financially responsible for any damage to other contractor's work and for undue delay caused to other contractors on the project.

d. The contractor is required to attend job site progress conferences as called by the designer. The contractor shall be represented at these job progress conferences by both home office and project personnel. These representatives shall have authority to act on behalf of the contractor. These meetings shall be open to subcontractors, material

suppliers and any others who can contribute toward maintaining required job progress. It shall be the principal purpose of these meetings, or conferences, to effect coordination, cooperation and assistance in every practical way toward the end of maintaining progress of the project on schedule and to complete the project within the specified contract time. Each contractor shall be prepared to assess progress of the work as required in his particular contract and to recommend remedial measures for correction of progress as may be appropriate. The designer or his authorized representative shall be the coordinator of the conferences and shall preside as chairman. The contractor shall turn over a copy of his daily reports to the Designer and Owner at the job site progress conference. Owner will determine daily report format.

e The contractor(s) shall, employ an engineer or a land surveyor licensed in the State of North Carolina to lay out the work and to establish a bench mark in a location where same will not be disturbed and where direct instruments sights may be taken.

f. The designer shall designate a Project Expediter on projects involving two or more prime contracts. The Project Expediter shall be designated in the Supplementary General Conditions. The Project Expediter shall have at a minimum the following responsibilities**.**

1. Prepare the project construction schedule and shall allow all prime contractors (multi-prime contract) and subcontractors (single-prime contract) performing general, plumbing, HVAC, and electrical work equal input into the preparation of the initial construction schedule.

2. Maintain a project progress schedule for all contractors.

3. Give adequate notice to all contractors to ensure efficient continuity of all phases of the work.

4. Notify the designer of any changes in the project schedule.

5. Recommend to the owner whether payment to a contractor shall be approved**.**

g. It shall be the responsibility of the Project Expediter to cooperate with and obtain from several prime contractors and subcontractors on the job, their respective work activities and integrate these activities into a project construction schedule in form of a detailed bar chart or Critical Path Method (CPM), schedule. Each prime contractor shall provide work activities within fourteen (14) days of request by the Project Expediter. A "work activity", for scheduling purposes, shall be any component or contractual requirement of the project requiring at least one (1) day, but not more than fourteen (14) days, to complete or fulfill**.** The project construction schedule shall graphically show all salient features of the work required to construct the project from start to finish and within the allotted time established in the contract. The time (in days) between the contractor's early completion and contractual completion dates is part of the project total float time; and shall be used as such, unless amended by a change order**.** On a multi-prime project, each prime contractor shall review the proposed construction schedule and approve same in writing**.** The Project Expediter shall submit the proposed construction schedule to the designer for comments. The complete Project construction schedule shall be of the type set forth in the Supplementary General Condition or subparagraph (1) or (2) below, as appropriate:

1. For a project with total contracts of $500,000 or less, a bar chart schedule will satisfy the above requirement. The schedule shall indicate the estimated starting and completion dates for each major element of the work.

2. For a project with total contracts over $500,000, a Critical Path Method (CPM) schedule shall be utilized to control the planning and scheduling of the Work. The CPM schedule shall be the responsibility of the Project Expediter and shall be paid for by the Project Expediter.

Bar Chart Schedule: Where a bar chart schedule is required, it shall be time-scaled in weekly increments, shall indicate the estimated starting and completion dates for each major element of the work by trade and by area, level, or zone, and shall schedule dates for all salient features, including but not limited to the placing of orders for materials, submission of shop drawings and other Submittals for approval, approval of shop drawings by designers, the manufacture and delivery of material, the testing and the installation of materials, supplies and equipment, and all Work activities to be performed by the Contractor. The Contractor shall allow sufficient time in his schedule for all commissioning, required inspections and completion of final punchlist(s). Each Work activity will be assigned a time estimate by the Contractor. One day shall be the smallest time unit used.

CPM Schedule: Where a CPM schedule is required, it shall be in time-scaled precedence format using the Project Expediter's logic and time estimates. The CPM schedule shall be drawn or plotted with activities grouped or zoned by Work area or subcontract as opposed to a random (or scattered) format. The CPM schedule shall be time-scaled on a weekly basis and shall be drawn or plotted at a level of detail and logic which will schedule all salient features of the work to be performed by the Contractor. The Contractor shall allow sufficient time in his schedule for all commissioning, required inspections and completion of final punchlist(s).. Each Work activity will be assigned a time estimate by the Contractor. One day shall be the smallest time unit used.

The CPM schedule will identify and describe each activity, state the duration of each activity, the calendar dates for the early and late start and the early and late finish of each activity, and clearly highlight all activities on the critical path. "Total float" and "free float" shall be indicated for all activities. Float time shall not be considered for the exclusive use or benefit of either the Owner or the Contractor, but must be allocated in the best interest of completing the Work within the Contract time. Extensions to the Contract time, when granted by Change Order, will be granted only when equitable time adjustment exceeds the Total Float in the activity or path of activities affected by the change. On contracts with a price over $2,500,000, the CPM schedule shall also show what part of the Contract Price is attributable to each activity on the schedule, the sum of which for all activities shall equal the total Contract Price.

Early Completion of Project: The Contractor may attempt to complete the project prior to the Contract Completion Date. However, such planned early completion shall be for the Contractor's convenience only and shall not create any additional rights of the Contractor or obligations of the Owner under this Contract, nor shall it change the Time

for Completion or the Contract Completion Date. The Contractor shall not be required to pay liquidated damages to the Owner because of its failure to complete by its planned earlier date. Likewise, the Owner shall not pay the Contractor any additional compensation for early completion nor will the Owner owe the Contractor any compensation should the Owner, its officers, employees, or agents cause the Contractor not to complete earlier than the date required by the Contract Documents.

h. The proposed project construction schedule shall be presented to the designer no later than fifteen (15) days after written notice to proceed. No application for payment will be processed until this schedule is accepted by the designer and owner.

i. The approved project construction schedule shall be distributed to all contractors and displayed at the job site by the Project Expediter.

j. The several contractors shall be responsible for their work activities and shall notify the Project Expediter of any necessary changes or adjustments to their work. The Project Expediter shall maintain the project construction schedule, making biweekly adjustments, updates, corrections, etc., that are necessary to finish the project within the Contract time, keeping all contractors and the designer fully informed. Copy of a bar chart schedule annotated to show the current progress shall be submitted by the Contractor(s) to the designer, along with monthly request for payment. For project requiring CPM schedule, the Contractor shall submit a biweekly report of the status of all activities. The bar chart schedule or status report shall show the actual Work completed to date in comparison with the original Work scheduled for all activities. If any activities of the work of several contractors are behind schedule, the contractor must indicate in writing, what measures will be taken to bring each such activity back on schedule and to ensure that the Contract Completion Date is not exceeded. A plan of action and recovery schedule shall be developed and submitted to the designer by the Project Expediter, when (1) the contractor's report indicates delays, that are in the opinion of the designer or the owner, of sufficient magnitude that the contractor's ability to complete the work by the scheduled completion is brought into question; (2) the updated construction schedule is thirty (30) days behind the planned or baseline schedule and no legitimate time extensions, as determined by the Designer, are in process; and (3) the contractor desires to make changes in the logic (sequencing of work) or the planned duration of future activities of the CPM schedule which, in the opinion of the designer or the owner, are of a major nature. The plan of action, when required shall be submitted to the Owner for review within two (2) business days of the Contractor receiving the Owner's written demand. The recovery schedule, when required, shall be submitted to the Owner within five (5) calendar days of the Contractor's receiving the Owner's written demand. Failure to provide an updated construction schedule or a recovery schedule may be grounds for rejection of payment applications or withholding of funds as set forth in Article 33.

k. The Project Expediter shall notify each contractor of such events or time frames that are critical to the progress of the job. Such notice shall be timely and reasonable. Should the progress be delayed due to the work of any of the several contractors, it shall be the duty of the Project Expediter to immediately notify the contractor(s) responsible for such delay, the designer, the State Construction Office and other prime contractors. The designer shall determine the contractor(s) who caused the delays and notify the bonding company of the responsible contractor(s) of the delays; and shall make a recommendation to the owner regarding further action.

l. Designation as Project Expediter entails an additional project control responsibility and does not alter in any way the responsibility of the contractor so designated, nor the

responsibility of the other contractors involved in the project. The project expeditor's Superintendent(s) shall be in attendance at the Project site at all times when work is in progress unless conditions are beyond the control of the Contractor or until termination of the Contract in accordance with the Contract Documents. It is understood that such Superintendent shall be acceptable to the Owner and Designer and shall be the one who will be continued in that capacity for the duration of the project unless he ceases to be on the Contractor's payroll or the Owner otherwise agrees. The Superintendent shall not be employed on any other project for or by the Contractor or by any other entity during the course of the Work. If the Superintendent is employed by the Contractor on another project without the Owner's approval, then the Owner may deduct from the Contractor's monthly general condition costs and amount representing the Superintendent's cost and shall deduct that amount for each month thereafter until the Contractor has the Superintendent back on the Owner's Project full-time.

ARTICLE 15 - SEPARATE CONTRACTS AND CONTRACTOR RELATIONSHIPS

a. Effective from January 1, 2002, Chapter 143, Article 8, was amended, to allow public contracts to be delivered by the following delivery methods: single-prime, dual (single-prime and separate-prime), construction manager at risk, and alternative contracting method as approved by the State Building Commission. The owner reserves the right to prepare separate specifications, receive separate bids, and award separate contracts for such other major items of work as may be in the best interest of the State. For the purposes of a single prime contract, refer to Article 1 – Definitions.

b. All contractors shall cooperate with each other in the execution of their work, and shall plan their work in such manner as to avoid conflicting schedules or delay of the work. See Article 14, Construction Supervision.

c. If any part of contractor's work depends upon the work of another contractor, defects which may affect that work shall be reported to the designer in order that prompt inspection may be made and the defects corrected. Commencement of work by a contractor where such condition exists will constitute acceptance of the other contractor's work as being satisfactory in all respects to receive the work commenced, except as to defects which may later develop. The designer shall be the judge as to the quality of work and shall settle all disputes on the matter between contractors.

d. Any mechanical or electrical work such as sleeves, inserts, chases, openings, penetrations, etc., which is located in the work of the general contractor shall be built in by the general contractor. The respective mechanical and electrical contractors shall set all sleeves, inserts and other devices that are to be incorporated into the structure in cooperation and under the supervision of the general contractor. The responsibility for the exact location of such items shall be that of the mechanical and/or electrical contractor.

e. The designer and the owner shall have access to the work whenever it is in preparation and progress and during normal working hours. The contractor shall provide facilities for such access so the designer may perform his functions under the contract documents.

f. Should a contractor cause damage to the work or property of another contractor, he shall be directly responsible, and upon notice, shall promptly settle the claim or otherwise resolve the dispute.

ARTICLE 16 - SUBCONTRACTS AND SUBCONTRACTORS

a. Within thirty (30) days after award of the contract, the contractor shall submit to the designer, owner and to the State Construction Office a list giving the names and addresses of subcontractors and equipment and material suppliers he proposes to use, together with the scope of their respective parts of the work. Should any subcontractor be disapproved by the designer or owner, the designer or owner shall submit his reasons for disapproval in writing to the State Construction Office for its consideration with a copy to the contractor. If the State Construction Office concurs with the designer's or owner's recommendation, the contractor shall submit a substitute for approval. The designer and owner shall act promptly in the approval of subcontractors, and when approval of the list is given, no changes of subcontractors will be permitted except for cause or reason considered justifiable by the designer or owner.

b. The designer will furnish to any subcontractor, upon request, evidence regarding amounts of money paid to the contractor on account of the subcontractor's work.

c. The contractor is and remains fully responsible for his own acts or omissions as well as those of any subcontractor or of any employee of either. The contractor agrees that no contractual relationship exists between the subcontractor and the owner in regard to the contract, and that the subcontractor acts on this work as an agent or employee of the contractor.

d. The owner reserves the right to limit the amount of portions of work to be subcontracted as hereinafter specified.

ARTICLE 17 - CONTRACTOR AND SUBCONTRACTOR RELATIONSHIPS

The contractor agrees that the terms of these contract documents shall apply equally to each subcontractor as to the contractor, and the contractor agrees to take such action as may be necessary to bind each subcontractor to these terms. The contractor further agrees to conform to the Code of Ethical Conduct as adopted by the Associated General Contractors of America, Inc., with respect to contractor-subcontractor relationships, and that payments to subcontractors shall be made in accordance with the provisions of G.S. 143-134.1 titled Interest on final payments due to prime contractors: payments to subcontractors.

a. On all public construction contracts which are let by a board or governing body of the state government or any political subdivision thereof, except contracts let by the Department of Transportation pursuant to G.S. 136-28.1, the balance due prime contractors shall be paid in full within 45 days after respective prime contracts of the project have been accepted by the owner, certified by the architect, engineer or designer to be completed in accordance with terms of the plans and specifications, or occupied by the owner and used for the purpose for which the project was constructed, whichever occurs first. Provided, however, that whenever the architect or consulting engineer in charge of the project determines that delay in completion of the project in accordance with terms of the plans and specifications is the fault of the contractor, the project may be occupied and used for the purposes for which it was constructed without payment of any interest on amounts withheld past the 45 day limit. No payment shall be delayed because of the failure of another prime contractor on such project to complete his contract. Should final payment to any prime contractor beyond the date such contracts have been certified to be completed by the designer or architect, accepted by the owner, or occupied by the owner and used for the purposes for which the project was constructed, be delayed by more than 45 days, said prime contractor shall be paid interest, beginning on the 46th day, at the rate of one percent (1%) per month or fraction thereof unless a lower rate is

agreed upon on such unpaid balance as may be due. In addition to the above final payment provisions, periodic payments due a prime contractor during construction shall be paid in accordance with the payment provisions of the contract documents or said prime contractor shall be paid interest on any such unpaid amount at the rate stipulated above for delayed final payments. Such interest shall begin on the date the payment is due and continue until the date on which payment is made. Such due date may be established by the terms of the contract. Funds for payment of such interest on state-owned projects shall be obtained from the current budget of the owning department, institution or agency. Where a conditional acceptance of a contract exists, and where the owner is retaining a reasonable sum pending correction of such conditions, interest on such reasonable sum shall not apply.

b. Within seven days of receipt by the prime contractor of each periodic or final payment, the prime contractor shall pay the subcontractor based on work completed or service provided under the subcontract. Should any periodic or final payment to the subcontractor be delayed by more than seven days after receipt of periodic or final payment by the prime contractor, the prime contractor shall pay the subcontractor interest, beginning on the eighth day, at the rate of one percent (1%) per month or fraction thereof on such unpaid balance as may be due.

c. The percentage of retainage on payments made by the prime contractor to the subcontractor shall not exceed the percentage of retainage on payments made by the owner to the prime contractor. Any percentage of retainage on payments made by the prime contractor to the subcontractor that exceeds the percentage of retainage on payments made by the owner to the prime contractor shall be subject to interest to be paid by the prime contractor to the subcontractor at the rate of one percent (1%) per month or fraction thereof.

d. Nothing in this section shall prevent the prime contractor at the time of application and certification to the owner from withholding application and certification to the owner for payment to the subcontractor for unsatisfactory job progress; defective construction not remedied; disputed work; third-party claims filed or reasonable evidence that claim will be filed; failure of subcontractor to make timely payments for labor, equipment and materials; damage to prime contractor or another subcontractor; reasonable evidence that subcontract cannot be completed for the unpaid balance of the subcontract sum; or a reasonable amount for retainage not to exceed the initial percentage retained by owner.

ARTICLE 18 - DESIGNER'S STATUS

a. The designer shall provide general administration of the performance of construction contracts, including liaison and necessary inspection of the work to ensure compliance with plans and specifications. He is the agent of the owner only for the purpose of constructing this work and to the extent stipulated in the contract documents. He has authority to direct work to be performed, to stop work, to order work removed, or to order corrections of faulty work, where any such action by the designer may be necessary to assure successful completion of the work.

b. The designer is the impartial interpreter of the contract documents, and, as such, he shall exercise his powers under the contract to enforce faithful performance by both the owner and the contractor, taking sides with neither.

c. Should the designer cease to be employed on the work for any reason whatsoever, then the owner shall employ a competent replacement who shall assume the status of the former designer.

d. The designer and his consultants will make inspections of the project. He will inspect the progress, the quality and the quantity of the work.

e. The designer and the owner shall have access to the work whenever it is in preparation and progress during normal working hours. The contractor shall provide facilities for such access so the designer and owner may perform their functions under the contract documents.

f. Based on the designer's inspections and evaluations of the project, the designer shall issue interpretations, directives and decisions as may be necessary to administer the project. His decisions relating to artistic effect and technical matters shall be final, provided such decisions are within the limitations of the contract.

ARTICLE 19 - CHANGES IN THE WORK

a. The owner may have changes made in the work covered by the contract. These changes will not invalidate and will not relieve or release the contractor from any guarantee given by him pertinent to the contract provisions. These changes will not affect the validity of the guarantee bond and will not relieve the surety or sureties of said bond. All extra work shall be executed under conditions of the original contract.

b. Except in an emergency endangering life or property, no change shall be made by the contractor except upon receipt of approved change order or written field order from the designer, countersigned by the owner and the state construction office authorizing such change. No claim for adjustments of the contract price shall be valid unless this procedure is followed.

A field order, transmitted by fax, electronically, or hand delivered, may be used where the change involved impacts the critical path of the work. A formal change order shall be issued as expeditiously as possible.

In the event of emergency endangering life or property, the contractor may be directed to proceed on a time and material basis whereupon the contractor shall proceed and keep accurately on such form as specified by the designer or owner, a correct account of costs together with all proper invoices, payrolls and supporting data. Upon completion of the work the change order will be prepared as outlined under either Method "c(1)" or Method "c(2)" or both.

c. In determining the values of changes, either additive or deductive, contractors are restricted to the use of the following methods:

1. Where the extra work involved is covered by unit prices quoted in the proposal, or subsequently agreed to by the Contractor, Designer, Owner and State Construction Office the value of the change shall be computed by application of unit prices based on quantities, estimated or actual as agreed of the items involved, except is such cases where a quantity exceeds the estimated quantity allowance in the contract by one hundred percent (100%) or more. In such cases, either party may elect to proceed under subparagraph c2 herein. If neither party elects to proceed under c2, then unit prices shall apply.

2. The contracting parties shall negotiate and agree upon the equitable value of the change prior to issuance of the change order, and the change order shall stipulate the corresponding lump sum adjustment to the contract price.

d. Under Paragraph “b” and Methods "c(2)" above, the allowances for overhead and profit combined shall be as follows: all contractors (the single contracting entity (prime), his subcontractors(1st tier subs), or their sub-subcontractors (2nd tier subs, 3rd tier subs, etc)) shall be allowed a maximum of 10% on work they each self-perform; the prime contractor shall be allowed a maximum of 5% on contracted work of his 1st tier sub; 1st tier, 2nd tier, 3rd tier, etc contractors shall be allowed a maximum of 2.5% on the contracted workof their subs. ; Under Method "c(1)", no additional allowances shall be made for overhead and profit. In the case of deductible change orders, under Method "c(2)" and Paragraph (b) above, the contractor shall include no less than five percent (5%***)*** profit, but no allowances for overhead.

e. The term "net cost" as used herein shall mean the difference between all proper cost additions and deductions. The "cost" as used herein shall be limited to the following:

1. The actual costs of materials and supplies incorporated or consumed as part of the work;

2. The actual costs of labor expended on the project site; labor expended in coordination, change order negotiation, record document maintenance, shop drawing revision or other tasks necessary to the administration of the project are considered overhead whether they take place in an office or on the project site.

3. The actual costs of labor burden, limited to the costs of social security (FICA) and Medicare/Medicaid taxes; unemployment insurance costs; health/dental/vision insurance premiums; paid employee leave for holidays, vacation, sick leave, and/or petty leave, not to exceed a total of 30 days per year; retirement contributions; worker’s compensation insurance premiums; and the costs of general liability insurance when premiums are computed based on payroll amounts; the total of which shall not exceed thirty percent (30%) of the actual costs of labor;

4. The actual costs of rental for tools, excluding hand tools; equipment; machinery; and temporary facilities required for the work;

5. The actual costs of premiums for bonds, insurance, permit fees, and sales or use taxes related to the work.

Overtime and extra pay for holidays and weekends may be a cost item only to the extent approved by the owner.

f. Should concealed conditions be encountered in the performance of the work below grade, or should concealed or unknown conditions in an existing structure be at variance with the conditions indicated by the contract documents, the contract sum and time for completion may be equitably adjusted by change order upon claim by either party made within thirty (30) days after the condition has been identified. The cost of such change shall be arrived at by one of the foregoing methods. All change orders shall be supported by a unit cost breakdown showing method of arriving at net cost as defined above.

g. In all change orders, the procedure will be for the designer to request proposals for the change order work in writing. The contractor will provide such proposal and supporting data in suitable format. The designer shall verify correctness. Delay in the processing of the change order due to lack of proper submittal by the contractor of all required supporting data shall not constitute grounds for a time extension or basis of a claim. Within fourteen (14) days after receipt of the contractor’s accepted proposal including all supporting documentation required by the designer**,** the designer shall prepare the change order and forward to the contractor for his signature or otherwise respond, in writing, to

the contractor's proposal. Within seven (7) days after receipt of the change order executed by the contractor, the designer shall, certify the change order by his signature, and forward the change order and all supporting data to the owner for the owner's signature. The owner shall execute the change order and forward to the State Construction Office for final approval**,** within seven (7) days of receipt. The State Construction Office shall act on the change order within seven (7) days. In case of emergency or extenuating circumstances, approval of changes may be obtained verbally by telephone or field orders approved by all parties, then shall be substantiated in writing as outlined under normal procedure.

h. At the time of signing a change order, the contractor shall be required to certify as follows:

"I certify that my bonding company will be notified forthwith that my contract has been changed 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."

i. A change order, when issued, shall be full compensation, or credit, for the work included, omitted or substituted. It shall show on its face the adjustment in time for completion of the project as a result of the change in the work.

j. If, during the progress of the work, the owner requests a change order and the contractor's terms are unacceptable, the owner**,** with the approval of the State Construction Office, may require the contractor to perform such work on a time and material basis whereupon the contractor shall proceed and keep accurately on such form as specified by the Designer or owner, a correct account of cost together with all proper invoices, payrolls and supporting data. Upon completion of the work a change order will be prepared with allowances for overhead and profit per paragraph d. above and "net cost" and "cost" per paragraph e. above. Without prejudice, nothing in this paragraph shall preclude the owner from performing or to have performed that portion of the work requested in the change order.

ARTICLE 20 - CLAIMS FOR EXTRA COST

a. Should the contractor consider that as a result of instructions given by the designer, he is entitled to extra cost above that stated in the contract, he shall give written notice thereof to the designer within seven (7) days without delay. The written notice shall clearly state that a claim for extra cost is being made and shall provide a detailed justification for the extra cost. The contractor shall not proceed with the work affected until further advised, except in emergency involving the safety of life or property, which condition is covered in Article 19(b) and Article 11(h). No claims for extra compensation shall be considered unless the claim is so made. The designer shall render a written decision within seven (7) days of receipt of claim.

b. The contractor shall not act on instructions received by him from persons other than the designer, and any claims for extra compensation or extension of time on account of such instruction will not be honored. The designer shall not be responsible for misunderstandings claimed by the contractor of verbal instructions which have not been confirmed in writing, and in no case shall instructions be interpreted as permitting a departure from the contract documents unless such instruction is confirmed in writing and supported by a properly authorized change order.

c. Should a claim for extra compensation that complies with the requirements of (a) above by the contractor and is denied by the designer or owner, and cannot be resolved by a

representative of the State Construction Office, the contractor may request a mediation in connection with GS 143-128(f1) in the dispute resolution rules adopted by the State Building Commission (1 N.C.A.C. 30H .0101 through .1001). If the contractor is unable to resolve its claim as a result of mediation, the contractor may pursue the claim in accordance with the provisions of G.S. 143-135.3, or G.S. 143-135.6 where Community Colleges are the owner,and the following:

1. A contractor who has not completed a contract with a board for construction or repair work and who has not received the amount he claims is due under the contract may submit a verified written claim to the director of the State Construction Office of the Department of Administration for the amount the contractor claims is due. The director may deny, allow or compromise the claim, in whole or in part. A claim under this subsection is not a contested case under Chapter 150B of the General Statutes.

2. (a) A contractor who has completed a contract with a board for construction or repair work and who has not received the amount he claims is due under the contract may submit a verified written claim to the director of the State Construction Office of the Department of Administration for the amount the contractor claims is due. The claim shall be submitted within sixty (60) days after the contractor receives a final statement of the board's disposition of his claim and shall state the factual basis for the claim.

   (b) The director shall investigate a submitted claim within ninety (90) days of receiving the claim, or within any longer time period upon which the director and the contractor agree. The contractor may appear before the director, either in person or through counsel, to present facts and arguments in support of his claim. The director may allow, deny or compromise the claim, in whole or in part. The director shall give the contractor a written statement of the director's decision on the contractor's claim.

   (c) A contractor who is dissatisfied with the director's decision on a claim submitted under this subsection may commence a contested case on the claim under Chapter 150B of the General Statutes. The contested case shall be commenced within sixty (60) days of receiving the director's written statement of the decision.

   (d) As to any portion of a claim that is denied by the director, the contractor may, in lieu of the procedures set forth in the preceding subsection of this section, within six (6) months of receipt of the director's final decision, institute a civil action for the sum he claims to be entitled to under the contract by filing a verified complaint and the issuance of a summons in the Superior Court of Wake County or in the superior court of any county where the work under the contract was performed. The procedure shall be the same as in all civil actions except that all issues shall be tried by the judge, without a jury.

ARTICLE 21 - MINOR CHANGES IN THE WORK

The designer will have the authority to order minor changes in the work not involving an adjustment in the contract sum or time for completion, and not inconsistent with the intent of the contract documents. Such changes shall be effected by written order, copied to the State Construction Office, and shall be binding on the owner and the contractor.

ARTICLE 22 - UNCORRECTED FAULTY WORK

Should the correction of faulty or damaged work be considered inadvisable or inexpedient by the owner and the designer, the owner shall be reimbursed by the contractor. A change order will be issued to reflect a reduction in the contract sum.

ARTICLE 23 - TIME OF COMPLETION, DELAYS, EXTENSION OF TIME

a. The time of completion is stated in the Supplementary General Conditions and in the Form of Construction Contract. The Project Expediter, upon notice of award of contract, shall prepare a construction schedule to complete the project within the time of completion as required by Article 14.

b. The contractors shall commence work to be performed under this agreement on a date to be specified in a written Notice to Proceed from the designer and shall fully complete all work hereunder within the time of completion stated. Time is of the essence and the contractor acknowledges the Owner will likely suffer financial damage for failure to complete the work within the time of completion. For each day in excess of the above number of days, the contractor(s) shall pay the owner the sum stated as liquidated damages reasonably estimated in advance to cover the losses to be incurred by the owner by reason of failure of said contractor(s) to complete the work within the time specified, such time being in the essence of this contract and a material consideration thereof.

c. In the event of multiple prime contractors, the designer shall be the judge as to the division of responsibility between the contractor(s), based on the construction schedule, weekly reports and job records, and shall apportion the amount of liquidated damages to be paid by each of them, according to delay caused by any or all of them.

d. If the contractor is delayed at any time in the progress of his work solely by any act or negligence of the owner, the designer, or by any employee of either; by any separate contractor employed by the owner; by changes ordered in the work; by labor disputes at the project site; by abnormal weather conditions not reasonably anticipated for the locality where the work is performed; by unavoidable casualties; by any causes beyond the contractor's control; or by any other causes which the designer and owner determine may justify the delay, then the contract time may be extended by change order only for the time which the designer and owner may determine is reasonable.

   Time extensions will not be granted for rain, wind, snow or other natural phenomena of normal intensity for the locality where work is performed. For purpose of determining extent of delay attributable to unusual weather phenomena, a determination shall be made by comparing the weather for the contract period involved with the average of the preceding five (5) year climatic range during the same time interval based on the National Oceanic and Atmospheric Administration National Weather Service statistics for the locality where work is performed and on daily weather logs kept on the job site by the contractor reflecting the effect of the weather on progress of the work and initialed by the designer's representative. No weather delays shall be considered after the building is dried in unless work claimed to be delayed is on the critical path of the baseline schedule or approved updated schedule. Time extensions for weather delays, acts of God, labor disputes, fire, delays in transportation, unavoidable casualties or other delays which are beyond the control of the Owner do not entitle the Contractor to compensable damages for delays. Any contractor claim for compensable damages for delays is limited to delays caused solely by the owner or its agents. Contractor caused delays shall be accounted for before owner or designer caused delays in the case of concurrent delays.

e. Request for extension of time shall be made in writing to the designer, copies to the owner and SCO, within twenty (20) days following cause of delay. In case of continuing cause for delay, the Contractor shall notify the_Designer to the designer, copies to the owner and SCO, of the delay within 20 days of the beginning of the delay and only one claim is necessary.

f. The contractor shall notify his surety in writing of extension of time granted.

g. No claim for time extension shall be allowed on account of failure of the designer to furnish drawings or instructions until twenty (20) days after demand for such drawings and/or instructions. See Article 5c. Demand must be in written form clearly stating the potential for delay unless the drawings or instructions are provided. Any delay granted will begin after the twenty (20) day demand period is concluded.

ARTICLE 24 - PARTIAL UTILIZATION/BENEFICIAL OCCUPANCY

a. The owner may desire to occupy or utilize all or a portion of the project prior to the completion of the project.

b. Should the owner request a utilization of a building or portion thereof, the designer shall perform a designer final inspection of area after being notified by the contractor that the area is ready for such. After the contractor has completed designer final inspection punch list and the designer has verified, then the designer shall schedule a beneficial occupancy inspection at a time and date acceptable to the owner, contractor(s) and State Construction Office. If beneficial occupancy is granted by the State Construction Office, in such areas the following will be established:

1. The beginning of guarantees and warranties period for the equipment necessary to support. in the area.

2. The owner assumes all responsibiliites for utility costs for entire building.

2. Contractor will obtain consent of surety.

3. Contractor will obtain endorsement from insurance company permitting beneficial occupancy.

c. The owner shall have the right to exclude the contractor from any part of the project which the designer has so certified to be substantially complete, but the owner will allow the contractor reasonable access to complete or correct work to bring it into compliance with the contract.

d. Occupancy by the owner under this article will in no way relieve the contractor from his contractual requirement to complete the project within the specified time. The contractor will not be relieved of liquidated damages because of beneficial occupancy. The designer may prorate liquidated damages based on the percentage of project occupied.

ARTICLE 25 - FINAL INSPECTION, ACCEPTANCE, AND PROJECT CLOSEOUT

a. Upon notification from the contractor(s) that the project is complete and ready for inspection, the designer shall make a Designer final inspection to verify that the project is complete and ready for SCO final inspection. Prior to SCO final inspection, the contractor(s) shall complete all items requiring corrective measures noted at the Designer

final inspection**.** The designer shall schedule a SCO final inspection at a time and date acceptable to the owner, contractor(s) and State Construction Office.

b. At the SCO final inspection, the designer and his consultants shall, if job conditions warrant, record a list of items that are found to be incomplete or not in accordance with the contract documents. At the conclusion of the SCO final inspection, the designer and State Construction Office representative shall make one of the following determinations:

   1. That the project is completed and accepted.

   2. That the project will be accepted subject to the correction of the list of discrepancies (punch list). All punch list items must be completed within thirty (30) days of SCO final inspection or the owner may invoke Article 28, Owner's Right to Do Work.

   4. That the project is not complete and another date for a SCO final inspection will be established.

c. Within fourteen (14) days of final acceptance per Paragraph b1 or within fourteen (14) days after completion of punch list per Paragraph b2 above, the designer shall certify the work and issue applicable certificate(s) of compliance.

d. Any discrepancies listed or discovered after the date of SCO final inspection and acceptance under Paragraphs b1 or b2 above shall be handled in accordance with Article 42, Guarantee.

f. The final acceptance date will establish the following:

   1. The beginning of guarantees and warranties period.

   2. The date on which the contractor's insurance coverage for public liability, property damage and builder's risk may be terminated.

   3. That no liquidated damages (if applicable) shall be assessed after this date.

   4. The termination date of utility cost to the contractor.

g. Prior to issuance of final acceptance date, the contractor shall have his authorized representatives visit the project and give full instructions to the designated personnel regarding operating, maintenance, care, and adjustment of all equipment and special construction elements. In addition, the contractor shall provide to the owner a complete instructional video (media format acceptable to the owner) on the operation, maintenance, care and adjustment of all equipment and special construction elements.

ARTICLE 26 - CORRECTION OF WORK BEFORE FINAL PAYMENT

a. Any work, materials, fabricated items or other parts of the work which have been condemned or declared not in accordance with the contract by the designer shall be promptly removed from the work site by the contractor, and shall be immediately replaced by new work in accordance with the contract at no additional cost to the owner. Work or property of other contractors or the owner, damaged or destroyed by virtue of such faulty work, shall be made good at the expense of the contractor whose work is faulty.

b. Correction of condemned work described above shall commence within twenty-four (24) hours after receipt of notice from the designer, and shall make satisfactory progress, as determined by the designer, until completed.

c. Should the contractor fail to proceed with the required corrections, then the owner may complete the work in accordance with the provisions of Article 28.

ARTICLE 27 - CORRECTION OF WORK AFTER FINAL PAYMENT

See Article 35, Performance Bond and Payment Bond, and Article 42, Guarantee**.** Neither the final certificate, final payment, occupancy of the premises by the owner, nor any provision of the contract, nor any other act or instrument of the owner, nor the designer, shall relieve the contractor from responsibility for negligence, or faulty material or workmanship, or failure to comply with the drawings and specifications. Contractor shall correct or make good any defects due thereto and repair any damage resulting there from, which may appear during the guarantee period following final acceptance of the work except as stated otherwise under Article 42, Guarantee. The owner will report any defects as they may appear to the contractor and establish a time limit for completion of corrections by the contractor. The owner will be the judge as to the responsibility for correction of defects.

ARTICLE 28 - OWNER'S RIGHT TO DO WORK

If, during the progress of the work or during the period of guarantee, the contractor fails to prosecute the work properly or to perform any provision of the contract, the owner, after seven (7) days' written notice sent by certified mail, return receipt requested, to the contractor from the designer, may perform or have performed that portion of the work. The cost of the work may be deducted from any amounts due or to become due to the contractor, such action and cost of same having been first approved by the designer. Should the cost of such action of the owner exceed the amount due or to become due the contractor, then the contractor or his surety, or both, shall be liable for and shall pay to the owner the amount of said excess.

ARTICLE 29 - ANNULMENT OF CONTRACT

If the contractor fails to begin the work under the contract within the time specified, or the progress of the work is not maintained on schedule, or the work is not completed within the time above specified, or fails to perform the work with sufficient workmen and equipment or with sufficient materials to ensure the prompt completion of said work, or shall perform the work unsuitably or shall discontinue the prosecution of the work, or if the contractor shall become insolvent or be declared bankrupt or commit any act of bankruptcy or insolvency, or allow any final judgment to stand against him unsatisfied for a period of forty-eight (48) hours, or shall make an assignment for the benefit of creditors, or for any other cause whatsoever shall not carry on the work in an acceptable manner, the owner may give notice in writing, sent by certified mail, return receipt requested, to the contractor and his surety of such delay, neglect or default, specifying the same, and if the contractor within a period of seven (7) days after such notice shall not proceed in accordance therewith, then the owner shall, declare this contract in default, and, thereupon, the surety shall promptly take over the work and complete the performance of this contract in the manner and within the time frame specified. In the event the surety shall fail to take over the work to be done under this contract within seven (7) days after being so notified and notify the owner in writing, sent by certified mail, return receipt requested, that he is taking the same over and stating that he will diligently pursue and complete the same, the owner shall have full power and authority, without violating the contract, to take the prosecution of the work out of the hands of said contractor, to appropriate or use any or all contract materials and equipment on the grounds as may be suitable and acceptable and may enter into an agreement, either by public letting or negotiation, for the completion of said contract according to the terms and provisions thereof

or use such other methods as in his opinion shall be required for the completion of said contract in an acceptable manner. All costs and charges incurred by the owner, together with the costs of completing the work under contract, shall be deducted from any monies due or which may become due said contractor and surety. In case the expense so incurred by the owner shall be less than the sum which would have been payable under the contract, if it had been completed by said contractor, then the said contractor and surety shall be entitled to receive the difference, but in case such expense shall exceed the sum which would have been payable under the contract, then the contractor and the surety shall be liable and shall pay to the owner the amount of said excess.

ARTICLE 30 - CONTRACTOR'S RIGHT TO STOP WORK OR TERMINATE THE CONTRACT

a. Should the work be stopped by order of a court having jurisdiction, or by order of any other public authority for a period of three months, due to cause beyond the fault or control of the contractor, or if the owner should fail or refuse to make payment on account of a certificate issued by the designer within forty-five (45) days after receipt of same, then the contractor, after fifteen (15) days' written notice sent by certified mail, return receipt requested, to the owner and the designer, may suspend operations on the work or terminate the contract.

b. The owner shall be liable to the contractor for the cost of all materials delivered and work performed on this contract plus 10 percent overhead and profit and shall make such payment. The designer shall be the judge as to the correctness of such payment.

ARTICLE 31 - REQUEST FOR PAYMENT

a. Not later than the fifth day of the month, the contractor shall submit to the designer a request for payment for work done during the previous month. The request shall be in the form agreed upon between the contractor and the designer, but shall show substantially the value of work done and materials delivered to the site during the period since the last payment, and shall sum up the financial status of the contract with the following information:

    1. Total of contract including change orders.

    2. Value of work completed to date.

    3. Less five percent (5%) retainage, provided however, that after fifty percent (50%) of the contractor’s work has been satisfactorily completed on schedule, with approval of the owner and the State Construction Office and written consent of the surety, further requirements for retainage will be waived only so long as work continues to be completed satisfactorily and on schedule.

    4. Less previous payments.

    5. Current amount due.

b. The contractor, upon request of the designer, shall substantiate the request with invoices of vouchers or payrolls or other evidence.

c. Prior to submitting the first request, the contractor shall prepare for the designer a schedule showing a breakdown of the contract price into values of the various parts of the work, so arranged as to facilitate payments to subcontractors in accordance with Article 17, Contractor and Subcontractor Relationships. The contractor(s) shall list the

value of each subcontractor and supplier, identifying each minority business subcontractor and supplier as listed in Affidavit C, if applicable.

d. When payment is made on account of stored materials and equipment, such materials must be stored on the owner's property, and the requests for payments shall be accompanied by invoices or bills of sale or other evidence to establish the owner's title to such materials and equipment. Such payments will be made only for materials that have been customized or fabricated specifically for this project. Raw materials or commodity products including but not limited to piping, conduit, CMU, metal studs and gypsum board may not be submitted. Responsibility for such stored materials and equipment shall remain with the contractor regardless of ownership title. Such stored materials and equipment shall not be removed from the owner's property. Should the space for storage on-site be limited, the contractor, at his option, shall be permitted to store such materials and/or equipment in a suitable space off-site. Should the contractor desire to include any such materials or equipment in his application for payment, they must be stored in the name of the owner in an independent, licensed, bonded warehouse approved by the designer, owner and the State Construction Office and located as close to the site as possible. The warehouse selected must be approved by the contractor's bonding and insurance companies; the material to be paid for shall be assigned to the owner and shall be inspected by the designer. Upon approval by the designer, owner and SCO of the storage facilities and materials and equipment, payment therefore will be certified. Responsibility for such stored materials and equipment shall remain with the contractor. Such stored materials and equipment shall not be moved except for transportation to the project site. Under certain conditions, the designer may approve storage of materials at the point of manufacture, which conditions shall be approved by the designer, the owner and the State Construction Office prior to approval for the storage and shall include an agreement by the storing party which unconditionally gives the State absolute right to possession of the materials at anytime. Bond, security and insurance protection shall continue to be the responsibility of the contractor(s).

e. In the event of beneficial occupancy, retainage of funds due the contractor(s) may be reduced with the approval of the State Construction Office to an equitable amount to cover the list of items to be completed or corrected. Retainage may not be reduced to less than two and one-half (2 1/2) times the estimated value of the work to be completed or corrected. Reduction of retainage must be with the consent and approval of the contractor's bonding company.

ARTICLE 32 - CERTIFICATES OF PAYMENT AND FINAL PAYMENT

a. Within five (5) days from receipt of request for payment from the contractor, the designer shall issue and forward to the owner a certificate for payment. This certificate shall indicate the amount requested or as approved by the designer. If the certificate is not approved by the designer, he shall state in writing to the contractor and the owner his reasons for withholding payment.

b. No certificate issued or payment made shall constitute an acceptance of the work or any part thereof. The making and acceptance of final payment shall constitute a waiver of all claims by the owner except:

   1. Claims arising from unsettled liens or claims against the contractor.

   2. Faulty work or materials appearing after final payment.

   3. Failure of the contractor to perform the work in accordance with drawings and specifications, such failure appearing after payment.

4. As conditioned in the performance bond and payment bond.

c. The making and acceptance of final payment shall constitute a waiver of all claims by the contractor except those claims previously made and remaining unsettled (Article 20(c)).

d. Prior to submitting request for final payment to the designer for approval, the contractor shall fully comply with all requirements specified in the" project closeout" section of the specifications. These requirements include but not limited to the following:

1. Submittal of Product and Operating Manuals, Warranties and Bonds, Guarantees, Maintenance Agreements, As-Built Drawings, Certificates of Inspection or Approval from agencies having jurisdiction. (The designer must approve the Manuals prior to delivery to the owner).

2. Transfer of Required attic stock material and all keys in an organized manner.

3. Record of Owner's training.

4. Resolution of any final inspection discrepancies.

5. Granting access to Contractor's records, if Owner's internal auditors have made a request for such access pursuant to Article 52.

e. The contractor shall forward to the designer, the final application for payment along with the following documents:

1. List of minority business subcontractors and material suppliers showing breakdown of contract amounts and total actual payments to subs and material suppliers.

2. Affidavit of Release of Liens.

3. Affidavit of contractors of payment to material suppliers and subcontractors. (See Article 36).

4. Consent of Surety to Final Payment**.**

5. Certificates of state agencies required by state law.

f. The designer will not authorize final payment until the work under contract has been certified by designer, certificates of compliance issued, and the contractor has complied with the closeout requirements. The designer shall forward the contractor's final application for payment to the owner along with respective certificate(s) of compliance required by law.

ARTICLE 33 - PAYMENTS WITHHELD

a. The designer with the approval of the State Construction Office may withhold payment for the following reasons:

1. Faulty work not corrected.

2. The unpaid balance on the contract is insufficient to complete the work in the judgment of the designer.

3. To provide for sufficient contract balance to cover liquidated damages that will be assessed.

b. The secretary of the Department of Administration may authorize the withholding of payment for the following reasons:

1. Claims filed against the contractor or evidence that a claim will be filed.

2. Evidence that subcontractors have not been paid.

c. The Owner may withhold all or a portion of Contractor's general conditions costs set forth in the approved schedule of values, if Contractor has failed to comply with: (1) a request to access its records by Owner's internal auditors pursuant to Article 52; (2) a request for a plan of action and/or recovery schedule under Article 14.j or provide The Owner; (3) a request to provide an electronic copies of Contractor's baseline schedule, updates with all logic used to create the schedules in the original format of the scheduling software; and (4) Contractor's failure to have its Superintendent on the Project full-time; (

d. When grounds for withholding payments have been removed, payment will be released. Delay of payment due the contractor without cause will make owner liable for payment of interest to the contractor in accordance with G.S. 143-134.1. As provided in G.S.143-134.1(e) the owner shall not be liable for interest on payments withheld by the owner for unsatisfactory job progess, defective construction not remedied, disputed work, or third-party claims filed against the owner or reasonable evidence that a third-party claim will be filed.

ARTICLE 34 - MINIMUM INSURANCE REQUIREMENTS

The work under this contract shall not commence until the contractor has obtained all required insurance and verifying certificates of insurance have been approved in writing by the owner. These certificates shall document that coverages afforded under the policies will not be cancelled, reduced in amount or coverages 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. If endorsements are needed to comply with the notification or other requirements of this article copies of the endorsements shall be submitted with the certificates.

a. **Worker's Compensation and Employer's Liability**

The contractor shall provide and maintain, until final acceptance, workmen's compensation insurance, as required by law, as well as employer's liability coverage with minimum limits of $100,000.

b. **Public Liability and Property Damage**

The contractor shall provide and maintain, until final acceptance, comprehensive general liability insurance, including coverage for premises operations, independent contractors, completed operations, products and contractual exposures, as shall protect such contractors from claims arising out of any bodily injury, including accidental death, as well as from claims for property damages which may arise from operations under this contract, whether such operations be by the contractor or by any subcontractor, or by

anyone directly or indirectly employed by either of them and the minimum limits of such insurance shall be as follows:

Bodily Injury:	$500,000 per occurrence
Property Damage:	$100,000 per occurrence / $300,000 aggregate

In lieu of limits listed above, a $500,000 combined single limit shall satisfy both conditions.

Such coverage for completed operations must be maintained for at least two (2) years following final acceptance of the work performed under the contract.

c. **Property Insurance (Builder's Risk/Installation Floater)**

The contractor shall purchase and maintain property insurance until final acceptance, upon the entire work at the site to the full insurable value thereof. This insurance shall include the interests of the owner, the contractor, the subcontractors and sub-subcontractors in the work and shall insure against the perils of fire, wind, rain, flood, extended coverage, and vandalism and malicious mischief. If the owner is damaged by failure of the contractor to purchase or maintain such insurance, then the contractor shall bear all reasonable costs properly attributable thereto; the contractor shall effect and maintain similar property insurance on portions of the work stored off the site when request for payment per articles so includes such portions.

d. **Deductible**

Any deductible, if applicable to loss covered by insurance provided, is to be borne by the contractor.

e. **Other Insurance**

The contractor shall obtain such additional insurance as may be required by the owner or by the General Statutes of North Carolina including motor vehicle insurance, in amounts not less than the statutory limits.

f. **Proof of Carriage**

The contractor shall furnish the owner with satisfactory proof of carriage of the insurance required before written approval is granted by the owner.

ARTICLE 35 - PERFORMANCE BOND AND PAYMENT BOND

a. Each contractor shall furnish a performance bond and payment bond executed by a surety company authorized to do business in North Carolina. The bonds shall be in the full contract amount. Bonds shall be executed in the form bound with these specifications.

b. All bonds shall be countersigned by an authorized agent of the bonding company who is licensed to do business in North Carolina.

ARTICLE 36 - CONTRACTOR'S AFFIDAVIT

The final payment of retained amount due the contractor on account of the contract shall not become due until the contractor has furnished to the owner through the designer an affidavit signed, sworn and notarized to the effect that all payments for materials, services or subcontracted work in connection with his contract have been satisfied, and that no claims or

liens exist against the contractor in connection with this contract. In the event that the contractor cannot obtain similar affidavits from subcontractors to protect the contractor and the owner from possible liens or claims against the subcontractor, the contractor shall state in his affidavit that no claims or liens exist against any subcontractor to the best of his (the contractor's) knowledge, and if any appear afterward, the contractor shall save the owner harmless.

ARTICLE 37 - ASSIGNMENTS

The contractor shall not assign any portion of this contract nor subcontract in its entirety. Except as may be required under terms of the performance bond or payment bond, no funds or sums of money due or become due the contractor under the contract may be assigned.

ARTICLE 38 - USE OF PREMISES

a. The contractor(s) shall confine his apparatus, the storage of materials and the operations of his workmen to limits indicated by law, ordinances, permits or directions of the designer and owner and shall not exceed those established limits in his operations.

b. The contractor(s) shall not load or permit any part of the structure to be loaded with a weight that will endanger its safety.

c. The contractor(s) shall enforce the designer's and owner’s instructions regarding signs, advertisements, fires and smoking.

d. No firearms, any type of alcoholic beverages, or drugs (other than those prescribed by a physician) will be permitted at the job site.

ARTICLE 39 - CUTTING, PATCHING AND DIGGING

a. The contractor shall do all cutting, fitting or patching of his work that may be required to make its several parts come together properly and fit it to receive or be received by work of other contractors shown upon or reasonably implied by the drawings and specifications for the completed structure, as the designer may direct.

b. Any cost brought about by defective or ill-timed work shall be borne by the party responsible therefor.

c. No contractor shall endanger any work of another contractor by cutting, digging or other means. No contractor shall cut or alter the work of any other contractor without the consent of the designer and the affected contractor(s).

ARTICLE 40 - UTILITIES, STRUCTURES, SIGNS

a. The contractor shall provide necessary and adequate facilities for water, electricity, gas, oil, sewer and other utility services which maybe necessary and required for completion of the project including all utilities required for testing, cleaning, balancing, and sterilization of designated plumbing, mechanical and electrical systems. Any permanent meters installed shall be listed in the contractor’s name until work has a final acceptance. The contractor will be solely responsible for all utility costs prior to final acceptance. Contractor shall contact all affected utility companies prior to bid to determine their requirements to provide temporary and permanent service and include all costs associated with providing those services in their bid. Coordination of the work of the utility companies during construction is the sole responsibility of the contractor.

b. Meters shall be relisted in the owner's name on the day following final acceptance of the Project Expediter's work, and the owner shall pay for services used after that date.

c. The owner shall be reimbursed for all metered utility charges after the meter is relisted in the owner's name and prior to completion and acceptance of the work of **all** contractors. Reimbursement shall be made by the contractor whose work has not been completed and accepted. If the work of two or more contractors has not been completed and accepted, reimbursement to the owner shall be paid by the contractors involved on the basis of assessments by the designer.

d Prior to the operation of permanent systems, the Project Expediter will provide temporary power, lighting, water, and heat to maintain space temperature above freezing, as required for construction operations.

e. All contractors shall have the permanent building systems in sufficient readiness for furnishing temporary climatic control at the time a building is enclosed and secured. The HVAC systems shall maintain climatic control throughout the enclosed portion of the building sufficient to allow completion of the interior finishes of the building. A building shall be considered enclosed and secured when windows**,** doorways (exterior, mechanical, and electrical equipment rooms), and hardware are installed**;** and other openings have protection which will provide reasonable climatic control. The appropriate time to start the mechanical systems and climatic condition shall be jointly determined by the contractor(s), the designer and owner. Use of the equipment in this manner shall be subject to the approval of the Designer and owner and shall in no way affect the warranty requirements of the contractor(s).

f. The electrical contractor shall have the building's permanent power wiring distribution system in sufficient readiness to provide power as required by the HVAC contractor for temporary climatic control.

g. The electrical contractor shall have the building's permanent lighting system ready at the time the general contractor begins interior painting and shall provide adequate lighting in those areas where interior painting and finishing is being performed.

h. Each prime contractor shall be responsible for his permanently fixed service facilities and systems in use during progress of the work. The following procedures shall be strictly adhered to:

1. Prior to final acceptance of work by the State Construction Office, each contractor shall remove and replace any parts of the permanent building systems damaged through use during construction.

2. Temporary filters as recommended by the equipment manufacturer in order to keep the equipment and ductwork clean and free of dust and debris shall be installed in each of the heating and air conditioning units and at each return grille during construction. New filters shall be installed in each unit prior to the owner's acceptance of the work.

3. Extra effort shall be maintained to keep the building and the site adjacent to the building clean and under no circumstances shall air systems be operated if finishing and site work operations are creating dust in excess of what would be considered normal if the building were occupied.

4. It shall be understood that any warranty on equipment presented to the owner shall extend from the day of final acceptance by the owner. The cost of warranting the

equipment during operation in the finishing stages of construction shall be borne by the contractor whose system is utilized.

5. The electrical contractor shall have all lamps in proper working condition at the time of final project acceptance.

i. The Project Expediter shall provide, if required and where directed, a shed for toilet facilities and shall furnish and install in this shed all water closets required for a complete and adequate sanitary arrangement. These facilities will be available to other contractors on the job and shall be kept in a neat and sanitary condition at all times. Chemical toilets are acceptable.

j. The Project Expediter shall, if required by the Supplementary General Conditions and where directed, erect a temporary field office, complete with lights, telephone, heat and air conditioning. A portion of this office shall be partitioned off, of sufficient size, for the use of a resident inspector, should the designer so direct.

k. On multi-story construction projects, the Project Expediter shall provide temporary elevators, lifts, or other special equipment for the general use of all contractors. The cost for such elevators, lifts or other special equipment and the operation thereof shall be included in the Project Expediter's bid.

l. The Project Expediter will erect one sign on the project if required. The sign shall be of sound construction, and shall be neatly lettered with black letters on white background. The sign shall bear the name of the project, and the names of prime contractors on the project, and the name of the designer and consultants. Directional signs may be erected on the owner's property subject to approval of the owner with respect to size, style and location of such directional signs. Such signs may bear the name of the contractor and a directional symbol. No other signs will be permitted except by permission of the owner.

ARTICLE 41 - CLEANING UP

a. The contractors shall keep the building and surrounding area reasonably free from rubbish at all times, and shall remove debris from the site on a timely basis or when directed to do so by the designer or Project Expediter. The Project Expediter shall provide an on site refuse container(s) for the use of all contractors. Each contractor shall remove their rubbish and debris from the building on a daily basis. The Project Expediter shall broom clean the building as required to minimize dust and dirt accumulation.

b. The Project Expediter shall provide and maintain suitable all-weather access to the building**.**

c. Before final inspection and acceptance of the building, each contractor shall clean his portion of the work, including glass, hardware, fixtures, masonry, tile and marble (using no acid), clean and wax all floors as specified, and completely prepare the building for use by the owner, with no cleaning required by the owner.

ARTICLE 42 - GUARANTEE

a. The contractor shall unconditionally guarantee materials and workmanship against patent defects arising from faulty materials, faulty workmanship or negligence for a period of twelve (12) months following the date of final acceptance of the work or beneficial occupancy and shall replace such defective materials or workmanship without cost to the owner.

b. Where items of equipment or material carry a manufacturer's warranty for any period in excess of twelve (12) months, then the manufacturer's warranty shall apply for that particular piece of equipment or material. The contractor shall replace such defective equipment or materials, without cost to the owner, within the manufacturer's warranty period.

c. Additionally, the owner may bring an action for latent defects caused by the negligence of the contractor which is hidden or not readily apparent to the owner at the time of beneficial occupancy or final acceptance, whichever occurred first, in accordance with applicable law.

d. Guarantees for roof, equipment, materials, and supplies shall be stipulated in the specifications sections governing such roof, equipment, materials, or supplies.

ARTICLE 43 - CODES AND STANDARDS

Wherever reference is given to codes, standard specifications or other data published by regulating agencies including, but not limited to, national electrical codes, North Carolina state building codes, federal specifications, ASTM specifications, various institute specifications, etc., it shall be understood that such reference is to the latest edition including addenda published prior to the date of the contract documents.

ARTICLE 44 - INDEMNIFICATION

To the fullest extent permitted by law, the contractor shall indemnify and hold harmless the owner, the designer and the agents, consultants and employees of the owner and designer, from and against all claims, damages, losses and expenses, including, but not limited to, attorneys' fees, arising out of or resulting from the performance or failure of performance of the work, provided that any such claim, damage, loss or expense (1) is attributable to bodily injury, sickness, disease or death, or to injury to or destruction of tangible property (other than the work itself) including the loss of use resulting there from, and (2) is caused in whole or in part by any negligent act or omission of the contractor, the contractor's subcontractor, or the agents of either the contractor or the contractor's subcontractor. Such obligation shall not be construed to negate, abridge or otherwise reduce any other right or obligation of indemnity which would otherwise exist as to any party or person described in this article.

ARTICLE 45 - TAXES

a. Federal excise taxes do not apply to materials entering into state work (Internal Revenue Code, Section 3442(3)).

b. Federal transportation taxes do not apply to materials entering into state work (Internal Revenue Code, Section 3475(b) as amended).

c. North Carolina sales tax and use tax, as required by law, do apply to materials entering into state work and such costs shall be included in the bid proposal and contract sum.

d. Local option sales and use taxes, as required by law, do apply to materials entering into state work as applicable and such costs shall be included in the bid proposal and contract sum.

e. **Accounting Procedures for Refund of County Sales & Use Tax**

Amount of county sales and use tax paid per contractor's statements:

Contractors performing contracts for state agencies shall give the state agency for whose project the property was purchased a signed statement containing the information listed in G.S. 105-164.14(e).

The Department of Revenue has agreed that in lieu of obtaining copies of sales receipts from contractors, an agency may obtain a certified statement as of April 1, 1991 from the contractor setting forth the date, the type of property and the cost of the property purchased from each vendor, the county in which the vendor made the sale and the amount of local sales and use taxes paid thereon. If the property was purchased out-of-state, the county in which the property was delivered should be listed. The contractor should also be notified that the certified statement may be subject to audit.

In the event the contractors make several purchases from the same vendor, such certified statement must indicate the invoice numbers, the inclusive dates of the invoices, the total amount of the invoices, the counties, and the county sales and use taxes paid thereon.

Name of taxing county: The position of a sale is the retailer's place of business located within a taxing county where the vendor becomes contractually obligated to make the sale. Therefore, it is important that the county tax be reported for the county of sale rather than the county of use.

When property is purchased from out-of-state vendors and the county tax is charged, the county should be identified where delivery is made when reporting the county tax.

Such statement must also include the cost of any tangible personal property withdrawn from the contractor's warehouse stock and the amount of county sales or use tax paid thereon by the contractor.

Similar certified statements by his subcontractors must be obtained by the general contractor and furnished to the claimant.
Contractors are not to include any tax paid on supplies, tools and equipment which they use to perform their contracts and should include only those building materials, supplies, fixtures and equipment which actually become a part of or annexed to the building or structure.

ARTICLE 46 - EQUAL OPPORTUNITY CLAUSE

The non-discrimination clause contained in Section 202 (Federal) Executive Order 11246, as amended by Executive Order 11375, relative to equal employment opportunity for all persons without regard to race, color, religion, sex or national origin, and the implementing rules and regulations prescribed by the secretary of Labor, are incorporated herein.

ARTICLE 47 - EMPLOYMENT OF INDIVIDUALS WITH DISABILITIES

The contractor(s) agree not to discriminate against any employee or applicant for employment because of physical or mental disabilities in regard to any position for which the employee or applicant is qualified. The contractor agrees to take affirmative action to employ, advance in employment and otherwise treat qualified individuals with such disabilities without discrimination based upon their physical or mental disability in all employment practices.

ARTICLE 48 - ASBESTOS-CONTAINING MATERIALS (ACM)

The State of North Carolina has attempted to address all asbestos-containing materials that are to be disturbed in the project. However, there may be other asbestos-containing materials in the work areas that are not to be disturbed and do not create an exposure hazard.

Contractors are reminded of the requirements of instructions under Instructions to Bidders and General Conditions of the Contract, titled Examination of Conditions. Statute 130A, Article 19, amended August 3, 1989, established the Asbestos Hazard Management Program that controls asbestos abatement in North Carolina. The latest edition of *Guideline Criteria for Asbestos Abatement* from the State Construction Office is to be incorporated in all asbestos abatement projects for the Capital Improvement Program.

ARTICLE 49 - MINORITY BUSINESS PARTICIPATION

GS 143-128.2 establishes a ten percent (10%) goal for participation by minority businesses in total value of work for each State building project. The document, *Guidelines for Recruitment and Selection of Minority Businesses for Participation in State Construction Contracts* including Affidavits and Appendix E are hereby incorporated into and made a part of this contract.

ARTICLE 50 – CONTRACTOR EVALUATION

The contractor's overall work performance on the project shall be fairly evaluated in accordance with the State Building Commission policy and procedures, for determining qualifications to bid on future State capital improvement projects. In addition to final evaluation, interim evaluation may be prepared during the progress of project. The document, Contractor Evaluation Procedures, is hereby incorporated and made a part of this contract. The owner may request the contractor's comments to evaluate the designer.

ARTICLE 51 – GIFTS

Pursuant to N.C. Gen. Stat. § 133-32, it is unlawful for any vendor or contractor (i.e. architect, bidder, contractor, construction manager, design professional, engineer, subcontractor, supplier, vendor, etc.), to make gifts or to give favors to any State employee. This prohibition covers those vendors and contractors who: (1) have a contract with a governmental agency; or (2) have performed under such a contract within the past year; or (3) anticipate bidding on such a contract in the future. For additional information regarding the specific requirements and exemptions, vendors and contractors are encouraged to review G.S. Sec. 133-32.

During the construction of the Project, the Contractor is prohibited from making gifts to any of the Owner's employees, Owner's project representatives (architect, engineers, construction manager and their employees), employees of the State Construction Office and/or any other State employee that may have any involvement, influence, responsibilities, oversight, management and/or duties that pertain to and/or relate to the contract administration, financial administration and/or disposition of claims arising from and/or relating to the Contract and/or Project.

ARTICLE 52 – AUDITING-ACCESS TO PERSONS AND RECORDS

In accordance with N.C. General Statute 147-64.7, the State Auditor shall have access to Contractor's officers, employees, agents and/or other persons in control of and/or responsible for the Contractor's records that relate to this Contracts for purposes of conducting audits under the referenced statute. The Owner's internal auditors shall also have the right to access and copy the Contractor's records relating to the Contract and Project during the term of the Contract and within two years following the completion of the Project/close-out of the Contract to verify accounts, accuracy, information, calculations and/or data affecting and/or

relating to Contractor's requests for payment, requests for change orders, change orders, claims for extra work, requests for time extensions and related claims for delay/extended general conditions costs, claims for lost productivity, claims for loss efficiency, claims for idle equipment or labor, claims for price/cost escalation, pass-through claims of subcontractors and/or suppliers, and/or any other type of claim for payment or damages from Owner and/or its project representatives.

ARTICLE 53 – NORTH CAROLINA FALSE CLAIMS ACT

The North Carolina False Claims Act ("NCFCA"), N.C Gen. Stat. § 1-605 through 1-618, applies to this Contract. The Contractor should familiarize itself with the entire NCFCA and should seek the assistance of an attorney if it has any questions regarding the NCFCA and its applicability to any requests, demands and/or claims for payment its submits to the State through the contracting state agency, institution, university or community college.

The purpose of the NCFCA "is to deter persons from knowingly causing or assisting in causing the State to pay claims that are false or fraudulent and to provide remedies in the form of treble damages and civil penalties when money is obtained from the State by reason of a false or fraudulent claim." (Section 1-605(b).) A contractor's liability under the NCFCA may arise from, but is not limited to: requests for payment, invoices, billing, claims for extra work, requests for change orders, requests for time extensions, claims for delay damages/extended general conditions costs, claims for loss productivity, claims for loss efficiency, claims for idle equipment or labor, claims for price/cost escalation, pass-through claims of subcontractors and/or suppliers, documentation used to support any of the foregoing requests or claims, and/or any other request for payment from the State through the contracting state agency, institution, university or community college. The parts of the NCFCA that are most likely to be enforced with respect to this type of contract are as follows:

- A "claim" is "[a]ny request or demand, whether under a contract or otherwise, for money or property and whether or not the State has title to the money or property that (i) is presented to an officer, employee, or agent of the State or (ii) is made to a contractor … if the money or property is to be spent or used on the State's behalf or to advance a State program or interest and if the State government: (a) provides or has provided any portion of the money or property that is requested or demanded; or (b) will reimburse such contractor … for any portion of the money or property which is requested or demanded." (Section 1-606(2).)

- "Knowing" and "knowingly." – Whenever a person, with respect to information, does any of the following: (a) Has actual knowledge of the information; (b) Acts in deliberate ignorance of the truth or falsity of the information; and/or (c) Acts in reckless disregard of the truth or falsity of the information. (Section 1-606(4).) Proof of specific intent to defraud is not required. (Section 1-606(4).)

- "Material" means having a natural tendency to influence, or be capable of influencing, the payment or receipt of money or property. (Section 1-606(4).)

- Liability. – "Any person who commits any of the following acts shall be liable to the State for three times the amount of damages that the State sustains because of the act of that person[:] … (1) Knowingly presents or causes to be presented a false or fraudulent claim for payment or approval. (2) Knowingly makes, uses, or causes to be made or used, a false record or statement material to a false or fraudulent claim. (3) Conspires to commit a violation of subdivision (1), (2) …" (Section 1-607(a)(1), (2).)

- The NCFCA shall be interpreted and construed so as to be consistent with the federal False Claims Act, 31 U.S.C. § 3729, et seq., and any subsequent amendments to that act. (Section 1-616(c).)

Finally, the contracting state agency, institution, university or community college may refer any suspected violation of the NCFCA by the Contractor to the Attorney General's Office for investigation. Under Section 1-608(a), the Attorney General is responsible for investigating any violation of NCFCA, and may bring a civil action against the Contractor under the NCFCA. The Attorney General's investigation and any civil action relating thereto are independent and not subject to any dispute resolution provision set forth in this Contract. (See Section 1-608(a).)

ARTICLE 54 – TERMINATION FOR CONVENIENCE

Owner may at any time and for any reason terminate Contractor's services and work at Owner's convenience. Upon receipt of such notice, Contractor shall, unless the notice directs otherwise, immediately discontinue the work and placing of orders for materials, facilities and supplies in connection with the performance of this Agreement.

Upon such termination, Contractor shall be entitled to payment only as follows: (1) the actual cost of the work completed in conformity with this Agreement; plus, (2) such other costs actually incurred by Contractor as are permitted by the prime contract and approved by Owner; (3) plus ten percent (10%) of the cost of the work referred to in subparagraph (1) above for overhead and profit. There shall be deducted from such sums as provided in this subparagraph the amount of any payments made to Contractor prior to the date of the termination of this Agreement. Contractor shall not be entitled to any claim or claim of lien against Owner for any additional compensation or damages in the event of such termination and payment.

SUPPLEMENTARY GENERAL CONDITIONS (SGC's) OF THE CONTRACT

STANDARD FORM FOR CONSTRUCTION CONTRACTS

PBS NORTH CAROLINA

SUPPLEMENTARY GENERAL CONDITIONS (SGC's) OF THE CONTRACT

This document supplements but does not alter in any way the requirements of the General Conditions of the Contract.

1. **SCOPE OF WORK**

See attached Technical Specifications and Drawings for scope of work including UNC-CH General Requirements. The project scope of work includes installation of 2 Owner-provided chillers and 2 Owner-provided cooling towers, refrigerant monitoring system, 2 condenser water pumps, 4 Owner-provided air handlers and return fans, and 120 linear feet of underground piping.

2. **TIME OF COMPLETION/LIQUIDATED DAMAGES**

The Contractor shall commence work to be performed under this Contract on the date to be specified in the Notice to Proceed from the Contract Administrator and shall fully complete all work hereunder within **159** consecutive calendar days from October 2, 2023. The following are the critical dates for the project: Anticipated Notice to Proceed: **June 7, 2023**; Site available for Work: **October 2, 2023**; Construction Completion: **March 8, 2024.**

Anticipated delivery date for the Owner-provided AHU equipment is December 7, 2023. If delivery is delayed, then the construction completion date will extend an equal number of calendar days (e.g. December 14th delivery would extend the construction completion date by 7 days).

For each day in excess of the above number of days, the Contractor(s) shall pay the Owner liquidated damages in the amount of $200 per site per consecutive calendar day.

If the Contractor is delayed at any time in the progress of the Contractor's work by any act or negligence of the Owner, the Owner's employees or the Owner's separate Contractor; by changes ordered in the work; by abnormal weather conditions; by any causes beyond the Contractor's control; or by other causes deemed justifiable by Owner, then the contract time may be reasonably extended in a written order from the Owner upon written request from the Contractor within ten (10) days following the cause for delay.

3. **CONSTRUCTION SCHEDULE**

The Contractor shall submit a project work schedule before beginning work. The starting date and work schedule shall be adhered to, and the work shall be performed during the Owner's normal working days. Normal working days shall be Monday to Thursday for the main building work and Monday to Friday for the utility building work. Requests by the Contractor to work outside normal working hours or days shall be made a minimum of one (1) week in advance to the Facilities Manager on site. The Contractor's bid shall include all costs associated with workers working outside of normal business hours and/or costs associated with workers working overtime as required to meet the specified project schedule. The Owner reserves the right to request work to be performed outside normal working hours and to limit Contractor activities when they conflict with Owner operations. Any increased costs due to Owner requirements for work outside normal hours not specified in the Contract Documents will be negotiated.

4. **UTILITIES**

The Owner will provide water and electricity to the extent they are available at the project site.

The Contractor shall provide restroom facilities. The Contractor's personnel shall not use toilet or washroom facilities in the existing building.

The Contractor shall be responsible for procedures for making temporary disruptions to existing utilities serving the building, and roads and pedestrian walks shall be planned well in advance of the

work and the work shall be executed in a manner to provide reasonably continuous service throughout the construction period. Interruptions of service shall be coordinated with the Contract Administrator at least seven (7) days in advance.

5. **SECURITY**

Site superintendent shall be required to clear security screening to a receive an access badge. All other contractors shall be required to display an identification badge while on site.

6. **USE OF SITE**

Work under this contract shall be performed in such a manner as to avoid interruption or interference with the operation of any existing activity on the premises or at the location of the work. The Owner may enforce extra restrictions during certain periods of the year.

While on campus, Contractor's and Sub-Contractor's personnel shall be identifiable at all times, for example, by wearing company names or logos on garments or hard hats.

Damage done to the premises that are under the control of the Contractor, or damage caused by the contractor to premises used by the contractor, shall be corrected at the Contractor's expense.

The Contractor shall schedule deliveries between 8:00am and 4:00pm. The Contractor shall notify PBS NC's Construction Manager of any deliveries of equipment, material or road work that will impede the flow of vehicular or pedestrian traffic. The contractor shall provide traffic control by certified traffic control personnel (vehicular and pedestrian) during these deliveries. Staging for multiple concrete / steel / other large material deliveries, crane and other large pieces of equipment must be coordinated with PBS NC's Facilities Manager.

A minimum five working days' notice must be given to PBS NC's Construction Manager to block parking spaces, drives, roads, streets and pedestrian walks.

Roads, streets, drives, fire lanes must remain open at all times. Adequate clearance must be maintained for emergency vehicles to negotiate the drive. Maintain a minimum of 20 feet for fire lanes. Construction vehicles are not allowed to block, park, or stage in a fire lanes. Vehicles blocking fire lanes will be ticketed and towed at the Contractor's expense.

Construction fences should be covered with fabric screening unless it blocks the view of oncoming traffic. Construction gates will swing into the construction area. The construction fences should not obstruct pedestrian or vehicle traffic unless alternate ways were designed in the site drawings and approved by UNC's Facilities Manager.

The Contractor will provide additional cleanup and warning signs and barricades if deemed necessary by the Owner.

The Contractor's scheduling and staging requirements must be coordinated with, and approved by, the PBS NC's Construction Manager.

The work shall be performed during the Owner's normal working days. Normal working days shall be Monday to Thursday for the main building work and Monday to Friday for the utility building work. Requests by the Contractor to work outside normal working hours shall be made in advance to the PBS NC's Construction Manager. The Contractor's bid shall include all costs associated with workers working outside of normal business hours and/or costs associated with workers working overtime as required to meet specified project schedule. The Owner reserves the right to request work to be performed outside normal working hours and to limit contractor activities when they conflict with

Owner operations. Any increased costs due to Owner requirements for work outside normal hours not specified in the Contract Documents will be negotiated.
Contractors working for the University are required to comply with The University of North Carolina "No Smoking Policy", which is provided herein and hereby incorporated and made a part of this contract.

7. **ALTERNATES**

See Section 012300, "Alternates" for a listing.

8. **SUBCONTRACTING**

All subcontractors shall be identified in writing and approved by the Owner prior to the start of work.

9. **SEDIMENTATION POLLUTION CONTROL ACT OF 1973**

Any land-disturbing activity performed by the Contractor in connection with the project shall comply with all erosion control measures set forth in the Contract Documents and any additional measures which may be required in order to ensure that the project is in full compliance with the Sedimentation Pollution Control Act of 1973, as implemented by Title 15, North Carolina Administrative Code, Chapter 4, Sedimentation Control, Subchapters 4A, 4B and 4C, as amended (15 N.C.A.C. 4A, 4B and 4C).

Upon receipt of notice that a land-disturbing activity is in violation of said Act, the Contractor shall be responsible for ensuring that all steps or actions necessary to bring the project in compliance with said Act are promptly taken.

The Contractor shall be responsible for defending any legal actions instituted pursuant to N.C.G.S. 113A-64 against any party or persons described in this section.

To the fullest extent permitted by law, the Contractor shall indemnify and hold harmless the Owner, the Contract Administrator and the agents, consultants and employees of the Owner and Contract Administrator, from and against all claims, damages, civil penalties, losses and expenses, including, but not limited to, attorneys' fees, arising out of or resulting from the performance of work or failure of performance of work, provided that any such claim, damage, civil penalty, loss or expense is attributable to a violation of the Sedimentation Pollution Control Act. Such obligation shall not be construed to negate, abridge or otherwise reduced any other right or obligation of indemnity which would otherwise exist as to any party or persons described in this section.

10. **SUBMITTAL DATA**

The submittal requirements are described in Section 5 of the General Conditions. Items for which submittals are required are listed below:

Pre-Submittals:

- Electrical & Mechanical/Plumbing Items referenced in Technical Specifications

Post-Submittals:

- All previously submitted documents revised to show as-built condition.

- O&M Manuals for any equipment requiring a submittal.

Data on the following items shall be sent to the Project Manager for review and approval. The submittal process is described in Section 5 of the General Terms and Conditions. Refer to “Technical Specifications” for required submittals. All Pre-Submittals shall be delivered to the Project Manager no later than the Preconstruction Meeting. The Project Manager shall receive all Post-Submittals within thirty (30) days of work completion. The final pay request shall be included with Post-Submittals.

11. **DEFINITIONS**

As defined in Article 1 of the General Conditions, the Supplementary General Conditions as well as the UNC General Requirements are considered part of the contact documents.

The Owner is the State of North Carolina through the University of North Carolina, Center for Public Television.

Provide shall mean purchase, deliver, install, new, clean, completely operational, fully tested and ready for use.

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 biding, 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

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

(Revised on 3/14/2003)

SECTION 01 23 00 - ALTERNATES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

This section specifies administrative and procedural requirements for Alternates.

A. GENERAL NOTE: The drawings generally indicate the work which will be included if the alternate bids are accepted. These portions of the work described in the alternates will not be included in the base bid.

B. Definition: An Alternate is an amount proposed by Bidders and stated on the Bid form for certain construction activities defined in the Bidding Requirements that may be added to the Base bid amount if the Owner decides to accept a corresponding change in either the amount of construction to be completed, or in the products, materials, equipment, systems or installation methods described in Contract Documents.

C. Coordination: Coordinate related Work and modify or adjust adjacent work as necessary to ensure that Work affected by each accepted alternate is complete and fully integrated into the project.

D. Notification: Immediately following the award of the Contract, prepare and distribute to each party involved notification of the status of each alternate. Indicate whether alternates have been accepted, rejected, modified or deferred for consideration at a later date. Include a complete description of negotiated modifications to alternates and other contract documents. Record this information on the project set of drawings in the job site construction trailer.

E. Schedule: A "Schedule of Alternates" is included at the end of this Section. Specification Sections referenced in the Schedule contain requirements for materials and methods necessary to achieve the Work described under each alternate.

a. Include as part of each Alternate, miscellaneous devices, accessory objects and similar items incidental to or required for a complete installation whether or not mentioned as part of the alternate.

PART 2 - PRODUCTS

(Not Applicable)

PART 3 - EXECUTION

SCHEDULE OF ALTERNATES

Alternate No. A-1: Remove metal screens at intake and relief vents. Prepare surface and recoat according to High Performance Coating requirements. See sheet G003.

Alternate No. A-2: Install Resinous Flooring with cove base in lieu of Sealed Concrete and Rubber Base at Mech Room 2075. See sheet G003 for materials and installation requirements.

Alternate No. A-3: Install Resinous Flooring with cove base in lieu of Sealed Concrete and Rubber Base at Mech Room 1072. See sheet G003 for materials and installation requirements.

Alternate No. M-1: Provide new primary CHW pumps to replace existing. Refer to plans.

Alternate No. M-2: Provide new secondary CHW pumps to replace existing. Refer to plans.

Alternate No. M-3: Provide a packaged cooling tower filtration unit. Refer to plans.

END OF SECTION

DIVISION 23 - MECHANICAL SPECIFICATIONS
TABLE OF CONTENTS

McKIM&CREED

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919-233-8091
NC License # F1222

SECTION 230100 - HVAC GENERAL

PART 1 - GENERAL REQUIREMENTS

1.1 DEFINITIONS

A. Piping: Pipe, fittings, flanges, valves, controls, hangers, supports, traps, drains, gauges, insulation, vents, and items customarily required in connection with the transfer of fluids.

B. Ductwork: All air distribution, re-circulation, and exhaust ducts, whether of sheet metal or other material, and includes all connections, hanger, supports, damper controls, insulation, accessories, fire and smoke control devices, and appurtenances necessary for and incidental to a complete system.

C. Provide: Furnish and install complete ready for use.

D. Furnish: Purchase and deliver to the project site complete with every necessary appurtenance and for installation.

E. Install: Unload at the delivery point and perform every operation necessary to establish secure mounting and correct operation at the proper location in the project.

F. Concealed: Embedded in masonry or other construction, installed behind wall furring, above ceilings, in crawl spaces, in shafts or otherwise not visible.

G. Exposed: Not concealed.

H. By other Trades: Shall mean by persons or parties who are not anticipated to be the Subcontractor for this trade working together with the Prime Contractor. In this context the words “by other trades” shall be interpreted to mean not included in the overall contract.

I. Contractor: As used in this Division of the specification refers to the Mechanical Contractor unless specifically noted otherwise.

1.2 INTERPRETATION OF CONTRACT DOCUMENTS

A. This section of the specifications and related drawings describe general provisions applicable to every section of Division 23.

B. Attention is directed to General Conditions, which is binding in its entirety, on this portion of the work and in particular to paragraphs concerning materials, workmanship, and substitutions.

C. Mention in these specifications, indications, and reasonable implications on drawings, whereby articles, materials, operation or methods related to execution of the mechanical work are noted, specified, drawing or described, thereby requires execution of each such item of work and provision of all labor, materials, equipment and appurtenances required for execution thereof.

D. Particular attention is directed to the drawings and other contract documents for information pertaining to required items or work which are related to and usually associated with the work of this Division of the specifications, but which are to be provided as part of the work of other Divisions of the specifications.

E. No exclusions from, or limitations in, the language used in the drawings or specifications shall be interpreted as meaning that the appurtenance or accessories necessary to complete any required system or item of equipment are to be omitted.

F. The drawings of necessity utilize symbols and schematic diagrams to indicate various items of work. Neither of these have any dimensional significance nor do they delineate every item required for the intended installations. The work shall be installed, in accordance with the intent diagrammatically expressed on the drawings, and in conformity with the dimensions indicated on final architectural and structural working drawings and on equipment shop drawings. No interpretation shall be made from the limitations of symbols and diagrams that any elements necessary for complete work are excluded. When abbreviations appear on the drawings or specification in lower case letter with or without periods, their meanings shall be the same as stated above.

G. Certain details appear on the drawings which are specific with regard to the dimensioning and positioning of the work. These details are intended only for the purpose of establishing general feasibility. They do no obviate field coordination for the indicated work.

H. Information as to the general construction shall be derived from structural and architectural drawings and specifications only.

I. The use of words in the singular shall be considered as limited where other indications denote that more than one item is referred to.

J. Submission of a proposal and ultimate acceptance of an agreement or contract for execution of this section of work will be construed as evidence that the Prime Contractor, Subcontractor and Vendor has carefully read and accepts all conditions set forth in each division. insofar as such conditions may affect both the bidding for and execution of this section of work.

K. Where compliance with drawings or specifications is in apparent conflict with the applicable building codes or applicable UL listings then contractor shall contact the engineer of record. Generally building codes and UL compliance will take precedence over the specifications and drawings.

1.3 QUALITY ASSURANCE AND WARRANTY

A. The Contractor shall guarantee all work, materials and equipment furnished against defects, leaks, performance, and non-operation for a period of one (1) year after the date of the Owner's final acceptance, or as indicated in the General Conditions. Warranties to extend past this date are defined in individual equipment specification sections. Defects shall be interpreted as defective materials or equipment or unsatisfactory installation and are not intended to apply to ordinary wear and tear. The Contractor shall pay for any repairs or replacements caused by these defects within the period covered by the guarantee, including all incidental work required to correct the deficiency.

B. All equipment and materials required for installation under these specifications shall be new and without blemish or defect. All equipment shall bear labels attesting to Underwriters Laboratories approval where subject to Underwriters Laboratories label service. Where no specific indication as to the type or quality of material or equipment is indicated, a first-class standard article shall be furnished. All manufacturers of equipment and materials pertinent to these items shall have been engaged in the manufacturers of said equipment a minimum of three (3) years and, if directed by the Designer, be able to furnish proof of their ability to deliver this equipment by submitting affidavits supporting their claim.

C. Each major component of equipment shall have the manufacturer's name, address, model number and rating on a plate securely affixed in a conspicuous place. The nameplate of a distributing agent will not be acceptable. UL or other label, or other data which is die-stamped into the surface of the equipment shall be stamped in a location easily visible. Performance as delineated in schedules and in the specifications shall be interpreted as minimum performance.

D. All equipment of one type (such as fans, pumps, valves, grilles, etc.) shall be the products of one manufacturer unless specifically stated otherwise.

E. Where the specifications do not list a specific model number for a manufacturer, the construction of a product shall be equal to those models specifically listed.

F. All welders shall be certified by the National Certified Pipe Welding Bureau for the appropriate service and shall perform all welding in accordance with Welding Bureau's procedures and the ASA Code for pipe welding. Welding and welder qualifications shall be in accordance with ASME Section IX.

1.4 REQUIREMENTS OF REGULATORY AGENCIES

A. Contractors shall submit to the appropriate Regulatory Agencies all items necessary to obtain all required permits obtain such required permits and pay all required fees.

B. All work shall conform to the following Standards and Codes (applicable edition):

1. North Carolina State Building Code.
2. National Fire Protection Association.
3. Uniform Boiler and Pressure Vessel Act of N.C. (Boiler Code).

C. Where applicable, all fixtures, equipment, and materials shall be as approved or listed by the following:

1. Factory Mutual Laboratories (FM).
2. Underwriters Laboratories, Inc. (UL).
3. CSA.
4. ETL.
5. AGA.
6. AWWA.

D. All fuel fired equipment shall meet the requirements of the agencies listed and also meet the Owner's insurer requirements.

1.5 STANDARDS AND PROCEDURES

A. ADC: Air Diffusion Council.

B. AMCA: Air Moving and Conditioning Association, Inc.

C. ANSI: American National Standards Institute.

D. API: American Petroleum Institute.

E. ARI: American Refrigeration Institute.

F. ASHRAE: American Society of Heating, Refrigeration and Air Conditioning Engineers.

G. ASME: American Society of Mechanical Engineers.

H. ASTM: American Society of Testing and Materials.

I. IBR: Institute of Boiler and Radiator Manufacturers.

J. MSS: Manufacturers Standardization Society.

K. NEMA: National Electrical Manufacturer's Association.

L. OSHA: Occupational Safety and Health Administration.

M. SMACNA: Sheet Metal and Air Conditioning Contractors National Association, Inc.

1. Where reference is made to ASA Standards it shall be understood that this reference is to the standards published by ANSI.
2. Include all items of labor and materials required to comply with such standards and codes. Where quantity, sizes or other requirements indicated on the drawings or herein specified are in excess of the standard or code requirements, the specifications or drawings, respectively, shall govern.

1.6 EQUIVALENT PRODUCTS

A. Notwithstanding any reference in the specifications to any article, device, product, materials, fixture, form or type of construction by name, make, or catalog number, such references shall be interpreted as establishing a standard of quality and shall not be construed as limiting competition and the Contractor, in such cases may, at his option, use any article, device, product, material, fixture, form or type of construction which, in the judgment of the Designer, expressed in writing, is equal to that specified.

B. Requests for written approval to substitute materials or equipment considered by the contractor as equal to those specified shall be submitted for approval, to the Engineer, in accordance with SUBSTITUTIONS section.

1.7 VERIFICATION OF DIMENSIONS AND LOCATIONS

A. The Contractor shall visit the premises and thoroughly familiarize himself with all details of the work, working conditions, verify all dimensions in the field, advise the Designer of any discrepancy, and submit shop drawings of any changes he proposes to make, in quadruplicate for approval, before starting the work. Contractor shall install all equipment in a manner to avoid building interference.

B. The location of duct, pipe, fixture, equipment, and appurtenances for existing facilities are shown on plans to indicate the extent of work required. Exact condition shall be field verified.

1.8 COORDINATION WITH OTHER TRADES

A. Coordinate all work of each section with work of other sections to avoid interference. Bidders are cautioned to check their equipment against space available as indicated on drawings and shall make sure that proposed equipment can be accommodated. If interferences occur and clearances cannot be maintained as recommended by manufacturer and as required for maintenance and inspection of equipment, Contractor shall bring them to the attention of Designer, in writing, prior to signing of contract; or Contractor shall, at his own expense, provide proper materials, equipment, and labor to correct any damage due to defects in his work caused by such interferences.

B. Prepare composite coordination drawings at a scale of ¼” = 1’-0” or larger, detailing major elements, components, and systems of mechanical equipment and materials in relationship with other systems, installations, and building components (For all floor levels including all mechanical areas, penthouses, and roof plans. Indicate locations where space is limited for installation and access and where sequencing and coordination of installations are of importance to the efficient flow of the work. The Mechanical Contractor will administer the effort of coordination between various trades. The coordination drawings will be prepared and reviewed approved by Engineer of Record and CxA before installation of any plumbing, sprinkler, mechanical or electrical work and will be shown as a task on the Project Schedule to be prepared by the General Contractor.

1.9 WORKMANSHIP

A. Workmen to be thoroughly experienced and fully capable of installing assigned work. Work to be in accordance with the best standard practice of the trade. Work that is not of good quality will require removal and reinstallation at no additional expense to Owner and as approved.

B. All material and equipment to be installed in accordance with manufacturer’s printed recommendations (using recommended accessories) and/or as approved by the Designer. Retain a copy on job site and submit others for approval when required.

PART 2 - PRODUCTS

This Part Not Used.

PART 3 - EXECUTION

3.1 SURFACE CONDITIONS

A. Inspection:

1. Prior to any work, the Contractor shall carefully inspect the installed Work of all other Trades and verify that all such Work is complete to the point where his installation may properly commence.
2. Verify that all equipment may be installed in accordance with all pertinent codes and regulations, the original design, and the referenced standards.

3.2 INSTALLATION

A. Install all equipment and appurtenances in strict accordance with the manufacturer's recommendations.

3.3 COMMISSIONING REQUIREMENTS

A. This project will require commissioning support from the contractor to verify control sequences and test and balance data (include minimum of 5 days for controls technician and test and balance technician support; refer to specification 23 08 01-BAS SYSTEM COMMISSIONING for additional information).

3.4 REQUIREMENTS FOR OPERATING HVAC EQUIPMENT DURING CONSTRUCTION

A. Building must be fully enclosed, including installation of all doors, windows, etc.

B. Set air handler to use 100% outside if construction is still generating dust and when conditions will not allow the coil to freeze.

C. If return air is to be used then all exhaust and return ducts/grilles shall be covered with temporary filter media, minimum MERV 8, to prevent dust infiltration into the ducting.

D. All chilled water piping shall be insulated.

E. Pump and fans shafts shall be aligned prior to operation. Laser alignment shall be provided for pumps, and reports shall be furnished prior to operation.

F. Supply and outside air connections of ductwork to AHUs shall be complete.

G. All manual dampers, fire dampers and combination fire/smoke dampers shall be open.

H. All main supply ductwork shall be insulated.

I. All safety circuits and basic control functions shall be active and fully functional. If the equipment may operate without a fully functional BAS, then means to prevent damage to ducting due to closed dampers and means to prevent damage to freezing coils shall be provided. Blow-out doors may be used to protect ducting. Until TAB activities commence, fans and pumps shall operate at no more than 70% of estimated design capacity.

J. Conditioning (cooling & dehumidifying) of the building shall remain once started.

K. Final approval of Engineer and Owner are required prior to starting AHUs for temporary operation.

L. Cover outside air intakes with 1" roll filter media.

M. The contractor shall perform all required preventative maintenance on mechanical equipment operated during construction and provide documentation in the operation and maintenance manuals of preventative maintenance activities completed during this period.

N. At the end of the construction period and prior to occupancy, clean the inside of AHUs and if more than 50% loaded, then install new pre and final filters.

O. AHU UV lights shall be operational, and all specified filters installed during all AHU operation.

3.5 PROTECTION AND CLEANING OF SYSTEMS AND EQUIPMENT

A. Protect all materials and equipment from damage during storage at the Site and throughout the construction period. In the event of damage prior to final inspections, the Contractor shall repair or replace damaged items as determined by the Architect/Engineer, at no cost to the Owner.

B. Damage from rain, dirt, sun, and ground water shall be prevented by storing the equipment on elevated supports and covering them on all sides with securely fastened protective rigid or flexible waterproof coverings.

C. Piping shall be protected by storing it on elevated supports and capping the ends with suitable closure material to prevent dirt accumulation in the piping.

D. During construction cap the top of all ductwork and piping installed vertically.

E. Periodically during construction and prior to Owner acceptance of the building, Contractor shall remove from the premises and dispose of all packing material and debris. All adjacent occupied areas shall be cleaned daily to remove dirt and debris resulting from this work.

3.6 WELDING AND PIPING PRESSURE TESTS

A. All welded piping shall be installed by Contractor using NCPWB or ASME Certified Welding Procedures. Welding shall comply with ANSI/ASME B31.1 and Section IX of the ASME Boiler and Pressure Code.

B. All piping shall be hydrostatically tested for pressure of 1-1/2 times the working pressure of the line, but not less than 150 psig. This hydrostatic test shall be witnessed by the Designer.

C. Ten days before any welded work is to start, the Contractor shall furnish the Designer copies of the welding procedures approved for the Contractor.

D. Before any welder is put to work in welding any piping for this job, the Designer shall be furnished with duplicate copies of the certification of each welder. If, in the opinion of the

Designer, the welding is not done properly, a coupon shall be cut from field welds for inspection and/or the welder may be required to pass a recertification test. Costs of cutting the coupon shall be the responsibility of the Contractor. Also, all welds shall be subject to non-destructive x-ray examination by Owner. Contractor will be responsible for all costs of non-destructive x-ray examination, including all remedial repair work and retesting of welding that is determined to be unsatisfactory.

E. No welding is to be covered with insulation or concealed until the welding has been approved by the Designer as outlined above.

F. All welding operations shall be approved by the Designer prior to beginning work. Extreme care shall be exercised to prevent damage to the existing buildings or building or surrounding contents during welding operations.

G. During welding of all piping, contractor shall use fire resistant or equal pad protection to prevent scorching or burning of existing floor and wall finishes, etc. Also, care shall be taken to eliminate sparks from dropping on existing furniture, equipment, and flooring material. All damages created by welding flame or sparks shall be repaired to owner's satisfaction at contractor's expense.

H. All welding shall be done in such a manner as to prevent welding fumes to enter other areas of the building and shall be coordinated with the owner to assure that it does not interfere with normal building operations while the building is occupied.

3.7 SUBSTITUTION OF EQUIPMENT

A. Requests for substitutions of products may be made during the bidding period by submitting completed substitution request accompanied by information sufficient for the Engineer to make a determination as to the equivalency of a product.

B. The Engineer will consider requests utilizing this section for substitution of products in place of those specified.

C. Submit 14 calendar days prior to Bid Date. No substitutions will be reviewed or accepted after this date unless there is an obvious advantage to the Owner.

D. Substitution requests may be submitted by U.S. Postal Service.

E. Prime Bidders shall request a substitution on the letterhead stationery of the Prime Bidder submitting the request. Requests from individual manufacturers will not be accepted.

F. Submit separate request for each substitution. Support each request with the following information. All items must be addressed.

G. Complete data substantiating compliance of proposed substitutions with requirements stated in Contract Documents:

1. Product identification, including manufacturer's name and address.
2. Manufacturer's literature, identifying:

a. Product description
b. Reference standards.
c. Performance and test data.

3. Name and address of similar projects on which product has been used and date of each installation.
4. Itemized comparison of the proposed substitution with product specified, listing significant variations.
5. Data relating to changes in construction schedule, if any.
6. All effects of substitution on separate contracts.
7. List of changes required in other work or products.
8. Designation of availability of maintenance services and sources of replacement parts.

H. Substitutions will not be considered for acceptance when:

1. Acceptance will require substantial revision of Contract Documents.
2. In judgment of Engineer, substitution request does not include adequate information for a complete evaluation.
3. Requests for substitutions not submitted by a Prime Bidder.
4. Where the effect on the schedule will be negative.

I. In making formal request for substitution, the Prime Bidder represents that:

1. The Prime Bidder has investigated proposed product and has determined that it is equivalent to or superior in all respects to that specified.
2. The Prime Bidder will provide the same warranties or bonds for substitution as for product specified.
3. The Prime Bidder will coordinate installation of accepted substitution into the Work and will make such changes as may be required for the Work to be complete in all respects.

3.8 SUBMITTALS

A. Refer to Division 1, as available, for information on submittal requirements. When conflicts exist, Division 1 shall apply.

B. The terms “Submittals” can generally be used to indicate any information which is required to be reviewed by the A/E before further action on that product can be taken by the Contractor. This may include product data sheets, shop drawings, and schedules.

C. Submittals generally not required when equipment is purchased exactly as specified and scheduled. Submit list of such equipment only. Equipment data sheets must be included in project manual prepared for Owner.

D. Submittals shall be searchable format, preferably pdf.

3.9 PRODUCT SUBMITTALS

A. The following product data information shall be submitted:

Section	Title
230100	MECHANICAL GENERAL
230200	MECHANICAL RELATED WORK
230300	ELECTRICAL WORK FOR MECHANICAL SYSTEMS
230500	FIRESTOPPING AND WATERPROOFING
230510	GAUGES AND METERS
230513	VARIABLE FREQUENCY DRIVES
230529	SUPPORTS AND ANCHORS
230548	VIBRATION ISOLATION
230553	MECHANICAL IDENTIFICATION
230593	TESTING, ADJUSTING, AND BALANCING (TAB)
230700	INSULATION
230923	ENTERPRISE BUILDING AUTOMATION SYSTEM
232113	HYDRONIC PIPING
232116	HYDRONIC SPECIALTIES
232123	PUMPS
233100	DUCTWORK
233300	DUCTWORK ACCESSORIES
236412	WATER COOLED CHILLER
236413	CHILLER EQUIPMENT ROOM
236500	COOLING TOWERS
237300	SEMI-CUSTOM AIR HANDLING UNITS

3.10 TEST AND REPORT SUBMITTALS

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

1. Test:

a. Underground and Aboveground HVAC piping
b. Duct pressure test.
c. System start up.
d. Test and Balance Agency Construction Report.
e. All required test reports.
f. Required Pressurization Systems.

3.11 FIRE PENETRATION SYSTEMS SUBMITTAL

A. Each type of system penetrating a fire rated assembly shall be identified by the Contractor. The Contractor shall demonstrate his understanding of fire stop systems by the following.

B. Submit 3/4-inch scale drawings of each assembly indicating type penetrations, slab, floor, wall or roof system, fire stop materials used, thickness and all other pertinent details. Submittal shall be neatly and accurately drafted.

C. Each type of system penetrating a fire rated assembly shall be identified by the Contractor. Provide approved installation details with agency approval indicated thereon.

3.12 RECORD DRAWINGS

A. The Contractor shall keep a record set of drawings on the job and, as construction progresses, shall show the actual installed location of all items, material, and equipment of these job drawings.

B. At the time of final inspection, two corrected sets of prints and sepias shall be delivered to the Designer. All drawing costs to be paid by the Contractor.

C. Sepias shall be corrected deleting incorrect locations and showing installed locations in accordance with information transferred from job drawing.

D. Qualified draftsmen shall perform this task.

3.13 OPERATION AND MAINTENANCE MANUALS

A. The Contractor shall compile and bind three (3) sets of all manufacturer's instructions and descriptive literature on all items of equipment furnished under this work. An electronic PDF copy of the O&M manuals shall also be provided and shall have searchable text.

B. The manuals shall comply with specifications in this section in additional to specifications in other mechanical specifications as well.

C. Binder shall be hard cover, three-ring notebook, 11" x 8-1/2" with heavy duty rings. Maximum binder size shall be 2-1/2".

D. The front of the binder shall be titled "Mechanical Operating and Maintenance Instructions," with the name of the job and documents date under the title.

E. Operating and Maintenance Instructions shall include the following:

1. A sheet in each binder listing the architect, engineer, and all contractors. List addresses and phone numbers.
2. List name, address, and phone number of organization responsible for warranty work if other than contractor and the specific work for which he is responsible.
3. List name, address and phone number of the nearest sales and the nearest service organization for each product.
4. Schedules of all equipment indicating identification number shown on plans cross referenced to field applied identification tag number.
5. Performance Curves: For pumps, balance valves and similar equipment at the operating conditions.
6. Lubrication Schedule: Indicating type and frequency of lubrication required.
7. List of Spare Parts: Recommended for normal service requirements. Each piece of equipment shall have this list clearly marked or attached to this submittal.
8. Parts List: Identifying the various parts of the equipment for repair and replacement purposes.
9. Instruction Books: May be standard booklets but shall be clearly marked to indicate applicable equipment and characteristics.
10. Wiring Diagrams: Generalized diagrams are not acceptable; submittal shall be specifically prepared for this Project.

11. Automatic Controls: Diagrams and functional descriptions.
12. Test and Balance Reports.
13. Valve tag list: Identifying valve type, size, service, and general location.
14. Filter schedule: Identifying filter type, size efficiency, manufacturer, and equipment number.
15. Ceiling marker schedule.

F. The following diagrams, schematics and lists shall be framed under glass and hung adjacent to equipment, in mechanical rooms, or where directed by Owner:

1. Automatic control diagrams.
2. Sequence of operation.
3. Valve Tag List.

3.14 OPERATIONAL AND MAINTENANCE INSTRUCTION

A. After all final tests and adjustments have been complete, a competent employee of the Contractor shall be provided to instruct the Owner's Representative in all details of operation and maintenance for equipment installed. Supply qualified personnel to operate equipment for sufficient length of time after instructions to assure that Owner's Representative is qualified to take over operation and maintenance procedures. Instruction periods shall be as designated by the Owner and shall not necessarily be consecutive. Minimum instruction periods shall be as follows:

1. Air handling units, Chilled Water, Hot Water, and Steam Systems (1 working day).
2. Air distribution system and Exhaust Systems (1/2 working day).
3. Split Systems (1/2 working day).

B. Instruction period shall be performed during the forty-five (45) days following substantial completion at time periods as approved by Owner.

3.15 CONTROLS OPERATION AND MAINTENANCE INSTRUCION

A. Upon completion of Operation and Maintenance instructions, competent employees of the Control Contractor shall be provided to instruct the Owner's representative in all details of operation and maintenance for the controls installed. Supply qualified personnel to operate system for sufficient length of time after instructions to assure the Owner's Representative is qualified to take over operation and maintenance procedures.

B. Controls Operation and Maintenance Instruction shall include the entire control system including control sequences that are inherent to equipment provided by the Equipment Manufacturer including economizer cycles, burner operation, low ambient operation, freezstats and similar sequences. Contractor shall provide sufficient personnel equipment walkie-talkies, gauges, and other accessories for this work.

C. Instruction periods shall be as designated by the Owner and shall not necessarily be consecutive. Minimum instruction periods shall be one (1) working day for on-site training.

D. Instructional period shall be performed during the forty-five (45) days following substantial completion at time periods as approved by Owner. One (1) day of instructions shall be in a formal classroom setting as determined by the owner.

E. Classroom instructions shall be videotaped by the Contractor. A copy of each tape shall be provided to the Owner. Contractor shall be responsible for all equipment, tapes, and accessories required.

3.16 GENERAL COMPLETION AND DEMONSTRATION

A. Results Expected:

1. All systems and controls shall be complete, tested, and operational.
2. All start-up and testing and balancing shall be complete.
3. All equipment shall be thoroughly cleaned. All excess materials and all debris shall be removed from the site.
4. All walls, floors, ceilings, and other surfaces marred or otherwise damaged as a result of execution of this contract shall be cleaned and repaired to the satisfaction of the Designer and Owner.

END OF SECTION 230100

SECTION 230200 - MECHANICAL RELATED WORK

PART 1 - GENERAL REQUIREMENTS

1.1 DRAWINGS AND SPECIFICATIONS

A. Provide all materials called for in these specifications and accompanying drawings and provide the apparatus complete in every respect. Anything called for in the specifications and not shown on the drawings or shown on the drawings and not called for in the specifications must be provided.

B. Where there is a discrepancy between drawings and specifications, the worst case shall be assumed.

C. Drawings show arrangements of system desired and shall be followed as closely as practical. Because of the small scale of the drawings not all offsets and bends can be shown, and these shall be provided as required, to fully complete the intent of plans. Should conditions and substitutions of equipment necessitate a rearrangement, prepare, and submit for review scaled drawings of such rearrangement, before beginning work.

D. Verify and check all measurements in the field.

E. Review architectural, structural, and electrical plans, and cooperate and coordinate work with other trades to the extent that interference shall be avoided. Discrepancies shown on different plans, or between plans and specifications, shall promptly be brought to the attention of the Designer.

1.2 CONCEALMENT OF PIPE AND DUCTS

A. Chases and Holes: Unless otherwise indicated, all piping and ductwork shall be run in concealed spaces between floor and ceilings or in chases. Ductwork and piping areas without ceilings shall be installed, exposed and as high as practical. This Contractor shall be responsible for the location and size of holes required for pipe, ducts and other equipment and shall advise of chase spaces and holes required as building progresses. Failure to do so shall require this Contractor to provide or cut same.

1.3 CUTTING AND PATCHING

A. This Contractor must have an experienced Mechanic upon the job before concrete floors, concrete or masonry walls are set in place, whose duty it shall be to locate the exact position of any and all sleeves and holes for the future installation of his pipe or duct work. This Contractor shall locate and size all openings required for his equipment in time to not delay the building construction.

B. If it becomes necessary to cut holes in concrete floors or concrete or other masonry walls, this Contractor shall call the General Contractor or his superintendent of Construction and inform

him of the position and size of the hole or other opening to be provided and the General Contractor shall determine how this will be done. Under no condition shall this Contractor make any cuts without permission from the General Contractor, nor shall he cut any green floors or walls.

C. This Contractor shall arrange proper openings in the building to admit his equipment. If it becomes necessary to cut any portion of the building to admit any equipment or install mechanical systems, this Contractor shall be responsible for cutting and patching. The portions cut must be restored to their former condition by this Contractor.

D. All cutting of structure shall be done using best method to minimize noise and cracking of structure. The method of cutting shall be approved by the Project Expediter (Prime Contractor) before work is started.

E. All drilled holes required for equipment or supports shall be done by this Contractor. Holes for piping shall be core drilled only.

1.4 EQUIPMENT STANDS, FOUNDATIONS AND MISCELLANEOUS STEEL FOR HANGERS AND SUPPORTS

A. Provide all equipment stands and supports for equipment as shown or required. Provide miscellaneous steel for hanging piping, ducts or other items of equipment as shown as required.

B. All concrete foundations, curbs and pads for equipment, ductwork, piping, etc. shall be provided by this Contractor, unless otherwise indicated. Pads shall be provided for all floor standing equipment.

C. All stands shall be adequately cross braced to provide rigid supporting foundation. All stands shall be adequately anchored to wall or floor as required. All miscellaneous steel shall have one coat of shop paint and two finished coats of rust resistant paint.

1.5 SITE EXAMINATION

A. Contractor, prior to submitting a bid, shall visit the site and thoroughly acquaint himself with the conditions under which the work will be performed.

1.6 PAINTING

A. Work to be Painted:

1. All piping, ductwork, conduit, steel supports, hangers, and other mechanical items exposed to view in occupied areas shall be painted under Division 09 by General Contractor.
2. All insulated piping as noted in Section 230700, uninsulated piping, ductwork, supporting steel and hangers for piping, ductwork and equipment (except made of galvanized steel) shall be shop coated with rust proof primer and shall be field painted by Mechanical Contractor except where installed above ceilings or where concealed in building construction. Concealed supports and hangers do not require painting.

3. All exposed insulated and uninsulated piping and ductwork in Mechanical Room shall be painted by Mechanical Contractor with (2) coats of paint.
4. All areas where cutting and patching are required the mechanical contractor shall paint to match adjacent surfaces.

B. Work not requiring Painting:

1. Piping and ductwork above solid (lay-in, gypsum board, etc.) ceilings do not require painting.
2. All exposed items specified to be finished by manufacturer will not be painted. See "Manufacturers' Finished Products".

C. Manufacturers' Finished Products:

1. All manufacturer finished products, such as water pumps, fans, air handling units, control panels, etc., shall have factory standard finish except where otherwise specified on the drawings or in other sections of this specification.
2. Contractor providing finished products shall be required to touch up any minor damages or scratches due to shipment, installation, or exposure to weather on all equipment with baked enamel or equivalent finish, Prime coated equipment shall be cleaned and touched up. Large areas of damaged finish shall be painted to match factory painting.

D. Refer to Division 09 for painting requirements

PART 2 - PRODUCTS

2.1 EQUIPMENT SUPPORTS

A. See notes on plans for supports provided by others.

B. Equipment Supports: Supports shall be prefabricated metal curb supports constructed of minimum 1.9 mm (14 gage) thick galvanized steel with fully mitered and welded corners, integral base plate with minimum ¾" flange, pressure treated top wood nailer, and 18 gage thick galvanized steel counterflashing cap.

1. Supports shall be 45-degree cant.
2. Minimum height shall be 12" above the finished roof.
3. Supports shall be constructed to match roof deck slope to create a level top surface.

PART 3 - EXECUTION

3.1 FORMWORK

A. General: Design, construct and maintain formwork to support vertical and lateral loads including pressure of cast-in-place concrete. Construct formwork so that formed concrete will be required size and shape and in required location. Construct with joints which will not leak cement paste. Form side and bottoms of concrete work, except where clearly indicated to be

cast directly in excavation or against other construction, or on grade or prepared subgrade. Design and construct forms for easy removal without damage to concrete and other work.

B. Form Costing: Cost concrete-contact surfaces of forms to be removed. Apply form-coating compound before reinforcement is placed. Apply in accordance with manufacturer's instructions and remove excess compound and spillage.

C. Deposit concrete continuously or in layers of thickness which will result in no concrete being placed on concrete which has hardened sufficiently to cause formation of seams or planes of weakness within section. If section cannot be placed continuously, provide construction joints. Deposit concrete as nearly as practicable in its final location, so as to avoid segregation due to rehandling or flowing.

D. Consolidate placed concrete by mechanical vibrating equipment supplemented by hand-spading, rodding, or tamping. Use equipment and procedures complying with recommended practices of ACI 309; eliminate voids in work.

E. Bring horizontal surfaces to correct level with straightedge and strike off. Use bull floats or darbies to smooth surface, free of humps and hollows.

F. Cold Weather Placement: Comply with ACI 306. Do not use frozen materials or materials containing ice and snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials. When air temperature has fallen or is expected to fall below 40 degrees F, heat water and aggregates uniformly before mixing, as required to obtain concrete mixture temperature of not less than 50 degrees F, and not more than 80 degrees F, at time of placement. Protect concrete work from physical damage and reduced strength resulting from frost, freezing actions, or low temperatures.

END OF SECTION 230200

SECTION 230300 - ELECTRICAL WORK FOR MECHANICAL SYSTEMS

PART 1 - GENERAL

1.1 SECTION INCLUDES:

A. 120V and 24V control Wiring.

B. Electrical wiring.

C. Starters and controllers.

1.2 CODES, STANDARDS, AND QUALIFICATIONS

A. All work shall conform to all sections of the most current North Carolina State Building Codes.

B. All work shall conform to all North Carolina Department of Administration State Construction Office Guidelines.

C. Electrical equipment shall be listed and/or labeled by an independent testing agency approved by the State Building Code.

D. Enclosure for electrical equipment and enclosed switches shall meet NEMA standards.

PART 2 - PRODUCTS

2.1 WIRING

A. All wiring and conduit shall be in accordance with the requirements of Division 26. This includes wiring requirements from variable frequency drives to equipment motors (refer to VFD cable requirements in Division 26).

B. Low voltage control wiring shall be not less than #18-gauge copper wire run in metallic conduit.

C. Low voltage shall be defined as a circuit operating at less than 30 volts and meeting the requirements of NEC Section 720 for Class I, power limited circuits.

2.2 MOTORS

A. Allowable manufacturers:

1. Baldor Super-E EM/XE (general purpose family) with optional cast iron frame.
2. TECO/Westinghouse ASHH or Max-PE, WEG W22.
3. Toshiba.

B. Substitutions:

1. Must be pre-approved in compliance with procedures outlined in 23 01 00 Mechanical General Specification.

C. Motors shall be built in accordance with the latest standards of NEMA and as specified. Motors shall be tested in accordance with standards of ASA C50 and conform thereto for insulation resistance and dielectric strength. Motors shall be provided with conduit terminal box, adequate starting and protective equipment as specified or required. Size shall be sufficient to operate associated driven devices under all conditions of operation and load and without overload, and at least shall be the horsepower indicated or specified. Motors shall be selected for quiet operation.

D. Motors less than 3/4 HP shall be single phase, PSC/capacitor start-induction run, open type, splashproof. Motors 3/4 HP and larger shall be induction, open 3-phase multi tap unless otherwise indicated. Voltage for 3-phase motors is noted in schedules. Coordinate electrical service requirements with Electrical Contractor.

E. Motors shall be provided with overload protection. On 3-phase motors overload protection shall be in the starters. Single-phase motors shall have built-in thermal overload protection.

F. Motors shall be sufficient size for the duty to be performed, not less than that indicated on the drawings, and shall not exceed their full rated load when the driven equipment is operating at specified capacity under the most severe conditions likely to be encountered. All motors shall be for continuous duty classification based on 40 degrees C ambient temperature unless otherwise indicated.

G. Motors less than 1 HP shall have efficiencies that comply with the current N.C. Building Code. Efficiency shall be determined in accordance with IEEE Standard 112, method B.

H. Motors 1 HP and larger shall have efficiencies that comply with NEMA Premium Efficiency ratings.

I. All vertically mounted motors shall be provided with thrust bearings.

J. Motors shall be open drip proof (ODP) for indoor use where satisfactorily housed, guarded drip proof when exposed to contact by employees or building occupants, TEFC (totally enclosed fan cooled) for outdoor use.

K. Motors that are specified to cycle on and off automatically under control of a device shall be capable of making starts as frequently as the device may demand. Other motors shall be capable of being started 4 times per hour without damage.

L. Motors that are to be used with adjustable frequency drives shall be approved by the motor manufacturer for that service.

M. All 3-phase motors shall be provided with lugs.

N. Motor Construction: NEMA Standard MG 1, general purpose, continuous duty, Design "B", except "C" where required for high starting torque. Class "B" insulation shall be provided.

1. Frames: NEMA Standard No. 48 or 54; use driven equipment manufacturer's standards to suit specific application.
2. Nameplate: Indicate the full identification of manufacturer, ratings, characteristics, construction, special features and similar information.
3. Service Factor: The service factor shall be at least 1.15 for polyphase motors and 1.35 for single phase motors.
4. Provide solid shaft grounding rings (Aegis SGR or approved equal). Soft carbon brushes and split shaft grounding rings shall not be accepted.

O. All motors 40 hp and larger not provided with VFD shall be provided with reduced voltage starters.

P. Provide armored AFD power cables for all motors served by AFD.

Q. For frames 284 or larger, bearing shall be capable of lubrication. Extend grease lines to an accessible location. For frames 140T-280T, bearings shall be capable of lubrication unless specifically reviewed and approved otherwise with Engineer and Owner.

R. The opposite shaft end bearing shall be clamped to secure the bearing in the housing. Electrical characteristics and horsepower shall be as specified on the project schedule.

S. For air handler fan motors, in a direct drive application, motors shall be capable of running continuously from 0 to 120Hz and deliver full rated horsepower at 60 to 120Hz operating frequencies. All motors shall maintain a minimum service factor of 1.15 throughout a 60 to 120HZ operating range. Motors shall conform to a G2.0 balance per NEMA S2.19.

2.3 STARTERS AND CONTROLLERS

A. Controllers and Control: Where controllers and controls are specified to be provided by the Contractor, they shall conform to the requirements specified below:

1. Controllers shall conform to adopted standards and recommended practices of the Industrial Control Standards of National Electrical Manufacturer's Association and the standard for Industrial Control Equipment of the Underwriters' Laboratories, Inc. Motors 93 W (1/8 hp) or larger and shall be provided with thermal overload protection. Manually reset type. Overload protective device shall be provided, mounted in separate enclosure. Single or double-pole tumbler heavy duty switches may be used as manual controllers for motors of 186 W (1/4 hp) or less in rating. Manual controllers for motors larger than 186 W (1/4 hp) shall be designed for purpose and shall have horsepower rating adequate for motor. Two speed motors shall have 2 winding type controllers unless otherwise specified.
2. Combination magnetic starter shall be full voltage, across the line type with under-voltage release for manual or automatic operation and shall break all phases on 3 phase starters for motors up to 40 hp. Starters shall be provided with start-stop pushbuttons mounted on cover unless controlled by hand-off-automatic (HOA) device. Hand-off-automatic device shall not be wired to override safety device interlocks on starter and shall be mounted on the starter or if adjacent mounted remotely, provide test start pushbutton on starter. All auxiliary contacts required for interlocking purposes shall be furnished and installed by the Contractor furnishing the starter. All starters not included in motor control centers shall be provided by Division 23.

3. Manual starters shall be provided with a manually operated trip free switch, horsepower rated with a separate fused disconnect.
4. Contractor providing the starters shall be responsible for all motors to be protected with proper size heater or thermal elements. All starters and enclosures shall be NEMA Standard, Type 1 unless otherwise specified. In wet locations, enclosures shall be NEMA 3R.
5. All starters and pushbutton stations shall be provided with labels as specified under identification designating service for which starter is used. Plate shall be firmly attached to starter or wall mounted adjacent to the starter.
6. All cabinets provided for the installation of motor starters, control transformers, relays, and appurtenant items shall be provided with gravity or forced ventilation at the option of the manufacturer. Openings shall be placed at bottom and top of the cabinet or high-low in the door if recessed and of sufficient size to limit the temperature rise through the enclosure or ambient compensated heater elements shall be provided.
7. All controllers and starters shall be rated for the same voltage as the motor which it serves. If the voltage is not indicated on the HVAC drawings, the Contractor shall provide the units at the voltage listed on the electrical drawings.
8. Provide interlocks, pneumatic switches and similar devices as required for coordination with control requirements of Division 23 Controls sections.
9. Provide built-in 120 volts control circuit transformer, fused from line side, where service voltage exceeds 240 volts.
10. Provide externally operated manual reset.
11. Motor connections shall be in waterproofed sealtite flexible conduit, maximum length of 457 mm (18"), except where plug-in electrical cords are specifically indicated.

2.4 SAFETY SWITCHES

A. All safety switches specified in Division 23 or on mechanical plans shall be heavy-duty type, NEMA 1 for indoor and NEMA 3R for outdoor use unless specifically stated specifically otherwise on plans. They shall be fused type unless specifically indicated otherwise on plans. Fused type shall be equipped with the following: Service Entrance and Feeder Circuits over 600A – Class L, UL Listed, current limiting with 200K interrupting rating; Service Entrance and Feeder Circuits 600A and less – Class RK1 or J, UL Listed, current limiting with 200K interrupting rating; Motor, Motor Controller and Transformer Circuits – Class RK5, UL Listed, current limiting time delay with 200K interrupting rating; and Individual Equipment where fault current does not exceed 50kA – Class K5, UL Listed, with 50K interrupting rating. Fusible safety switches with short circuit withstand rating of 100K or 200K shall include Class R or Class J rejection fuse block feature. Switches shall be equipped with defeatable door interlocks and padlocking provisions in the on and off positions. Padlocks shall be provided for switches located in public areas. Switches shall be by Square D, Cutler-Hammer, General Electric Co., or equivalent by others.

B. Contractor shall furnish one spare set of fuses for each piece of equipment.

C. All safety switches, motor starters, or other boxes or panels, designated as NEMA 3R or otherwise intended for outdoor use or use in wet areas, shall use raintight conduit hub fittings with bonding screw.

D. Control wiring shall not be installed in the same raceways as power wiring.

PART 3 - EXECUTION

3.1 WIRING

A. Regardless of voltage, furnish and install all temperature control wiring, and all interlock wiring and equipment control wiring for the equipment furnished.

B. Electrical Contractor will furnish and install all power wiring to line side of starters (see details on plans). The mechanical contractor shall furnish disconnects for equipment. Mechanical contractor shall provide all load side power wiring (see details on plans) and temperature control and interlock wiring. Controllers and controls shall be provided by the Mechanical Contractor.

C. Check with Electrical Contractor on service outlets provided to determine that service, circuit protection, switches and wiring provided are of adequate size to meet Code requirements for equipment provided. Discrepancies shall be brought to the attention of the Designer before work is installed. Cost for changes not so noted shall be at the expense of this Contractor. Electrical cost increase due to equipment substitution of different electrical characteristics shall be this Contractor’s expense.

D. Provide necessary electrical data for all equipment to the Electrical Contractor for proper coordination.

E. Control and interlock wiring shall be run in conduit. Conduit shall be minimum 3/4” in size.

F. Provide control circuit disconnect for all motor starters as required by Section 430-74 of NEC.

G. Unless otherwise noted or specified, all low voltage and line voltage control and instrumentation wiring and devices for equipment furnished under Division 23 shall be provided as part of this Division 23. Control wiring is considered to be the portion of the wiring which carries the electric signal directing or indicating the performance of a starter, relay, or contactor generally installed between starters, indicators, and remote-control devices. All wiring from indicated or available electrical source in the electrical room and/or mechanical room to direct digital control panels shall be provided as part of this Division.

H. Examine the drawings, and in cooperation with the Electrical Contractor, confirm the final location of all electrical equipment to be installed in the vicinity of piping. Plan and arrange all overhead piping to be no closer than 24" from the vertical line to electric motor controllers, switchboards, panelboards, or similar equipment. If the vertical line is less than 24", the installation of piping shall be relocated.

END OF SECTION 230300

SECTION 230500 - FIRESTOPPING

PART 1 - GENERAL REQUIREMENTS

1.1 SCOPE OF WORK

A. General:

1. Furnish all labor, materials, tools, and equipment and perform all operations in connection with the patching and repair of building structure, finishes and building assemblies as specified hereinafter.
2. Furnish all labor, materials, tools, and equipment and perform all penetrations in connection with the installation of fire stopping and smoke stopping systems required to seal all penetrations of required rated partitions, walls, or assemblies for Division 23 work.

B. Descriptions:

1. Patch and repair all building finishes, structural components, or other appurtenances that are removed or damaged as a result of the performance of this contract. Patch and repair work shall include finishes, components, substructure, and materials required for the installation of such work in accordance with standard practices.
2. All penetrations through exterior walls, floors, and roof systems shall be sealed watertight.
3. Firestop all existing openings in walls, roofs, slabs, and similar assemblies remaining as a result of removing existing pipes, ducts, conduit, equipment appurtenances.
4. Firestop and Smokestop as required for assembly type all new openings in walls, roofs, slabs and similar assemblies at pipe, duct, conduits, equipment, and appurtenances.
5. Patched and repaired work shall be finished to match existing or adjacent construction and conditions.

1.2 QUALITY ASSURANCE

A. Materials:

1. Materials shall be new, unused, properly stored and matching existing in colors, texture, finish, appearance, and function.
2. Fire stopping and smoke stopping materials shall be delivered to the job site ready to install and require no critical mixing procedures or precise installation time constraints.
3. Materials shall be delivered to the site in sealed containers, fully identified with manufacturer’s name, brand, type, grade and U.L. and FM labels. Store materials in a dry space under cover and off the ground.
4. Products shall be applied in strict accordance with their listing and manufacturers’ application requirements.

B. Code and Standards: All work shall meet or exceed the standards and procedures (latest editions) of the following:

1. ASTM E814, Fire Tests of Through-Penetration Firestop Systems.
2. UL 1479, Through-Penetration Firestop Systems.

C. Manufacturer: The following firestopping and waterproofing sealant manufacturers are acceptable:

1. Nelson.
2. Thomas & Betts.
3. 3M.
4. Hilti.
5. GE.
6. Frye Putty.

D. The following smoke stopping manufacturers are acceptable:

1. Nelson.
2. Thomas & Betts.
3. 3M.

PART 2 - PRODUCTS

2.1 FIRESTOPPING

A. Firestopping material shall maintain its dimension and integrity while preventing the passage of flame, smoke, and gases under conditions of installation and use when exposed to the ASTM E119 time-temperature rating of the assembly penetrated.

B. All material shall be listed by U.L.

2.2 SMOKESTOPPING

A. Smoke-stop shall provide an effective barrier against the spread of smoke.

B. All material shall be listed by U.L.

2.3 WATERPROOFING

A. Sealant materials shall be as follows:

1. Penetrations of Fire Rated assemblies shall meet the requirements of 2.1 FIRESTOPPING specified hereinbefore.
2. Exterior joint sealant shall be Polyurethane base, multi-component; self-leveling type for application in vertical joints; capable of withstanding movement of up to 50% of joint width and satisfactorily handled throughout temperature of 4 to 27 degrees C.; uniform, homogeneous, and free from lumps, skins and coarse particles when mixed; Shore “A”

hardness of minimum 15 and maximum 50; non-staining; non-bleeding; colors selected by Architect/Engineer.

2.4 SUBMITTAL

A. Provide U.L. approval assembly detail for specific application of the product.

B. Provide installation detail of the product.

PART 3 - EXECUTION

3.1 GENERAL

A. Exercise care in the performance of this contract so as not to damage any existing building components and finishes, outside components, shrubs, or other appurtenances.

B. Clean and prepare joints for sealant application in accordance with manufacturer's recommendations. Ensure that joint forming materials are compatible with sealant.

C. Openings larger than required for proper installation of pipe or duct shall be patched or repaired.

D. Protect the roof at all times. Provide planking, plywood, supports, and other materials and means to ensure damage is not incurred.

E. Firestopping and smoke stopping will meet the U.L. approved assembly detail for the product used.

3.2 EQUIPMENT PENETRATIONS:

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

B. Repair all insulation damaged during installation of equipment.

END OF SECTION 230500

SECTION 230510 - GAUGES AND METERS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Pressure gauges and Pressure Gauge taps.

B. Thermometers and thermometer wells.

1.2 ENVIRONMENTAL REQUIREMENTS

A. Do not install instrumentation when areas are under construction, except for required rough-in, taps, supports and test plugs.

PART 2 - PRODUCTS

2.1 PRESSURE GAUGES

A. Glycerin-Filled Pressure Gauge: 4-1/2” dial with snubber and stainless steel or cast aluminum case, gasketed Plexiglas Lens, stainless steel movement, Polypropylene blow-out back plate, White scale with black divisions and numerals, Plastic lens, Manufactured in accordance with ASME specification B40.1, Grade 2A.

B. Acceptable Manufacturers:

1. Dwyer.
2. Weiss.
3. Weksler.
4. Trerice.

C. All gauges shall have brass valve. Graduation in feet.

2.2 PRESSURE GAUGE TAPPINGS

A. Gauge Valve: Brass 1/4” ball valve.

B. 1/4-inch NPT for minimum 150 psig.

2.3 STEM TYPE THERMOMETERS

A. Acceptable manufacturers:

1. Trerice.

2. Weksler.
3. Weiss.

B. Thermometer: ASTM E1, adjustable angle, lens front tube, cast aluminum case with enamel finish, cast aluminum adjustable joint with positive locking device. Temperature ranges shall be appropriate for water service type and shall be submitted to Engineer for approval prior to installation.

1. Size: 9-inch scale.
2. Window: Clear glass.
3. Stem: 3/4-inch NPT brass.
4. Accuracy: 1 percent.
5. Calibration: Degrees F., 2 degrees per graduation.

C. Thermometers shall be solar powered digital readout able to operate with lighting levels of 10 Lux (1 foot Candle). Casing shall be of high impact ABS. Range shall read from 0 °F to 250 °F with a 1% or 1 °F accuracy whichever is greater. Resolution shall be to 1/10th °F. Recalibration shall be via an internal potentiometer and the display shall update once every 10 seconds. The thermometer shall be able to operate in relative humidity up to 100%. The sensor shall be a glass passivated thermistor. The stem assembly shall be bi-metallic and fully conform to standard ASME B40.3-1990 and be fully interchangeable with bi-metallic dial thermometers.

2.4 THERMOMETER SUPPORTS

A. Pipe Socket: Brass separable sockets with insulation extensions as required.

2.5 TEST PLUGS

A. Test Plug: 1/4 inch or 1/2-inch brass or stainless-steel fitting and cap for receiving 1/8 inch outside diameter pressure or temperature probe with neoprene core for temperatures up to 200 degrees F.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Provide one pressure Gauge per pump, installing taps on suction and discharge of pump. Pipe to Gauge. Provide pressure Gauge at inlet, outlet connection to condenser and evaporator of chiller, coils.

C. Install pressure gauges with pulsation dampers. Provide valves to isolate each Gauge. Extend nipples to allow clearance from insulation.

D. Install thermometers in piping systems in sockets in short couplings. Enlarge pipes smaller than 2-1/2 inch for installation of thermometer sockets. Ensure sockets allow clearance from

insulation. Dip thermometer stems in heat conducting paste before installing in wells. Provide thermometers at each inlet, outlet of coils, condenser and evaporator connections to each chiller, boiler.

E. Install thermometer sockets adjacent to controls systems transmitter.

F. Provide instruments with scale ranges selected according to service.

G. Install gauges and thermometers in locations where they are easily read from normal operating level.

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

I. Locate test plugs adjacent thermometers and thermometer sockets adjacent to pressure gauges and pressure Gauge taps adjacent to control device sockets.

END OF SECTION 230510

SECTION 230513 - VFDS

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Adjustable frequency drive units for pumps and fans.

1.2 QUALITY ASSURANCE

A. The complete unit shall be listed by a testing agency approved in North Carolina.

B. All wiring to conform to the NEMA Standards.

C. All enclosures to be NEMA rated.

D. All units shall conform to Part 23 of the FCC regulations on RFI/EMI emissions.

E. The inverter and any associated hardware are to be "run in" at rated ambient temperature and rated load on variable speeds at the manufacturer's plant prior to shipment.

F. The VFD and options shall be tested to ANSI/UL Standard 508. The complete VFD including all specified options, shall be assembled by the manufacturer, which shall be UL-508 certified for the building and assembly of option panels. Local representative panel shop assembly for option control panels is not acceptable. The appropriate UL stickers shall be applied to both the drive and option panel. Both drive and option panel shall be manufactured in ISO 9001 certified facilities.

G. All adjustable frequency drives for mechanical equipment shall be furnished by the same manufacturer.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Square D.

B. ABB.

C. Alan Bradley.

D. Cutler Hammer.

E. Danfoss Graham.

2.2 EQUIPMENT REQUIREMENTS

A. The seller shall, with the aid of the buyer's electrical power single line diagram, perform an analysis to initially demonstrate that the supplied equipment will meet the IEEE standards after installation. If, as results of the analysis, it is determined that additional filter equipment is required to meet the IEEE recommendations, the cost of such equipment shall be included in the bid.

B. A harmonic analysis shall be submitted with the approval drawings to verify compliance with IEEE-519 2014 voltage and current distortion limits as shown in Tables 10.2 and 10.3 at the point of common coupling (PCC). The PCC shall be defined as the consumer-utility interface or metering point.

Table 10.2 Low-Voltage System Classification and Distribution Limits

	Special Applications (1)	General Systems (2)
Notch Depth	10%	20%
THD (Voltage)	3%	5%

NOTES:
1. Airports and medical facilities having patient monitoring equipment.
2. In volt-microseconds at rated voltage and current.

Table 10.3
Current Distortion Limits for General Distribution Systems
(120V Through 69,000V)

Maximum Harmonic Current Distortion
in Percent of IL

	Individual Harmonic Order (Odd Harmonics)					
Iso/IL	<11	11≤ sn <17	17≤ sn <23	23≤ sn <35	35 <sn	TDD
<20 (1)	4.0	2.0	1.5	0.6	0.3	5.0
20<50	7.0	3.5	2.5	1.0	0.5	8.0
50<100	10.0	4.5	4.0	1.5	0.7	12.0
100<1000	12.0	5.5	5.0	2.0	1.0	15.0
>1000	15.0	7.0	6.0	2.5	1.4	20.0

NOTES:
1. Even harmonics are limited to 25% of the odd harmonic limits above.
2. Current distortion that results in a dc offset, e.g., half-wave converters, are not allowed.
3. All power generation equipment is limited to these values of current distortion, regardless of actual Iso/IL.

C. The VFD shall convert incoming fixed frequency three-phase AC power into variable frequency and voltage for controlling the speed of three phase AC motors (note: all motors provided for VFD equipment shall be inverter duty rated). The motor current shall closely approximate a sine wave. Motor voltage shall be varied with frequency to maintain desired motor magnetization current suitable for centrifugal pump and fan control. An advanced sine wave approximation and voltage vector control shall be used to allow operation at rated motor shaft output at nominal speed with no derating. This voltage vector control shall minimize harmonics to the motor to increase motor efficiency and life. The VFD shall include a full-wave diode bridge rectifier and maintain a fundamental power factor near unity regardless of speed or load. The VFD, including the options listed below, shall be tested to ANSI/UL Standard 508.

1. The VFD shall have a DC link reactor on both positive and negative rails of the DC bus to minimize power line harmonics. VFD's without a DC link reactor shall have a 5% impedance input AC line reactor.
2. An automatic energy optimization selection feature shall be provided standard in the drive. This feature shall reduce voltages when lightly loaded and provide a 3% to 10% additional energy savings.
3. Galvanic and/or optical isolation shall be provided between the drive’s power circuitry and control circuitry to ensure operator safety and to protect connected electronic control equipment from damage caused by voltage spikes, current surges, and ground loop currents. Drives not including isolation on both analog I/O and discrete I/O shall include additional isolation modules.
4. Drive shall include current sensors on all three output phases to detect and report phase loss to the motor. The VFD will identify which of the output phases is low or lost.
5. Input and output power circuit switching can be done without interlocks or damage to the VFD.
6. Class 20 I2t electronic motor overload protection for single motor applications and thermal-mechanical overloads for multiple motor applications.
7. Protection against input transients, loss of AC line phase, short circuit, ground fault, overvoltage, undervoltage, drive overtemperature and motor overtemperature.
8. Display all faults in English language. Codes are not acceptable.
9. If the temperature of the drive’s heat sink rises to 80o C, the drive shall automatically reduce the carrier frequency to reduce the heat sink temperature. If the temperature of the heat sink continues to rise the drive shall automatically reduce its output frequency to the motor. As the drive’s heat sink temperature returns to normal, the drive shall automatically increase the output frequency to the motor and return the carrier frequency to its normal switching speed.
10. Fully range minimum and maximum speed adjustment with ability to automatically.
11. Select speeds as defined in controls sequence.
12. Separately adjustable linear acceleration and deceleration.
13. Field adjustable or automatic current limit.
14. Four short circuit current settings protection.
15. All units shall operate on a 4-20 ma signal in automatic mode.
16. Drive shall communicate with building automation system via BACnet protocol.
17. Be rated to provide 100% of rated current, minimum 110% break away current.

18. Inverter is to be rated for an input line voltage variation of + 10% and -10%.
19. Provide a manual 3 contactor bypass consisting of a door interlocked main fused disconnect padlockable in the off position, a built-in motor starter and a four position DRIVE/OFF/LINE/TEST switch controlling three contactors. In the DRIVE position, the motor is operated at an adjustable speed from the drive. in the OFF position, the motor and drive are disconnected. In the LINE position, the motor is operated at full speed from the AC power line and power is disconnected from the drive, so that service can be performed. In the TEST position, the motor is operated at full speed from the AC line power. This allows the drive to be given an operational test while continuing to run the motor at full speed in bypass. Customer supplied normally closed dry contact shall be interlocked with the drives safety trip circuitry to stop the motor whether in DRIVE or BYPASS mode in case of an external safety fault. The use of microprocessor-based bypass control shall not be allowed.
20. Provide circuit breaker for main power disconnect. Service personnel shall be able to defeat the main power disconnect and open the bypass enclosure without disconnecting power. This shall be accomplished through the use of a specially designed tool and mechanism while meeting all local and national code requirements for safety.
21. The drive and bypass circuits shall operate independently of each other and have completely separate switch mode power supplies operating off AC line Voltage.
22. The bypass shall provide motor functionality with the drive removed. The bypass shall automatically respond to the BAS for start and stop while operating in bypass.
23. The bypass shall include a service switch or line isolation contactor to disconnect power to the drive, but not the bypass.
24. The drive and bypass package shall be UL listed and have a labeled, short circuit current rating (SCCR) of 100,000 amps.
25. Smoke purge circuitry shall be interconnected such that an external dry contact can be used in both drive and bypass modes.

PART 3 - EXECUTION

3.1 INSTALLATION AND START UP

A. Install in accordance with manufacturer's written installation instructions.

B. The contractor shall assume the responsibility for coordinating the purchased equipment with the motor served and with the automatic temperature control system, paying specific attention to the signal sent and received, the ground source and the required speed range.

C. Contractor to verify that job site conditions for installation meet factory recommended and code-required conditions for VFD installation prior to start-up, including clearance spacing, temperature, contamination, dust, and moisture of the environment. All power and control wiring shall (including from VFD to motor) be installed in conduit. Separate conduit installation of the motor wiring, power wiring, and control wiring, and installation per the manufacturer's recommendations shall be verified.

D. VFD shall be installed a maximum distance of 100’ away from associated motor.

E. The VFD is to be covered and protected from installation dust and contamination until the environment is cleaned and ready for operation. The VFD shall not be operated while the unit is covered.

F. The manufacturer shall provide start-up commissioning of the variable frequency drive and its optional circuits by a factory certified service technician who is experienced in start-up and repair services. The commissioning personnel shall be the same personnel that will provide the factory service and warranty repairs at the customer's site. Sales personnel and other agents who are not factory certified technicians for VFD field repair are not acceptable as commissioning agents. Start-up services shall include checking for verification of proper operation and installation for the VFD, its options and its interface wiring to the building automation system. Start-up shall include customer operator training at the time of the equipment commissioning.

3.2 WARRANTY

A. The VFD shall be warranted by the manufacturer for a period of 36 months from date of shipment. The warranty shall include parts, labor, travel costs and living expenses incurred by the manufacturer to provide factory authorized on-site service.

END OF SECTION 230513

SECTION 230529 - SUPPORTS AND ANCHORS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Pipe and equipment hangers and supports.

B. Equipment bases and supports.

C. Sleeves and seals.

D. Flashing and sealing equipment and pipe stacks

1.2 PRODUCTS FURNISHED BUT NOT INSTALLED UNDER THIS SECTION

A. Placement of inserts sleeves in existing walls and slabs.

1.3 REFERENCES

A. ASME B31.1 - Power Piping.

B. ASME B31.2 - Fuel Gas Piping.

C. ASME B31.5 - Refrigeration Piping.

D. ASME B31.9 - Building Services Piping.

E. ASTM F708 - Design and Installation of Rigid Pipe Hangers.

F. MSS SP58 - Pipe Hangers and Supports - Materials, Design and Manufacturer.

G. MSS SP69 - Pipe Hangers and Supports - Selection and Application.

H. MSS SP89 - Pipe Hangers and Supports - Fabrication and Installation Practices.

I. NFPA 13 - Installation of Sprinkler Systems.

J. NFPA 14 - Installation of Standpipe and Hose Systems.

K. UL 203 - Pipe Hanger Equipment for Fire Protection Service.

1.4 SUBMITTALS

A. Submit under provisions of Division 1.

B. Product Data: Provide manufacturers catalog data including load capacity.

C. Design Data: Indicate load carrying capacity of trapeze, multiple pipe, and riser support hangers.

D. Manufacturer's Installation Instructions: Indicate special procedures and assembly of components.

1.5 REGULARTORY REQUIREMENTS

A. Conform to applicable code for support of hydronic piping.

PART 2 - PRODUCTS

2.1 PIPE HANGERS AND SUPPORTS

A. Pipe hangers for insulated piping shall be sized to fit around the pipe covering. Contractor shall provide at each hanger a galvanized insulation protection shield formed to fit the outside of the covering. Shield shall extend above center line on both sides. Shield to be #18 gauge up to 3" pipe, #16 gauge up to 6" pipe and #14 gauge for 8" and larger. Provide rigid insulation under all hangers. See Section 23 07 00, Insulation.

B. Hydronic Piping:

1. Conform to MSS SP58.
2. Hangers for Pipe Sizes 1/2 to 1 1/2 Inch (13 to 38 mm): Carbon steel, adjustable swivel, split ring.
3. Hangers for Cold Pipe Sizes 2 Inches (50 mm) and Over: Carbon steel, adjustable, clevis.
4. Hangers for Hot Pipe Sizes 2 to 4 Inches (50 to 100 mm): Carbon steel, adjustable, clevis.
5. Hangers for Hot Pipe Sizes 6 Inches (150 mm) and Over: Adjustable steel yoke, cast iron roll, double hanger.
6. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.
7. Multiple or Trapeze Hangers for Hot Pipe Sizes 6 Inches (150 mm) and Over: Steel channels with welded spacers and hanger rods, cast iron roll.
8. Wall Support for Pipe Sizes to 3 Inches (76 mm): Cast iron hook.
9. Wall Support for Pipe Sizes 4 Inches (100 mm) and Over: Welded steel bracket and wrought steel clamp.
10. Wall Support for Hot Pipe Sizes 6 Inches (150 mm) and Over: Welded steel bracket and wrought steel clamp with adjustable steel yoke and cast-iron roll.
11. Vertical Support: Steel riser clamp.
12. Floor Support for Cold Pipe: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
13. Floor Support for Hot Pipe Sizes to 4 Inches (100 mm): Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
14. Floor Support for Hot Pipe Sizes 6 Inches (150 mm) and Over: Adjustable cast iron roll and stand, steel screws, and concrete pier or steel support.
15. Copper Pipe Support: Carbon steel ring, adjustable, copper plated.

2.2 ACCESSORIES

A. Hanger Rods: Mild steel threaded both ends, threaded one end, or continuous threaded.

2.3 FLASHING

A. Metal Flashing: 26 gage galvanized steel.

B. Metal Counterflashing: 22 gage galvanized steel.

C. Lead Flashing:

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

D. Flexible Flashing: 47mil thick sheet compatible with roofing.

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

2.4 SLEEVES

A. Sleeves for Pipes Through Non-Fire Rated Floors: 18 gage (1.2 mm thick) galvanized steel.

B. Sleeves for Pipes Through Non-Fire Rated Beams, Walls, Footings, and Potentially Wet Floors: Steel pipe or 18 gage galvanized steel.

C. Sleeves for Pipes Through Fire Rated and Fire Resistive Floors and Walls, and Fire Proofing: Prefabricated fire rated sleeves including seals, UL listed.

D. Sleeves for Round Ductwork: Galvanized steel.

E. Sleeves for Rectangular Ductwork: Galvanized steel.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install in accordance with manufacturer's instructions.

3.2 INSERTS

A. Provide inserts for placement in concrete walls and slabs as noted on plans.

B. Provide inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.

3.3 PIPE HANGERS AND SUPPORTS

A. Support horizontal piping as scheduled.

B. Install hangers to provide minimum 1/2-inch (13 mm) space between finished covering and adjacent work.

C. Place hangers within 12 inches (300 mm) of each horizontal elbow.

D. Use hangers with 1 1/2 inch (38 mm) minimum vertical adjustment.

E. Support vertical piping at every floor.

F. Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.

G. Support riser piping independently of connected horizontal piping.

H. Provide copper plated hangers and supports for copper piping.

I. Design hangers for pipe movement without disengagement of supported pipe.

J. Prime coat exposed steel hangers and supports. Refer to Division 9. Hangers and supports located in crawl spaces, pipe shafts, and suspended ceiling spaces are not considered exposed.

3.4 EQUIPMENT BASES AND SUPPORTS

A. Provide housekeeping pads of concrete, minimum 6 inches thick and extending 6 inches (150 mm) beyond supported equipment. Refer to Division 3.

B. Provide templates, anchor bolts, and accessories for mounting and anchoring equipment.

C. Construct supports of steel members. Brace and fasten with flanges bolted to structure.

D. Provide rigid anchors for pipes after vibration isolation components are installed.

3.5 FLASHING

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

B. Flash vent and soil pipes projecting 3 inches (75 mm) minimum above finished roof surface with lead worked one inch (25 mm) minimum into hub, 8 inches (200 mm) minimum clear on sides with 24 x 24 inches (600 x 600 mm) sheet size. For pipes through outside walls, turn flanges back into wall and calk, metal counter flash, and seal.

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

D. Provide curbs for mechanical roof installations 8 inches minimum high above roofing surface. Flash and counterflash with sheet metal; seal watertight. Attach counterflashing mechanical equipment and lap base flashing on roof curbs. Flatten and solder joints. Roof curbs shall be constructed to match the roof slope so the equipment will be installed level with the ground.

E. Adjust storm collars tight to pipe with bolts, calk around top edge. Use storm collars above roof jacks. Screw vertical flange section to face of curb.

3.6 SLEEVES

A. Set sleeves in position in formwork. Provide reinforcing around sleeves.

B. Size sleeves large enough to allow for movement due to expansion and contraction. Provide for continuous insulation wrapping.

C. Extend sleeves through floors one inch above finished floor level. Calk sleeves.

D. Where piping or ductwork penetrates floor, ceiling, or wall, close off space between pipe or duct and adjacent work with fire stopping material and calk as per UL approved detail. Provide close fitting metal collar or escutcheon covers at both sides of penetration.

E. Install chrome plated steel escutcheons at finished surfaces.

3.7 SCHEDULES

	Pipe Size **Inches**	Max Hanger Spacing **Feet (m)**	Hanger Rod Diameter **Inches (mm)**
1.	1/2 to 1-1/4	6.5 (2)	3/8 (9)
2.	1-1/2 to 2	10 (3)	3/8 (9)
3.	2-1/2 to 3	10 (3)	1/2 (13)
4.	4 to 6	10 (3)	5/8 (15)
5.	8 to 12	12 (3.7)	7/8 (22)

END OF SECTION 230529

SECTION 230548 - VIBRATION ISOLATION

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Provide vibration isolation as noted on plans for motor driven equipment over 3/4 HP, plus connected piping, and ductwork. Provide neoprene pad isolator under each Air Handling Unit.

B. Provide minimum static deflection of isolators for equipment as indicated.

1. Basement, Under 20 hp (15 kw):

a. Under 400 rpm: 1 inch (25 mm).
b. 400 - 600 rpm: 1 inch (25 mm).
c. 600 - 800 rpm: 0.5 inch (12 mm).
d. 800 - 900 rpm: 0.2 inch (5 mm).
e. 1100 - 1500 rpm: 0.14 inch (4 mm).
f. Over 1500 rpm: 0.1 inch (3 mm).

PART 2 - PRODUCTS

2.1 VIBRATION ISOLATORS

A. Open Spring Isolators:

1. Spring Isolators:

a. For Exterior and Humid Areas: Provide hot dipped galvanized housings and neoprene coated springs.
b. Color code springs for load carrying capacity.

2. Springs: Minimum horizontal stiffness equal to 75 percent vertical stiffness, with working deflection between 0.3 and 0.6 of maximum deflection.
3. Spring Mounts: Provide with levelling devices, minimum 0.25-inch-thick neoprene sound pads, and zinc chromate plated hardware.
4. Sound Pads: Size for minimum deflection of 0.05 inch; meet requirements for neoprene pad isolators.

B. Restrained Spring Isolators:

1. Spring Isolators:

a. For Exterior and Humid Areas: Provide hot dipped galvanized housings and neoprene coated springs.
b. Color code springs for load carrying capacity.

2. Springs: Minimum horizontal stiffness equal to 75 percent vertical stiffness, with working deflection between 0.3 and 0.6 of maximum deflection.
3. Spring Mounts: Provide with levelling devices, minimum 0.25-inch-thick neoprene sound pads, and zinc chromate plated hardware.
4. Sound Pads: Size for minimum deflection of 0.05 inch; meet requirements for neoprene pad isolators.
5. Restraint: Provide heavy mounting frame and limit stops.

C. Closed Spring Isolators:

1. Spring Isolators:

a. For Exterior and Humid Areas: Provide hot dipped galvanized housings and neoprene coated springs.
b. Color code springs for load carrying capacity.

2. Type: Closed spring mount with top and bottom housing separated with neoprene rubber stabilizers.
3. Springs: Minimum horizontal stiffness equal to 75 percent vertical stiffness, with working deflection between 0.3 and 0.6 of maximum deflection.
4. Housings: Incorporate neoprene isolation pad meeting requirements for neoprene pad isolators, and neoprene side stabilizers with minimum 0.25-inch clearance.

D. Spring Hanger:

1. Spring Isolators:

a. For Exterior and Humid Areas: Provide hot dipped galvanized housings and neoprene coated springs.
b. Color code springs for load carrying capacity.

2. Springs: Minimum horizontal stiffness equal to 75 percent vertical stiffness, with working deflection between 0.3 and 0.6 of maximum deflection.
3. Housings: Incorporate [**neoprene isolation pad meeting requirements for neoprene pad isolators] [rubber hanger with threaded insert]**.
4. Capable of 20-degree hanger rod misalignment.

E. Neoprene Pad Isolators:

1. Rubber or neoprene waffle pads:

a. 30 durometer.
b. Minimum 1/2 inch thick.
c. Maximum loading 40 psi.
d. Height of ribs shall not exceed 0.7 times width.

2. Rubber Mount or Hanger: Molded rubber designed for 0.5 inches deflection with threaded insert.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install isolation for motor driven equipment.

C. Adjust equipment level.

D. Install spring hangers without binding.

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

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

G. Provide pairs of horizontal limit springs on hanger supported horizontally mounted fans.

H. Support piping connections to isolated equipment as follows:

1. Up to 4 Inch (100 mm) Diameter: First three points of support.
2. 5 to 8 Inch (125 to 200 mm) Diameter: First four points of support.
3. 10-inch (250 mm) Diameter and Over: First six points of support.
4. Select three hangers closest to vibration source for minimum 1.0 inch (25 mm) static deflection or static deflection of isolated equipment. Select remaining isolators for minimum 1.0 inch (25 mm) static deflection or 1/2 static deflection of isolated equipment.

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

END OF SECTION 230548

SECTION 230553 - MECH IDENTIFICATION

PART 1 - GENERAL

1.1 SECTION INCLUDES:

A. Nameplates.

B. Tags.

C. Stencils.

D. Ceiling Tacks.

1.2 REFERENCES

A. ASME A13.1 Scheme for the Identification of Piping Systems.

PART 2 - PRODUCTS

2.1 NAMEPLATES

A. Description: Laminated three-layer plastic with engraved black letters on light contrasting background color.

2.2 TAGS

A. Metal Tags: Brass with stamped letters; tag size minimum 1 1/2-inch diameter.

B. Chart: Typewritten letter size list in 3-ring notebook.

2.3 STENCILS

A. Stencils: With clean cut symbols and letters of following size:

1. 3/4 to 1 1/4 inch Outside Diameter of Insulation or Pipe: 8-inch-long color field, 1/2-inch-high letters.
2. 1 1/2 to 2 inch Outside Diameter of Insulation or Pipe: 8-inch-long color field, 3/4-inch-high letters.
3. 2 1/2 to 6 inch Outside Diameter of Insulation or Pipe: 12-inch-long color field, 1 1/4-inch-high letters.
4. 8 to 10 inch Outside Diameter of Insulation or Pipe: 24-inch-long color field, 2 1/2-inch-high letters.

5. Over 10 inch Outside Diameter of Insulation or Pipe: 32-inch-long color field, 3 1/2-inch-high letters.
6. Ductwork and Equipment: 2 1/2-inch-high letters.

B. Stencil Paint: Semi-gloss enamel, black on white background conforming to ASME A13.1.

2.4 CEILING TACKS

A. Description: Steel with 3/4-inch diameter color coded head; In addition, provide clear plastic label adjacent to ceiling tack indicating specific equipment identification tag.

B. Color code as follows:

1. Yellow - HVAC equipment.
2. Red - Fire dampers/smoke dampers.
3. Green - Plumbing valves.
4. Blue - Heating/cooling valves.

PART 3 - EXECUTION

3.1 PREPARATION

A. Degrease and clean surfaces to receive adhesive for identification materials.

B. Reference division 9 for surface preparation.

3.2 INSTALLATION

A. All equipment requiring periodic maintenance or testing located in concealed spaces shall be clearly identified on an adjacent finished surface to identify the location of equipment. For equipment mounted above ceilings, provide an ID label on the ceiling below the equipment. Typical concealed equipment includes air terminals, air valves, PRVs, mixing valves, duct and pipe differential pressure sensors, steam traps, fire smoke dampers, etc. Labels shall be clear or white with 0.375" high black letters.

B. Install plastic nameplates with corrosive resistant mechanical fasteners, or adhesive. Apply with sufficient adhesive to ensure permanent adhesion and seal with clear lacquer.

C. Install tags with corrosion resistant chain.

D. Reference division 9 for surface preparation. Black on white background or color as coordinated with Engineer and Owner prior to beginning work.

E. Install underground plastic pipe markers 6 to 8 inches below finished grade, directly above buried pipe.

F. Identify air handling units, pumps, heat transfer equipment, tanks, and water treatment devices with plastic nameplates. Small devices, such as in line pumps, may be identified with tags.

G. Identify control panels and major control components outside panels with plastic nameplates.

H. Identify thermostats relating to terminal boxes or valves with nameplates.

I. Identify valves in main and branch piping with tags.

J. Identify air terminal units and associated valves with numbered tags.

K. Tag automatic controls, instruments, and relays. Key to control schematic.

L. Identify piping, concealed, or exposed, with stencils. Identify service, flow direction, and pressure. Install in clear view and align with axis of piping. Locate identification not to exceed 20 feet on straight runs including risers and drops, adjacent to each valve and Tee, at each side of penetration of structure or enclosure, and at each obstruction.

M. Identify ductwork with stenciled painting. Identify with air handling unit identification number and area served. Locate identification at air handling unit, at each side of penetration of structure or enclosure, and at each obstruction.

N. Provide ceiling tacks to locate valves or dampers above T-bar type panel ceilings. Locate in corner of panel closest to equipment.

END OF SECTION 230553

SECTION 230593 - TAB

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Testing, adjustment, and balancing of air systems.

B. Testing, adjustment, and balancing of hydronic systems.

C. Measurement of final operating condition of HVAC systems.

1.2 ALLOWANCES

A. Work is included in this section and is part of the Contract Sum/Price.

1.3 REFERENCES

A. AABC - National Standards for Total System Balance.

B. ADC - Test Code for Grilles, Registers, and Diffusers.

C. ASHRAE 111 - Practices for Measurement, Testing, Adjusting, and Balancing of Building Heating, Ventilation, Air-conditioning, and Refrigeration Systems.

D. NEBB - Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems.

E. SMACNA - HVAC Systems Testing, Adjusting, and Balancing.

1.4 PROJECT RECORD DOCUMENTS

A. Record actual locations of flow and pressure measuring stations and balancing valves.

1.5 QUALIFICATIONS

A. Agency: Company specializing in the testing, adjusting, and balancing of systems specified in this Section with minimum five years documented experience certified by AABC.

B. Perform Work under supervision of AABC Certified Test and Balance Engineer, NEBB Certified Testing, Balancing and Adjusting Supervisor, or registered Professional Engineer experienced in performance of this Work and licensed in the State of North Carolina.

1.6 PRE-BALANCE CONFERENCE

A. Convene one month prior to commencing work. Include all pertinent contractors and designers.

1.7 SEQUENCING

A. Sequence work to commence after completion of systems and schedule completion of work before Substantial Completion of Project.

B. The test and balance report shall be completed, reviewed, and approved by project engineer prior to final inspection and occupancy. Preliminary/rough draft reports are not acceptable.

1.8 SCHEDULING

A. Schedule and provide assistance in final adjustment and test of life safety and lab exhaust system.

PART 2 - PRODUCTS – This Part Not Used.

PART 3 - 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. Temperature control systems are installed complete and operable.
3. Proper thermal overload protection is in place for electrical equipment.
4. Final filters are clean and in place. If required, install temporary media in addition to final filters.
5. Duct systems are clean of debris.
6. Fans are rotating correctly.
7. Fire and volume dampers are in place and open.
8. Air coil fins are cleaned and combed.
9. Access doors are closed, and duct end caps are in place.
10. Air outlets are installed and connected.
11. Duct system leakage is minimized.
12. Hydronic systems are flushed, filled, and vented.
13. Pumps are rotating correctly.
14. Proper strainer baskets are clean and in place.
15. Service and balance valves are open.

B. Submit field reports. Report defects and deficiencies noted.

C. Beginning of work means acceptance of existing conditions.

3.2 PREPARATION

A. Provide instruments required for testing, adjusting, and balancing operations. Make technician and instruments available to Designer to facilitate spot checks during testing.

B. Provide additional balancing devices as required.

3.3 INSTALLATION TOLERANCES – CHECK AND SELECT APPROPRIATE TAB TOLERANCES HERE.

A. Air Handling Systems: Adjust to within plus or minus 5 percent of design for air conditioning systems and plus or minus 5 percent of design for exhaust systems.

B. Hydronic Systems: Adjust to within plus or minus 10 percent of design.

C. Where pressure relationship between adjacent spaces is called for, document compliance.

3.4 ADJUSTING

A. Ensure recorded data represents actual measured or observed conditions.

B. Permanently mark settings of valves, dampers, and other adjustment devices allowing settings to be restored. Set and lock memory stops.

C. After adjustment, take measurements to verify balance has not been disrupted or that such disruption has been rectified.

D. Leave systems in proper working order, replacing belt guards, closing access doors, closing doors to electrical switch boxes, and restoring thermostats to specified settings.

E. At final inspection, recheck random selections of data recorded in report. Recheck points or areas as selected and witnessed by the Owner.

F. Check and adjust systems approximately six months after final acceptance and submit report.

3.5 AIR SYSTEM PROCEDURE

A. Adjust air handling and distribution systems to provide required air quantities.

B. Make air quantity measurements in ducts by Pitot tube traverse of entire cross-sectional area of duct.

C. Measure air quantities at air inlets and outlets.

D. Adjust distribution system to obtain uniform space temperatures control.

E. Use volume control devices to regulate air quantities only to the extent that adjustments do not create objectionable air motion or sound levels. Effect volume control by duct mounted devices.

F. Vary total system air quantities by adjustment of fan speeds. Provide drive changes required. Vary branch air quantities by damper regulation.

G. Provide system schematic with required and actual air quantities recorded at each outlet or inlet. Provide summary report with all test and equipment data included.

H. Measure static air pressure conditions on air supply units, including filter and coil pressure drops, and total pressure across the fan. Make allowances for 50 percent loading of filters.

I. Adjust automatic, outside air, return air, and exhaust dampers for design conditions.

J. Measure temperature conditions across outside air, return air, and exhaust dampers to check leakage.

K. Where modulating dampers are provided, take measurements and balance at extreme conditions. Balance variable volume systems at maximum air flow rate, full cooling, and at minimum air flow rate, full heating.

L. Measure building and/or system static pressure and adjust supply, return, and exhaust air systems to provide required relationship between each to maintain approximate positive static pressure called for.

M. Check all motorized dampers for leakage. Adjust air quantities with mixing dampers set first for cooling, then heating, then modulating.

N. For variable air volume system powered units set volume controller to air flow setting indicated. Confirm connections properly made and confirm proper operation for automatic variable air volume temperature control.

3.6 WATER SYSTEM PROCEDURE

A. Adjust water systems to provide required or design quantities.

B. Use calibrated fittings and pressure gages to determine flow rates for system balance. Where flow metering devices are not installed, base flow balance on suitable temperature difference.

C. Adjust systems to provide specified pressure drops and flows through heat transfer elements prior to thermal testing. Perform balancing by measurement of temperature differential in conjunction with air balancing.

D. Effect system balance with automatic control valves fully open to heat transfer elements.

E. Effect adjustment of water distribution systems by means of balancing cocks, valves, and fittings. Do not use service or shut-off valves for balancing unless indexed for balance point.

F. Where available pump capacity is less than total flow requirements or individual system parts, full flow in one part may be simulated by temporary restriction of flow to other parts.

3.7 SCHEDULES

A. Equipment Requiring Testing, Adjusting, and Balancing:

1. Chillers.
2. Pumps.
3. Air Handling System.
4. Fans.
5. Air filters.
6. Duct Leakage Testing.

B. Report Forms:

1. Title Page:

a. Name of Testing, Adjusting, and Balancing Agency.
b. Address of Testing, Adjusting, and Balancing Agency.
c. Telephone number of Testing, Adjusting, and Balancing Agency.
d. Project name.
e. Project location.
f. Project Architect.
g. Project Engineer.
h. Project Contractor.
i. Project altitude.
j. Report Date.

2. Summary Comments:

a. Design versus final performance.
b. Notable characteristics of system.
c. Description of systems operation sequence.
d. Summary of outdoor and exhaust flows to indicate amount of building pressurization.
e. Nomenclature used throughout report.
f. Test conditions.

3. Instrument List:

a. Instrument.
b. Manufacturer.
c. Model number.
d. Serial number.
e. Range.
f. Calibration date.

4. Electric Motors:

a. Manufacturer.
b. Model / Frame.
c. HP / BHP.
d. Phase, voltage, amperage, nameplate, actual, no load.
e. RPM.
f. Service factor.

g. Starter size, rating, heater elements.
h. Sheave Make/Size/Bore.

5. V-Belt Drive:

a. Identification/Location.
b. Required driven RPM.
c. Driven sheave, diameter, and RPM.
d. Belt, size, and quantity.
e. Motor sheave diameter and RPM.
f. Center to center distance, maximum, minimum, and actual.

6. Pump Data:

a. Identification number.
b. Manufacturer.
c. Size/Model.
d. Impeller.
e. Service.
f. Design flow rate, pressure drop, BHP.
g. Actual flow rate, pressure drop, BHP.
h. Discharge pressure.
i. Suction pressure.
j. Total operating head pressure.
k. Shut off, discharge, and suction pressure.
l. Shut off, total head pressure.

7. Chillers, Boilers, and Heat Exchangers:

a. Identification number.
b. Location.
c. Service.
d. Manufacturer.
e. Model number.
f. Serial number.
g. Primary water entering temperature, design and actual.
h. Primary water leaving temperature, design and actual.
i. Primary water flow, design and actual.
j. Primary water pressure drop, design and actual.
k. Secondary water leaving temperature, design and actual.
l. Secondary water leaving temperature, design and actual.
m. Secondary water flow, design and actual.
n. Secondary water pressure drop, design and actual.

8. Cooling Coil Data:

a. Identification number.
b. Location.
c. Service.
d. Manufacturer.
e. Air flow, design, and actual.

f. Entering air DB temperature, design and actual.
g. Entering air WB temperature, design and actual.
h. Leaving air DB temperature, design and actual.
i. Leaving air WB temperature, design and actual.
j. Water flow, design, and actual.
k. Water pressure drop, design, and actual.
l. Entering water temperature, design and actual.
m. Leaving water temperature, design and actual.
n. Saturated suction temperature, design and actual.
o. Air pressure drop, design and actual.

9. Heating Coil Data:

a. Identification number.
b. Location.
c. Service.
d. Manufacturer.
e. Air flow, design, and actual.
f. Water flow, design and actual.
g. Water pressure drop, design and actual.
h. Entering water temperature, design and actual.
i. Leaving water temperature, design and actual.
j. Entering air temperature, design and actual.
k. Leaving air temperature, design and actual.
l. Air pressure drop, design and actual.

10. Air Moving Equipment:

a. Location.
b. Manufacturer.
c. Model number.
d. Serial number.
e. Arrangement / Class / Discharge.
f. Air flow - specified and actual.
g. Return air flow - specified and actual.
h. Outside air flow - specified and actual.
i. Total static pressure (total external) - specified and actual.
j. Inlet pressure.
k. Discharge pressure.
l. Sheave Make /Size / Bore.
m. Number of Belts / Make / Size.
n. Fan RPM.

11. Outside Air Data:

a. Identification/Location.
b. Design air flow.
c. Actual air flow.
d. Design return air flow.
e. Actual return air flow.
f. Design outside air flow.

g. Actual outside air flow.
h. Return air temperature.
i. Outside air temperature.
j. Required mixed air temperature.
k. Actual mixed air temperature.
l. Design outside/return air ratio.
m. Actual outside/return air ratio.

12. Exhaust Fan Data:

a. Location.
b. Manufacturer.
c. Model number.
d. Serial number.
e. Air Flow – specified and actual.
f. Total static pressure (total external), specified and actual.
g. Inlet pressure.
h. Discharge pressure.
i. Sheave Make / Size/ Bore.
j. Number of Belts / Make / Size.
k. Fan RPM.

13. Duct Traverse:

a. System zone / branch.
b. Duct size.
c. Area.
d. Design velocity.
e. Design air flow.
f. Test velocity.
g. Test air flow.
h. Duct static pressure.
i. Air temperature.
j. Air correction factor.

14. Duct Leak Test:

a. Description of ductwork under test.
b. Duct design operating pressure.
c. Duct design test static pressure.
d. Duct capacity, air flow.
e. Maximum allowable leakage duct capacity times leak factor.
f. Test apparatus:

1) Blower.
2) Orifice, tube size.
3) Orifice size.
4) Calibrated.

g. Test static pressure.
h. Test orifice differential pressure.

i. Leakage.

15. Air Monitoring Station Data:

    a. Identification/location.
    b. System.
    c. Size.
    d. Area.
    e. Design velocity.
    f. Design air flow.
    g. Test velocity.
    h. Test air flow.

16. Flow Measuring Station:

    a. Identification/number.
    b. Location.
    c. Size.
    d. Manufacturer.
    e. Model number.
    f. Serial number.
    g. Design flow rate.
    h. Design pressure drop.
    i. Actual / final pressure drop.
    j. Actual / final flow rate.
    k. Station calibrated setting.

END OF SECTION 230593

SECTION 230700 - INSULATION

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Work required under this section consists of insulation for piping and duct system and equipment specified in Division 23.

B. Provide all necessary labor, materials, tools, and equipment to perform work required on the drawings and specified herein.

C. All pipe fittings, valves, and strainers to be insulated.

D. Certain equipment and/or systems to be factory insulated by manufacturer. Factory insulation materials to be as specified in applicable sections of the specifications.

1.2 DEFINITIONS

A. Thermal resistance “R” values are expressed in units of “Hour-Degrees F-sq. ft./Btu per inch of Thickness” on a flat surface at a mean temperature of 75 degrees F unless noted otherwise.

B. Thermal conductivity (K), the reciprocal of "R", btu per inch thickness/hr/ft2/degree.

C. Insulation to consist of insulating material, jacket, mastic, and adhesive, either as a “system” or as an individual component when used separately.

1.3 QUALITY ASSURANCE / CERTIFICATION

A. Unless noted otherwise, all insulation, adhesives, coatings, sealers, and tapes to have a flamespread rating of 25 or less and smoke development of 50 or less when tested in accordance with ASTM E-84, NFPA 225 AND UL 723.

B. Apply insulation in a workmanlike manner using experienced, qualified tradesmen.

C. Do not apply insulation until all pressure testing has been completed, inspected, and released or insulation application.

D. Clean and dry surfaces prior to insulation application.

E. Butt insulation joints firmly together; smoothly and securely install all jackets and tapes.

F. Insulation jacket for duct, pipe, and equipment exposed to weather to be certified as self-extinguishing in less than 53 seconds when tested in accordance with ASTM D1692.

G. Certify that all duct and piping insulation meets the minimum requirements of the current State Energy Code for New Building Construction.

PART 2 - PRODUCTS

2.1 MATERIALS FOR PIPE AND EQUIPMENT

A. Provide factory premolded or shop mitered segment type insulation for pipe, fittings, and valves, unless otherwise noted.

B. Fitting insulation to be of same thickness and material as adjoining pipe insulation.

C. Cellular Glass (Foamglass):

1. Product to be guaranteed by manufacturer to have continuous operational temperature limit of not less than 90 degrees F and minimum “R” value of 2.63.
2. Provide Pittsburgh Corning “Foamglass” noncombustible factory-molded material.
3. Provide factory applied pre-sized glass cloth jacket having an inside vapor barrier and white exterior color equivalent to Johns-Manville “Flame-Safe type “GVB”.
4. Provide for the following services:

    a. Under pipe saddles where compressible piping insulation is used (Fiberglass, flexible elastomeric).
    b. At all penetrations of rated walls and floors with insulated piping services.

D. Flexible Elastomeric:

1. Provide AP Armaflex manufactured by Armstrong or equivalent.
2. Provide 2-pound density, fire-retardant polyolefin, flexible type insulation, pre-formed tubular for piping and sheet for equipment.
3. Maximum water vapor transmission rate of 0.03 perms per inch and UV stabilized with a guaranteed outdoor life of 10 years.
4. Product to have continuous operational temperature limit of not less than 210 degrees F and a minimum “R” value of 3.71.
5. Provide white, self-seal Armaflex 2000 manufactured by Armstrong for 1/2-inch application thickness.
6. Provide insulation for the following services:

    a. Copper or steel moisture condensate drains: 1/2-inch thick.
    b. Pump casings below 60o service: 1-1/2” thick.
    c. Run-outs to terminal units and split systems: 1-1/2" thick.

E. Glass Fiber:

1. Provide factory-formed, factory-jacketed “system” type fiberglass insulation.
2. Jacket to be fiberglass reinforced, white kraft paper with aluminum foil vapor barrier.
3. Insulation density to be not less than 3.5 pounds per cubic foot.
4. Product to have continuous operational temperature limit of no less than 650 degrees F and a minimum “R” value of 4.00.
5. Product to be equivalent to Manville “Micro-Lok 650” with Type AP jacketing. Applicable products manufactured by Certainteed, Knauf, Owens Corning or Blue Trymer 2000 are acceptable.
6. Provide insulation for following services:

a. Heating hot water and low-pressure steam piping.

1) 1-1/2-inch diameter and smaller hot water and steam piping: 1-1/2" thick.
2) Above 1-1/2-inch hot water piping: 2" thick.
3) Above 1-1/2-inch steam piping: 3” thick.

b. Domestic cold water make-up piping (inside building): 1/2- inch thick
c. Tanks: 2”.

F. Rigid Foam Insulation:

1. Insulation shall be polyisocyanurate foam or Styrafoam with a K value (90 days aged) of .20 at a mean temperature of 75 degrees F. Density shall be 2#/cu. ft., flame spread less than 30 and smoke density less than 150 in 4” thickness. Insulation shall not be used in plenums. All joints and seams shall be neatly sealed in place with Foster 95-50 vapor barrier adhesive.
2. Valves and fittings shall be insulated with same material and to the same thickness as adjoining pipe. When insulating flanges and valve bodies, insulation shall extend a minimum of 1" beyond the end of the flange bolts and the bolt area shall be filled with fiberglass before molded insulation is applied.
3. Fill small voids with approved sealer before finish is applied.
4. Provide a one-piece Zeston type fitting jacket as recommended by the manufacturer for the applicable design conditions.
5. Clean and apply bitumen coating prior to applying rigid foam insulation.
6. Apply on:

a. Chilled Water piping: 1.5” thick.
b. Chilled water specialties, except those insulated with flexible foam: 1.5" thick.
c. Condenser Water Piping (Outside, above ground): 1.5" thick.
d. Make-up water and drain piping subject to freezing at cooling tower: 1.5” thick.

2.2 MATERIALS FOR DUCTS

A. Blanket Type Insulation:

1. Provide minimum 1 pound per cubic foot density, flexible, factory reinforced glass fiber blanket with foil-faced, glass-fiber reinforced kraft vapor barrier jacket. Provide 1.5 pcf with vinyl jacket where noted.
2. Insulation to have a minimum installed “R” value of 3.92.
3. Product to be manufactured by Manville, or equivalent by Certainteed, Knoff, or Owens-Corning.
4. Provide glass fiber blanket insulation for the following:

a. Unlined hot air or cold air supply ducts concealed from view (except where noted otherwise): 2 inch thick.

B. Glass fiber Board Type Insulation:

1. Provide minimum 3 pound per cubic foot density semi-rigid insulation with factory applied reinforced foil faced kraft vapor barrier glass fiber board "system" type insulation.
2. Insulating board to have a minimum "R" value of 4.34.
3. Product to be manufactured by Manville, or equivalent by Certainteed, Knoff, or Owens Corning.
4. Provide glass fiber board insulation for the following:

    a. Ducts within equipment rooms and exposed to view: 1-1/2 inch thick.
    b. Ductwork located outside of building or outside of building insulation system: 2-inch thick.
    c. Unlined apparatus casing: 1-1/2 inch thick.

C. Exhaust ductwork shall not be insulated.

2.3 ELECTRICAL HEAT TAPE

A. Furnish and install electrical, self-regulating heat tape at locations indicated on drawings.

B. Unless otherwise noted, provide the following minimum heat densities:

1. Outdoor condenser water piping (including centrifugal separator piping): 5 watts per linear foot.
2. Outdoor chilled water, hot water, and domestic cold water makeup piping: 5 watts per linear foot.
3. Outdoor cooling tower drain piping: 5 watts per linear foot.

C. Install heat tape underneath insulation and jackets specified in this section.

D. Provide ambient air sensing thermostat to switch the heat tape off when ambient conditions rise above setpoint. Provide one thermostat for each circuit.

2.4 MATERIALS FOR FITTINGS AND VALVES

A. Premolded or mitered and fitted insulation and one-piece PVC insulated fitting covers.

B. Provide factory pre-molded one-piece PVC insulated fitting covers, precut insulation inserts and installation materials for the following services.

1. All pipe fittings and valves.
2. All grooved coupling installations.

C. Materials to be equal to Foster Seaglass PVC fitting cover, UNI-Fit inserts and accessories, or equivalent by Molded Acoustical Products, Inc., Hamfab, Zeston division of Mansfield; or Armstrong Products.

2.5 COATINGS, FINISHES, AND JACKETS

A. Piping and Equipment:

1. Prior to application of all pipe insulation, pipe surfaces shall be cleaned of rust and debris and painted. Prior to starting painting, Engineer and/or CM shall approve pipe when cleaned and painted.
2. All chill water piping and all piping in Mechanical Rooms shall be painted with one coat of rust proof paint after cleaning and prior to application of insulation. Paint on hot water, steam and condensate piping shall be high temperature.
3. For pipe, fittings, and valves through 1-1/2-inch size in systems exposed-to-view inside building or in equipment rooms, finish to be PVC factory jacket.
4. For tanks, heat exchangers, insulated equipment and pipes 2" and larger in systems exposed inside building or in equipment rooms, cover insulation with one layer of 8 oz. canvas and finish with fire retardant logging adhesive ready for painting.
5. Fitting Jackets: Inside use PVC molded one-piece or matching 2-piece jacket:

    a. Hot surfaces; apply with stainless steel tacks or staples.
    b. Cold surface; use 2" wide, 10 mil vinyl tape furnished by manufacturer of jacket. Where vapor barrier is required, apply tape to jacket and vapor barrier on pipe before canvas is applied.

6. For any service when above grade and exposed to the weather outside building, cover pipe insulation with 0.016-inch-thick aluminum jacket.
7. Do not insulate valves in systems operating above 60 degrees F. Paint valves with a rust-resistant product equivalent to Rustoleum.
8. For flexible tubular elastomeric pipe and fitting insulation when exposed-to-view inside building or exposed to the weather, finish with two coats of fire-retardant self-extinguishing vinyl lacquer type flexible coating equivalent to Armstrong “Armaflex Finish”.

B. Ducts

1. In Equipment Rooms and where exposed to view: 8 oz canvas treated with fire retardant lagging adhesive. Seal joints and seams with 3" aluminum tape. Reinforce corners.

PART 3 - EXECUTION

3.1 GENERAL

A. All surfaces to be clean and dry (and painted where noted above) when covering is applied. Covering to be dry when installed and during application of any finish.

B. All adhesives, cements, and mastics to be compatible with materials applied without attacking materials in either wet or dry state.

C. Insulation Exposed to view to have a well-tailored appearance.

D. Do not insulate expansion tanks or heads of hot water pumps.

E. Install all insulation in accordance with manufacturer’s instructions.

3.2 PENETRATION OF RATED WALLS, PARTITIONS, AND FLOORS

A. Do not pass pipe insulation through fire rated partitions or floors unless firestopping system is listed for insulated pipe. Stop and properly terminate insulation at each side of partition.

B. Install foamglass insulation on chilled water piping where lines pass through rated partitions.

C. Stop all duct coverings including jacket and insulation at all penetrations of rated walls. Flare-out or extend insulation jacket at least 2-inches beyond angle frames of fire dampers and seal to structure.

D. Maintain vapor barrier.

E. Install covering over damper and smoke detector access doors readily removable and identifiable.

3.3 INSTALLATION OF DUCT INSULATION

A. Install in accordance with TIMA National Insulation Standards.

B. Insulated ductwork conveying air below ambient temperature:

1. Provide insulation with vapor barrier jacket.
2. Finish with tape and vapor barrier jacket.
3. Continue insulation through walls, sleeves, hangers, and other duct penetrations.
4. Insulate entire system including fittings, joints, flanges, fire dampers, flexible connections, and expansion joints.

C. Insulated ductwork conveying air above ambient temperature:

1. Provide with or without standard vapor barrier jacket.
2. Insulate fittings and joints. Where service access is required, bevel and seal ends of insulation.

D. Blanket type insulation:

1. Apply jacketed blanket type glass fiber pulled snug to ducts but not more than 1/2-inch compression at corners.
2. Use insulation having 2-inch tab or cut insulation long enough to allow for “peel-off” of insulation from jacket to affect a minimum overlap tab of 2-inch.
3. Staple lap with flare type staples on 1-inch centers.
4. Cover standing seams, stiffeners, and braces with an insulation blanket, using 2-inch jacket lap and staple lap.
5. Cover and seal all staples and attachment pins with foster 30-35 reinforced with glass cloth or FSK tape.
6. Apply insulation with approved adhesive and weld pins at 18” o.c. on the bottom of ducts 16” or wider. Provide pins at 18” o.c. on sides of ducts 20” or more. Vertical ducts that are larger than 16” shall have weld pins on all sides. Overlap facing 3” and seal with approved adhesive or apply reinforced aluminum tape. Seal punctures and breaks with aluminum tape.

E. Jacketed Board Type Insulation:

1. Apply jacketed board type insulation to ducts using adhesive and weld pins or nylon “Stick-clip” plates having self-locking, coated metal or nylon discs.
2. If insulation is grooved for corners, pin as required to hold insulation tight to duct.
3. Seal pins and joints with Foster 30-56 reinforced with glass cloth or FSK tape.
4. Insulation shall be applied to the ductwork using approved adhesive and mechanical fasteners such as weld pins or stick clips located not less than 3” from each edge or corner of the board. Pin spacing along the duct not greater than 12” o.c. Additional fasteners used on the sides and bottom of all ducts at a maximum spacing of approximately 18” o.c. All edges and joints sealed with 5” wide aluminum vapor barrier tape applied with Foster 85-20 adhesive. All punctures in the vapor barrier facing likewise sealed.
5. Cover all joints, rips, tears, punctures, disc heads, staples, or breaks in vapor barrier jacket with 4-inch-wide woven glass fabric tape embedded in equivalent of Childers CP-82 or Benjamin-Foster No. 85-20 “Sparkfast” vapor barrier fire resistant adhesive. Pressure sensitive tape permitted if recommended by manufacturer.
6. Cover all board type insulation with 8 oz. canvas jacket applied with fire retardant logging adhesive.

F. Rigid Foam Insulation:

1. Apply with adhesive as recommended and weld pins or "Stock-clips" having self-locking metal or nylon discs.
2. Place pins 3" from edges and not more than 18" O.C.
3. Seal all joints and pin penetrations with 3" wide aluminum tape or as recommended by the manufacturer.
4. Finish insulation with 2 coats of Armaflex white paint.

3.4 INSTALLATION OF PIPE INSULATION

A. Install in accordance with TIMA National Insulation Standards.

B. Exposed Piping: Cover insulation with 8 oz canvas or factory jacket as noted above. Locate seams in least visible locations. Size canvas for painting. Paint (color as noted herein or as required by owner) canvas and PVC fitting covers.

C. Insulate entire system including fittings, valves, unions, flanges, strainers, flexible connections, pump bodies, and expansion joints.

D. Glass fiber insulated pipes conveying fluids below ambient temperature:

1. Provide vapor barrier jackets, factory-applied or field-applied. Secure with self-sealing longitudinal laps and butt strips with pressure sensitive adhesive. Secure with outward clinch expanding staples and vapor barrier mastic.
2. Insulate fittings, joints, and valves with molded insulation of like material and thickness as adjacent pipe and PVC fitting covers.

E. Glass fiber insulated pipes conveying fluids above ambient temperature:

1. Provide standard jackets, with or without vapor barrier, factory-applied or field-applied. Secure with self-sealing longitudinal laps and butt strips with pressure sensitive adhesive. Secure with outward clinch expanding staples.
2. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe. Finish with glass cloth and adhesive or PVC fitting covers.

F. Insulation above furred ceiling and in chases requires no finish beyond factory jacket.

G. Inserts and Shields:

1. Shields: Galvanized steel between pipe hangers or hanger rolls and insulation.
2. Insert location: Between support shield and piping and under the finish jacket.
3. Insert configuration: Minimum 12" inches long, of same thickness and contour as adjoining insulation; may be factory fabricated.
4. Insert material: Hydrous calcium silicate or foamglas insulation material suitable for the planned temperature range.

H. Continue insulation through walls, sleeves, pipe hangers, and other pipe penetrations. Finish at supports, protrusions, and interruptions. At fire and smoke separations, refer to Section 23 05 00.

3.5 INSTALLATION OF EQUIPMENT COVERING

A. Factory Insulated Equipment: Do not insulate, except as otherwise noted.

B. Apply insulation close to equipment by grooving, scoring, and beveling insulation. Fasten insulation to equipment with studs, pins, clips, adhesive, wires, or bands as appropriate.

C. Fill joints, cracks, seams, and depressions with bedding compound to form smooth surface. On cold equipment, use vapor barrier cement.

D. Insulated equipment containing fluids below ambient temperature: Insulate entire system.

E. Fiber glass insulated equipment containing fluids below ambient temperature: Provide vapor barrier jackets, factory-applied or field-applied. Finish with glass cloth and vapor barrier adhesive.

F. For hot equipment containing fluids 140 degrees F or less, do not insulate flanges and unions, but bevel and seal ends of insulation.

G. Fiber glass insulated equipment containing fluids above ambient temperature: Provide standard jackets, with or without vapor barrier, factory-applied or field-applied. Finish with glass cloth and adhesive.

H. Finish insulation at supports, protrusions, and interruptions.

I. Equipment in Mechanical Equipment Rooms or Finished Spaces: Finish with canvas jacket sized for finish painting.

J. Exterior Applications: Provide vapor barrier jacket or finish with glass mesh reinforced vapor barrier cement. Cover with aluminum jacket with seams located on bottom side of horizontal equipment.

K. Nameplates and ASME Stamps: Bevel and seal insulation around; do not insulate over.

L. Equipment Requiring Access for Maintenance, Repair, or Cleaning: Install insulation so it can be easily removed for inspection.

3.6 INSTALLATION OF ONE-PIECE PVC INSULATED FITTING COVERES

A. Premolded fitting covers to be precisely cut or mitered to fit or be tucked snugly into the throat of fitting and edges adjacent to pipe covering and taped to form a fully insulated pipe covering.

B. Use adhesive and/or tape specified for type of insulation to insure a thorough vapor barrier.

C. Tape ends securely to adjacent pipe covering. Tape to extend over adjacent pipe insulation with an overlap of at least 2-inch on both sides.

END OF SECTION 230700

SECTION 230923 - ENTERPRISE BUILDING AUTOMATION SYSTEM

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Building Automation System (BAS) Requirements.

1.2 REFERENCES

A. ASME MC85.1 - Terminology for Automatic Control.

B. NEMA EMC1 - Energy Management Systems Definitions.

C. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).

D. NFPA 70 - National Electrical Code.

E. NFPA 90A - Installation of Air Conditioning and Ventilation Systems, where applicable to controls and control sequences.

F. NFPA 92 – Standard for Smoke Control Systems, where applicable to controls and control sequences.

G. UL 916: Energy Management Systems.

H. UUKL 864: UL Supervised Smoke Control, where applicable to controls and control sequences.

I. ANSI/ASHRAE Standard 135, BACnet - A Data Communication Protocol for Building Automation and Control Systems.

1.3 REGULATORY REQUIREMENTS

A. The BAS shall comply with all governing codes, ordinances, and regulations, including UL, NFPA, State and local Building Code, and NEC.

B. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc.

C. All electronic equipment shall conform to the requirements of FCC Regulation, Part 15, Governing Radio Frequency Electromagnetic Interference, and be so labeled.

D. The BAS and components shall be listed by Underwriters Laboratories (UL 916) as an Energy Management System.

E. Portions of the BAS utilized for fire/smoke management controls and monitoring shall be listed by Underwriters Laboratories (UUKL 864).

1.4 RELATED WORK SPECIFIED IN OTHER SECTIONS

A. Where work specified under other Sections of these specifications connects to equipment or systems which are a part of this Section provide proper connections to such equipment including trade coordination (including commissioning specifications).

1.5 PRODUCTS FURNISHED BUT NOT INSTALLED UNDER THIS SECTION

A. Sensors and Transmitters:

1. Flow switches, etc.

1.6 PRODUCTS INSTALLED BUT NOT FURNISHED UNDER THIS SECTION

A. Fire Detection and Alarm:

1. Smoke Detectors/Fire Stats

1.7 PRODUCTS NOT FURNISHED OR INSTALLED UNDER, BUT INTEGRATED WITH THE WORK OF THIS SECTION

A. Section – General:

1. Integration Meeting: The Installer furnishing the BAS system shall meet with the Installer(s) furnishing each of the following products to coordinate details of the interface between these products and the BAS system. The Owner or his designated representative shall be invited to this meeting. Each Installer shall provide the Owner and all other Installers with details of the proposed interface including PICS for BACnet equipment, hardware and software identifiers for the interface points, network identifiers, wiring requirements, communication speeds, and required network accessories. The purpose of this meeting shall be to insure there are no unresolved issues regarding the integration of these products into the BAS system. Submittals for these products shall not be approved prior to the completion of this meeting.

B. Low-Voltage Controllers:

1. Variable frequency drives: The variable frequency drive (VFD) vendor shall furnish VFDs with an interface to the control and specified monitoring points specified. These specified points shall be the minimum acceptable interface to the VFD. The connection to these points shall be by one of the following methods: (a) Hardwired connection such as relay, 0-10VDC, or 4-20mA. (b) BACnet/IP network connection. (c) BACnet over ARCNET network connection. (d) BACnet MS/TP network connection.

C. Central Cooling Equipment:

1. Chiller controls: The chiller vendor shall furnish chillers with an interface to the control and monitoring points specified. These specified points shall be the minimum acceptable interface to the chiller. The connection to these points shall be by one of the following methods: (a) Hardwired connection such as relay, 0-10VDC, or 4-20mA. (b) BACnet/IP network connection. (c) BACnet over ARCNET network connection. (d) BACnet MS/TP network connection.

D. Central HVAC Equipment:

1. Packaged AHU or evaporative cooler controls: Unit shall be furnished configured to accept control inputs from an external building automation system controller as specified. Factory mounted safeties and other controls shall not interfere with this controller.

1.8 PRE-INSTALLATION MEETING

A. BAS contractor shall initiate a meeting two weeks following submittal date to review engineer and owner comments and to finalize the submittal. If the engineer does not feel the submittal can be approved yet, then this meeting may occur after resubmittal. The meeting shall include the owner, the engineer, and all parties directly affecting the work of this section.

B. Reference integration meeting requirements defined above.

1.9 SCOPE OF WORK

A. Furnish and install a Building Automation System (BAS) as detailed within these specifications. This system shall be provided, erected, assembled, and installed by the control system manufacturer or the manufacturer's authorized representative and utilizing technicians and mechanics regularly employed by the control manufacturer or the manufacturer's authorized representative. The Building Automation System of this defined project, as specified, will be capable of complete stand-alone operation and must include, but are not limited to the required features, options, and functions. The system shall be connected to the campus computer network. One network switch and network data connection to the campus network will be provided by others, however all other necessary equipment, connections, programming, etc. required to make the system fully functional per this specification shall be provided by the controls contractor as part of this contract.

1.10 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum five years' experience.

1. Design system software under direct supervision of a Professional Engineer experienced in design of this Work and licensed in the State of North Carolina.
2. Installer must provide a description of their quality assurance operations from contract award through final delivery. The description shall include organizational responsibilities for each department represented within the execution of this document from installers to engineers, service technicians and management.

1.11 SYSTEM DESCRIPTION

A. Automatic temperature controls field monitoring and control system using field programmable microprocessor-based units.

B. BAS is based on distributed system of fully intelligent, stand-alone controllers, operating in a multi-tasking, multi-user environment on token passing network, with central and remote

hardware, software, and interconnecting wire and conduit communicating via BACnet communication protocols or Ethernet / IP.

C. Include computer software and hardware, operator input/output devices, control units, sensors, control devices, electronic actuators as necessary for a fully functional controls system.

D. Provide operating software including central system software.

E. Provide control systems consisting of thermostats, interface equipment and other apparatus and accessories required to operate mechanical systems, and to perform functions specified.

F. Include installation and calibration, supervision, and fine-tuning necessary for complete and fully operational system.

G. The failure of any single component or network connection shall not interrupt the execution of control strategies at other operational devices.

1.12 SYSTEM PERFORMANCE

A. Performance Standards. System shall conform to the following minimum standards over network connections. Systems shall be tested using manufacturer's recommended hardware and software for operator workstation (server and browser for web-based systems).

B. Graphic Display. A graphic with 20 dynamic points shall display with current data within 10 seconds.

C. Graphic Refresh. A graphic with 20 dynamic points shall update with current data within 8 sec. and shall automatically refresh every 15 seconds.

D. Configuration and Tuning Screens. Screens used for configuring, calibrating, or tuning points, PID loops, and similar control logic shall automatically refresh within 6 seconds.

E. Object Command. Devices shall react to command of a binary object within 2 sec. Devices shall begin reacting to command of an analog object within 2 seconds.

F. Alarm Response Time. An object that goes into alarm shall be annunciated at the workstation within 45 seconds.

G. Program Execution Frequency. Custom and standard applications shall be capable of running as often as once every 5 sec. Select execution times consistent with the mechanical process under control,

H. Performance. Programmable controllers shall be able to completely execute PID control loops at a frequency adjustable down to once per second. Select execution times consistent with the mechanical process under control.

I. Multiple Alarm Annunciation. Each workstation on the network shall receive alarms within 5 sec of other workstations.

1.13 SUBMITTALS FOR REVIEW

A. BAS Contractor shall not order material or begin fabrication or field installation until receiving authorization to proceed in the form of an approved submittal. BAS Contractor shall be solely responsible for the removal and replacement of any item not approved by submittal at no cost to the Owner.

B. Proposed project team:

1. Resumes of key personnel such as leadmen, superintendent and managers. Include relevant project experience, certifications, licenses, education, role, qualifications, recent training on submitted technology and years with the firm.
2. Any substitutions from the proposed project team during the project shall be identified and approved prior to beginning of construction.

C. Product Data: When manufacturer's cutsheets apply to a product series rather than a specific product, the data specifically applicable to the project shall be highlighted or clearly indicated by other means. Each submitted piece of literature and drawing shall clearly reference the specification and/or drawing that the submittal is to cover. General catalogs shall not be accepted as cutsheets to fulfill submittal requirements. Select and show submittal quantities appropriate to scope of work. Submittal approval does not relieve Contractor of responsibility to supply sufficient quantities to complete work. Submittals shall be provided within 8 weeks of contract award. Submittals shall include:

1. Each submittal shall have a cover sheet with the following information provided: submittal ID number; date; project name, address, and title; BAS Contractor name, address, and phone number; BAS Contractor project manager, quality control manager, and project engineer names and phone numbers.
2. BAS System Hardware:

a. A complete bill of materials to be used indicating quantity, manufacturer, model number, and relevant technical data of equipment to be used.

b. Manufacturer's description and technical data such as performance curves, product specifications, and installation and maintenance instructions for items listed below and for relevant items not listed below.

1) Direct digital controllers (controller panels).
2) Transducers and transmitters.
3) Uninterruptable power supplies.
4) Sensors (including accuracy data).
5) Actuators.
6) Valves.
7) Relays and switches.
8) Control panels.
9) Power supplies.
10) Batteries.
11) Operator interface equipment.
12) Wiring.

c. Wiring diagrams and layouts for each control panel. Show termination numbers.
d. Schematic diagrams for all field sensors and controllers. Provide floor plans of all sensor locations and control hardware. Riser diagrams showing control network layout, communication protocol, and wire types.

3. Central System Hardware and Software:
    a. A complete bill of material of equipment used indicating quantity, manufacturer, model number, and relevant technical
    b. Manufacturer's description and technical data such as product specifications and installation and maintenance instructions for items listed below and for relevant items furnished under this contract not listed below
        1) Central Processing Unit (CPU) or web server.
        2) Monitors.
        3) Keyboards.
        4) Power supplies.
        5) Battery backups.
        6) Interface equipment between CPU or server and control panels.
        7) Operating System software.
        8) Operator interface software.
        9) Device configuration software.
        10) Color graphic software.
        11) Third-party software.
    c. Schematic diagrams for all control, communication, and power wiring. Provide a schematic drawing of the central system installation. Label all cables and ports with computer manufacturers' model numbers and functions. Show interface wiring to control system.
    d. Network riser diagrams of wiring between central control unit and control panels.
4. Controlled Systems:
    a. Riser diagrams showing control network layout, communication protocol, and wire types.
    b. A schematic diagram of each controlled system. The schematics shall have all control points labeled with point names shown or listed. The schematics shall graphically show the location of all control elements in the system.
    c. A schematic wiring diagram of each controlled system. Label control elements and terminals. Where a control element is also shown on control system schematic, use the same name.
    d. An instrumentation list (Bill of Materials) for each controlled system. List each control system element in a table. Show element name, type of device, manufacturer, model number, and product data sheet number.
    e. A mounting, wiring, and routing plan-view drawing. The design shall consider HVAC, electrical, and other systems' design, and elevation requirements. The drawing shall show the specific location of all concrete pads and bases and any special wall bracing for panels to accommodate this work.
    f. A complete description of the operation of the control system, including sequences of operation. The description shall include and reference a schematic diagram of the controlled system.
    g. A point list for each control system. List I/O points and software points. Indicate alarmed and trended points.

D. Provide a training agenda including course descriptions, course durations, location, and target audience. Include resume of videographer along with list of intended equipment to be used.

1.14 SUBMITTALS AT PROJECT CLOSEOUT

A. Submittal Requirement: The O&M manuals shall be submitted prior to the start of functional testing and prior to the start of any Owner's training.

B. While all requirements for hard copy submittal apply, control submittals and O&M information shall also be provided in electronic format as follows.

C. BAS contractor checkout sheets indicating calibration of each device include initial BAS reading, field measured value, calibration offset, final BAS value and final field measured value.

D. Drawings and Diagrams: Shop drawings shall be provided on electronic media as an AutoCAD or in Visio format. During the initial submittal approval process the drawings can be submitted in PDF format. All 'x reference' and font files must be provided with AutoCAD files.

E. Drawings shall include individual floor plans with controller locations with all interconnecting wiring routing including space sensors, LAN wiring, power wiring, low voltage power wiring.

F. Provide final riser diagram showing the location of all controllers.

G. Other Submittals: All other submittals shall be provided in Adobe Portable Document Format.

H. Controller databases.

I. Operation and Maintenance Materials:

1. Documents shall be provided electronically as described for electronic submittals and shall be text searchable.
2. Submit maintenance instructions, including frequency, and spare parts lists for each type of control device, control unit, and accessory.
3. Include all submittals (product data, shop drawings, control logic documentation, hardware manuals, software manuals, installation guides or manuals, maintenance instructions and spare parts lists) in maintenance manual. Only include sections for equipment and software used on this project. Do not provide entire catalog of product data with extraneous information.
4. Submit BAS User's Guides (Operating Manuals) for each controller type and for all workstation hardware and software and workstation peripherals.
5. Submit BAS advanced Programming Manuals for each controller type and for all workstation software.
6. Controls contractor shall provide Owner with all product line technical manuals and technical bulletins, to include new and upgraded products, by the same distribution channel as to dealers or branches throughout the warranty period of the project.
7. Manufacturers Certificates: For all listed and/or labeled products, provide certificate of conformance.
8. Product Warranty Certificates: Coordinate and submit manufacturers product warranty certificates covering the hardware provided once approved by PU. Provide a written one-year guarantee showing the starting and ending dates. List the local offices and the representatives to perform routine and emergency maintenance on system components.
9. Accurately record actual setpoints and settings of controls, final sequence of operation, including changes to programs made after submission and approval of shop drawings and including changes to programs made during specified testing.

10. Warranty: Submit manufacturer's warranty and ensure forms have been filled out in Owner's name and registered with manufacturer.

J. Framed Control Drawings:

1. Laminated control drawings including system control schematics, sequences of operation and panel termination drawings, shall be provided in panels and mounted in a suitable frame with a .125" Lexan polycarbonate cover for major pieces of equipment. Drawings should be of sufficient size to be easily read. Terminal unit drawings shall be in the central plant equipment panel or mechanical room panel.
2. Product Data: Submit manufacturer's technical product data for each control device, panel, and accessory furnished, indicating dimensions, capacities, performance and electrical characteristics, and material finishes. Also include installation and start-up instructions.

1.15 WARRANTY

A. Contractor shall provide all software upgrades, patches, and other manufacturer recommended upgrades through the duration of the project.

B. Contractor shall warrant all products and labor for a period of 18 months after Final Acceptance of each fiscal year package by Owner.

C. Owner reserves the right to make changes to the BAS during the warranty period. Such changes do not constitute a waiver of warranty. The Contractor shall warrant parts and installation work regardless of any such changes made by the Owner unless the Contractor provides clear and convincing evidence that a specific problem is the result of such changes to the BAS. Any disagreement between Owner and the Contractor on such matters shall be subject to resolution through the contract 'Disputes' clause.

D. During the warranty period, the Contractor shall provide maintenance services for software and hardware components as specified below, at no additional cost to Owner.

1. Maintenance services shall be provided for all devices, database systems and hardware installed with this project. Service all equipment per the manufacturer's recommendations. All devices shall be calibrated within the last month of the warranty period. A label indicating the date of calibration and initials of the technician performing calibration shall be affixed to the device at that time.
2. Emergency Service: Any malfunction, failure, or defect in any hardware component or failure of any control programming that would result in property damage or loss of comfort control shall be corrected and repaired following notification by Owner to the Contractor.
3. Response by telephone to any request for service shall be provided within one (1) hour of Owner's initial telephone request for service.
4. If the malfunction, failure, or defect is not corrected through the telephonic communication, at least one (1) hardware and software technician, trained in the system to be serviced, shall be dispatched to Owner's site within two (2) hours of Owner's initial telephone request for such services, as specified.
5. Normal Service: Any malfunction, failure, or defect in any hardware component or failure of any control programming that would not result in property damage or loss of

comfort control shall be corrected and repaired following telephonic notification by Owner to the Contractor.

6. Response by telephone to any request for service shall be provided within two (2) working hours (contractor specified 40 hr. per week normal working period) of Owner's initial telephone request for service.
7. If the malfunction, failure, or defect is not corrected through the telephonic communication, at least one (1) hardware and software technician, trained in the system to be serviced, shall be dispatched to Owner's site within three (3) working days of Owner's initial telephone request for such services, as specified.
8. Telephonic Request for Service: Contractor shall specify a maximum of three telephone numbers for the Owner to call in the event of a need for service. At least one of the lines shall be attended at any given time. Once contacted, a technician shall respond to calls within 1 hour.
9. Technical Support: Contractor shall provide technical support by telephone throughout the warranty period.
10. Preventive maintenance shall be provided throughout the warranty period in accordance with the hardware component manufacturer's requirements.

1.16 PROTECTION OF SOFTWARE RIGHTS

A. Prior to delivery of software, the Owner and the party providing the software will enter into a software license agreement with provisions for the following:

1. Limiting use of software to equipment provided under these specifications.
2. Limiting copying.
3. Preserving confidentiality.
4. Prohibiting transfer to a third party.

PART 2 - MATERIALS

2.1 MANUFACTURERS

A. Schneider Electric.

B. Johnson Controls, Inc.

C. Automated Logic.

D. Substitutions: None.

2.2 OPEN, INTEROPERABLE, INTEGRATED ARCHITECTURES

A. The intent of this specification is to provide a peer-to-peer networked, campus control system with the capability to integrate with existing ANSI/ASHRAE Standard 135-2001 BACnet, MODBUS, OPC, and other open and proprietary communication protocols in one open, interoperable system. New installations shall utilize MODBUS, BACnet, OPC or Ethernet/IP communication protocols.

B. The supplied computer software shall employ object-oriented technology (OOT) for representation of all data and control devices within the system. In addition, adherence to industry standards including ANSI / ASHRAE™ Standard 135-2001 BACnet to assure interoperability between all system components is required. For each BACnet device, the device supplier must provide a PICS document showing the installed device's compliance level. Minimum compliance is Level 3; with the ability to support data read and write functionality. Physical connection of BACnet devices shall be via Ethernet (BACnet Ethernet/IP,) and/or RS-485 (BACnet MSTP) as specified.

C. All components and controllers supplied under this Division shall be true "peer-to-peer" communicating devices. Components or controllers requiring "polling" by a host to pass data shall not be acceptable.

D. The supplied system must incorporate the ability to access all data using standard Web browsers without requiring proprietary operator interface and configuration programs. An Open Database Connectivity (ODBC) or Structured Query Language (SQL) compliant server database is required for all system database parameter storage. This data shall reside on a supplier-installed server for all database access. Systems requiring proprietary database and user interface programs shall not be acceptable.

E. A hierarchical topology is required to assure reasonable system response times and to manage the flow and sharing of data without unduly burdening the customer's internal Intranet network. Systems employing a "flat" single tiered architecture shall not be acceptable.

1. Maximum acceptable response time from any alarm occurrence (at the point of origin) to the point of annunciation shall not exceed 5 seconds for network connected user interfaces.
2. Maximum acceptable response time from any alarm occurrence (at the point of origin) to the point of annunciation shall not exceed 60 seconds for remote or dial-up connected user interfaces.

2.3 NETWORKS

A. The Local Area Network (LAN) shall be a 100 Megabits/sec Ethernet network supporting BACnet, Java, XML, HTTP, and SOAP for maximum flexibility for integration of building data with enterprise information systems and providing support for multiple Network Area Controllers (NACs), user workstations and, if specified, a local server.

B. Local area network minimum physical and media access requirements:

1. Ethernet; IEEE standard 802.3.
2. Cable: 100 Base-T, UTP-8 wire, category 5.
3. Minimum throughput; 100 Mbps.

2.4 REMOTE DATA ACCESS

A. Coordinate remote access connectivity with Owner and Engineer. The system shall support the following methods of remote access to the building data.

1. Browser-based access: A remote user using a standard browser shall be able access all control system facilities and graphics with proper password. Owner shall provide the

required server-side internet connection. The following paradigms are acceptable for browser-based access.

a. Native Internet-based user interfaces (HTML 5, Java, XML, etc.) that do not require a plug-in. The user interface must be compatible with the most current stable version of the supporting software (Java, etc.) without requiring the user to downgrade to a lesser version.
b. Terminal emulation software that works across the Internet and requires licensing and an installed program on the remote machine. Licenses shall be provided for at least 10 simultaneous remote connections.

2.5 COMMUNICATION SPEED

A. The communication speed between the controllers, LAN interface devices, and operator interface devices shall be sufficient to ensure fast system response time under any loading condition. In no case shall delay times between an event, request, or command initiation and its completion be greater than those listed herein. Contractor shall reconfigure LAN as necessary to accomplish these performance requirements.

1. 5 seconds between a Priority 1 (critical) alarm occurrence and enunciation at operator workstation.
2. 10 seconds between a Priority 2 alarm occurrence and enunciation at operator workstation.
3. 10 seconds between an operator command via an operator interface to change a setpoint and the subsequent change in the controller.
4. 5 seconds between an operator command via an operator interface to start/stop a device and the subsequent command to be received at the controller.
5. 10 seconds between a change of value or state of an input and it being updated on an operator interface.
6. 10 seconds between an operator selection of a graphic and it completely painting the screen and updating at least 10 points.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that conditioned power supply is available to the control units. Verify that field end devices and wiring are installed prior to installation proceeding.

3.2 COMMISSIONING REQUIREMENTS

A. Controls system technician responsible for onsite programming checkout shall also provide commissioning support services. Refer to commissioning specifications for additional information.

3.3 WORKMANSHIP

A. Install equipment, piping, and wiring/raceway 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 equipment in readily accessible locations as defined by Chapter 1 Article 100 Part A of the National Electrical Code (NEC).

D. Verify integrity of all wiring to ensure continuity and freedom from shorts and grounds.

E. All equipment, installation, and wiring shall comply with industry specifications and standards for performance, reliability, and compatibility and be executed in strict adherence to local codes and standard practices.

3.4 COORDINATION

A. 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. The contractor shall coordinate and resolve any incompatibility issues that arise between control products provided under this section and those provided under other sections or divisions of this specification.
2. The contractor is responsible for providing all controls described in the contract documents regardless of where within the contract documents these controls are described.
3. The contractor is responsible for the interface of control products provided by multiple suppliers regardless of where this interface is described within the contract documents.

3.5 INSTALLATION

A. HVAC Control System Wiring:

1. Routing of wiring in existing walls does not require conduit, unless required by the building code. Where used, conduit shall be EMT and the use of set screw connectors is not permitted.
2. All conduit, wiring, accessories and wiring connections required for the installation of the BAS, as herein specified, shall be provided by the BAS Contractor or his subcontractors. All wiring shall comply with the requirements of local and national electric codes, unless specified otherwise in this section.
3. All system input wiring shall be twisted shielded pair, minimum 18-gauge wire. All system analog output wiring shall be twisted shielded pair/3-wire as required, minimum 18-gauge wire. Preconfigured cables between Terminal Unit Controllers and Thermostats are acceptable, minimum 24 gauge.
4. All internal panel device wiring for binary outputs and pilot relay shall be minimum 16-gauge wire.
5. Low voltage control wiring and 24VAC can be run in the same conduit. Power wiring 120VAC and greater must be in a separate conduit.
6. Minimum control wiring conduit size ¾”.

B. Digital Controller Systems:

1. Each system will be provided with its own dedicated BAS controller or application specific controller. Mechanical systems such as AHUs, VAVs or Packaged system shall not be controlled from more than 1 application specific controller.
2. Systems that use second tier controllers as point expansion for system controllers shall only be allowed under when the I/O points are directly controlled by the CPU of the local application specific controller.

C. Input Devices:

1. All Input devices shall be installed per the manufacturer's recommendation. The contractor shall install all in-line devices such as temperature wells, pressure taps, duct smoke detectors, air flow stations, etc.

D. Output Devices:

1. All output devices shall be installed per the manufacturer's recommendation. The contractor shall install all in-line devices such as control valves, dampers, etc.

E. Install control units and other hardware in position on permanent walls where not subject to excessive vibration.

F. Install software in control units and in operator workstation. Implement all features of programs to specified requirements and appropriate to sequence of operation.

G. 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 contractor shall provide training in the use of these tools. This training will be planned for a minimum of 4 hours.
3. In addition, the contractor shall provide a qualified technician to assist in the test and balance process, until the first 20 terminal units are balanced.
4. The tools used during the test and balance process will be returned at the completion of the testing and balancing.

3.6 IDENTIFICATION OF HARDWARE AND WIRING

A. All wiring and cabling, including that within factory-fabricated panels shall be labeled at each end within 5 cm (2 in.) of termination with control system address or termination number.

B. All pneumatic tubing shall be labeled at each end within 5 cm (2 in.) of termination with a descriptive identifier.

C. Permanently label or code each point of field terminal strips to show the instrument or item served.

D. Identify control panels with minimum 1 cm (½ in.) letters on laminated plastic nameplates.

E. Identify all other control components with permanent labels. All plug-in components shall be labeled such that label removal of the component does not remove the label.

F. Identify room sensors related to terminal boxes or valves with nameplates.

G. Manufacturers' nameplates and UL or CSA labels shall be visible and legible after equipment is installed.

H. Identifiers shall match record documents.

I. Field Devices. All field devices shall be identified by a typed (not handwritten) securely attached tag label.

J. Panel Devices. All panel devices shall be identified by a typed label securely fastened to the backplane of the local control panel.

3.7 EIXISTING EQUIPMENT

A. Wiring. Interconnecting control wiring shall be removed and shall become the property of the contractor unless specifically noted or shown to be reused.

B. Local Control Panels. Remove and deliver existing control panels to Owner.

C. Repair. Unless otherwise directed, the contractor is not responsible for repair or replacement of existing energy equipment and systems, valves, dampers, or actuators. Should the contractor find existing equipment that requires maintenance, the engineer is to be notified immediately.

D. Indicator Gauges. Where these devices remain and are not removed, they must be made operational and recalibrated to ensure reasonable accuracy.

E. Room Thermostats. Remove and deliver existing room thermostats to Owner unless otherwise noted. Patch and finish holes and marks left by removal to match existing walls.

F. Electronic Sensors and Transmitters. Remove and deliver existing sensors and transmitters to Owner.

G. Controllers and Auxiliary Electronic Devices. Remove and deliver existing controllers and auxiliary electronic devices to Owner.

H. Damper Actuators, Linkages, and Appurtenances. Remove and deliver existing damper actuators, linkages, and appurtenances to Owner.

I. Control Valves. Replace existing control valves with new. Deliver removed control valves to Owner.

J. Control Compressed Air Systems. Replace existing control compressed air systems with new unless otherwise noted. Deliver removed systems to Owner.

K. Existing System Operating Schedule. Existing mechanical system may be disabled during this work.

L. The scheduling of fans through existing or temporary time clocks or control system shall be maintained throughout the DDC system installation.

M. Install control panels where shown.

N. Modify existing starter control circuits, if necessary, to provide hand-off-auto control of each controlled starter. If new starters or starter control packages are required, these shall be included as part of this contract.

O. Patch holes and finish to match existing walls.

3.8 SOFTWARE LICENSE

A. The Owner shall be the named license holder of all software associated with any and all incremental work on the project(s).

B. The owner, or his appointed agent, shall receive ownership of all job specific software configuration documentation, data files, and application-level software developed for the project. This shall include all custom, job specific software code and documentation for all configurations and programming that is generated for a given project. Any and all required Ids and passwords for access to any component or software program shall be provided to the owner.

3.9 MANUFACTURER'S FIELD SERVICES

A. Commissioning. Commissioning the BAS is a mandatory documented performance requirement of the selected BAS Contractor for all control systems detailed in this Specification and sequence of operations. Commissioning shall include verification of proper installation practices by the BAS Contractor and subcontractors under the BAS Contractor, point verification and calibration, system/sequence of operation verification with respect to specified operation, and network/workstation verification. Documentation shall be presented upon completion of each commissioning step and final completion to ensure proper operation of the BAS. Refer to the Commissioning Specification for more information.

B. Noncompliant Items:

1. The Contractor shall remove and replace, at its expense, all items that are not in compliance with the Specification requirements.

3.10 CONTROL SYSTEM CHECKOUT AND TESTING

A. Startup Testing. All testing listed in this article 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 of all 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 manufacturers' recommendations.

4. Verify that all binary output devices (relays, solenoid valves, two-position actuators and control valves, magnetic starters, etc.) operate properly and that the normal positions are correct.
5. Verify that 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 that 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.
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.

3.11 CONTROL SYSTEM DEMONSTRATION AND ACCEPTANCE

A. Demonstration:

1. Prior to acceptance, the control system shall undergo a series of performance tests to verify operation and compliance with this specification. These tests shall occur after the Contractor has completed the installation, started up the system, and performed his/her own tests.
2. The tests described in this section are to be performed in addition to the tests that the contractor performs as a necessary part of the installation, start-up, and debugging process and as specified in the "Control System Checkout and Testing" article in Part 3 of this specification. The engineer will be present to observe and review these tests. The engineer shall be notified at least 10 days in advance of the start of the testing procedures.
3. The demonstration process shall follow that approved in Part 1, "Submittals." The approved checklists and forms shall be completed for all systems as part of the demonstration.
4. The contractor shall provide at least two persons equipped with two-way communication and shall demonstrate actual field operation of each control and sensing point for all modes of operation including day, night, occupied, unoccupied, fire/smoke alarm, seasonal changeover, and power failure modes. The purpose is to demonstrate the calibration, response, and action of every point and system. Any test equipment required to prove the proper operation shall be provided by and operated by the contractor.
5. As each control input and output is checked, a log shall be completed showing the date, technician’s initials, and any corrective action taken or needed.
6. Demonstrate compliance with Part 1, "System Performance”.
7. Demonstrate compliance with sequences of operation through all modes of operation.
8. Demonstrate complete operation of operator interface.
9. Additionally, the following items shall be demonstrated:
    a. DDC loop response. The contractor shall supply trend data output in a graphical form showing the step response of each DDC loop. The test shall show the loop’s response to a change in set point, which represents a change of actuator position of

at least 25% of its full range. The sampling rate of the trend shall be from 10 seconds to 3 minutes, depending on the speed of the loop. The trend data shall show for each sample the set point, actuator position, and controlled variable values. Any loop that yields unreasonably under-damped or over-damped control shall require further tuning by the Contractor.

b. Demand limiting. The contractor shall supply a trend data output showing the action of the demand limiting algorithm. The data shall document the action on a minute-by-minute basis over at least a 30-minute period. Included in the trend shall be building kW, demand limiting set point, and the status of sheddable equipment outputs.

c. Optimum start/stop. The contractor shall supply a trend data output showing the capability of the algorithm. The change-of-value or change-of-state trends shall include the output status of all optimally started and stopped equipment, as well as temperature sensor inputs of affected areas.

d. Interface to the building fire alarm system.

e. Operational logs for each system that indicate all set points, operating points, valve positions, mode, and equipment status shall be submitted to the architect/engineer. These logs shall cover three 48-hour periods and have a sample frequency of not more than 10 minutes. The logs shall be provided in both printed and disk formats.

10. Any tests that fail to demonstrate the operation of the system shall be repeated at a later date. The contractor shall be responsible for any necessary repairs or revisions to the hardware or software to successfully complete all tests.

B. Acceptance:

1. All tests described in this specification shall have been performed to the satisfaction of both the engineer and owner prior to the acceptance of the control system as meeting the requirements of completion. Any tests that cannot be performed due to circumstances beyond the control of the contractor may be exempt from the completion requirements if stated as such in writing by the engineer. Such tests shall then be performed as part of the warranty.
2. The system shall not be accepted until all forms and checklists completed as part of the demonstration are submitted and approved as required in Part 1, "Submittals".

3.12 TRAINING

A. Provide professional video recording services to capture all training sessions.

B. Provide training for a designated staff of Owner's representatives. Training shall be provided classroom training and field training.

1. Field training shall provide operators and Owner's technical staff with facility specific details of the installation including the locations of field controllers, sequence of operations, network diagrams, etc.
2. Training shall be provided for up to 6 people.
3. Classroom training shall enable students to accomplish the following objectives.
4. Day-to-day Operators:

a. Proficiently operate the system.
b. Understand control system architecture and configuration.
c. Understand BAS system components.

d. Understand system operation, including BAS system control and optimizing routines (algorithms).
e. Operate the workstation and peripherals.
f. Log on and off the system.
g. Access graphics, point reports, and logs.
h. Adjust and change system set points, time schedules, and holiday schedules.
i. Recognize malfunctions of the system by observation of the printed copy and graphical visual signals.
j. Understand system drawings and Operation and Maintenance manual.
k. Understand the job layout and location of control components.
l. Access data from BAS controllers and ASCs.
m. Operate portable operator's terminals.

C. Advanced Operators:

1. Make and change graphics on the workstation.
2. Create, delete, and modify alarms, including annunciation and routing of these.
3. Create, delete, and modify point trend logs and graph or print these both on an ad-hoc basis and at user-definable time intervals.
4. Create, delete, and modify reports.
5. Add, remove, and modify system's physical points.
6. Create, modify, and delete programming.
7. Add panels when required.
8. Add operator interface stations.
9. Create, delete, and modify system displays, both graphical and others.
10. Perform BAS system field checkout procedures.
11. Perform BAS controller unit operation and maintenance procedures.
12. Perform workstation and peripheral operation and maintenance procedures.
13. Perform BAS system diagnostic procedures.
14. Configure hardware including PC boards, switches, communication, and I/O points.
15. Maintain, calibrate, troubleshoot, diagnose, and repair hardware.
16. Adjust, calibrate, and replace system components.

D. System Managers/Administrators:

1. Maintain software and prepare backups.
2. Interface with job-specific, third-party operator software.
3. Add new users and understand password security procedures.

E. Organize the training into sessions or modules for the three levels of operators listed above. (Day-to-Day Operators, Advanced Operators, System Managers and Administrators). Students will receive one or more of the training packages, depending on knowledge level required.

F. Provide course outline and materials according to the submittal requirements of this specification. Provide one copy of training material per student.

G. The instructor(s) shall be factory-trained and experienced in presenting this material.

H. Classroom training shall be done using a network of working controllers' representative of installed hardware.

I. Classroom training shall be held offsite within 30 miles of the Owner's site.

J. Provide training for up to 8 people for day-to-day operators and advanced operators. Provide training for up to 4 people for system managers training.

END OF SECTION 230923

SECTION 232113 - HYDRONIC PIPING

PART 1 - GENERAL

1.1 SECTION INCLUDES:

A. Pipe and pipe fittings for:

1. Heating water piping system.
2. Chilled water piping system.
3. Condenser water piping system.
4. Equipment drains and overflows.

B. Valves:

1. Gate valves.
2. Globe or angle valves.
3. Ball valves.
4. Butterfly valves.
5. Check valves.

1.2 GENERAL REQUIREMENTS

A. Where more than one piping system material is utilized, ensure system components are compatible and joined to ensure the integrity of the system is not jeopardized. Provide necessary joining fittings. Ensure flanges, union, and couplings for servicing are consistently provided.

B. Use non-conducting dielectric connections whenever jointing dissimilar metals in open systems.

C. Use unions, flanges, and couplings downstream of valves and at equipment or apparatus connections. Do not use direct welded connections to valve bodies, equipment or other apparatus.

D. Except where shown otherwise, use ball or butterfly valves for shut-off and to isolate equipment, part of systems, or vertical risers.

E. Use ball or butterfly valves for throttling, bypass, or manual flow control requirements for water systems if special valves or fittings are not indicated.

F. Use spring loaded check valves on discharge of pumps when piped in parallel.

G. Use lug type butterfly valves to isolate equipment.

H. Use 3/4-inch ball valve with cap for drains at low points of piping, bases of vertical risers, and at equipment.

I. All piping and fittings to be made in USA.

1.3 REFERENCES

A. ASME - Boiler and Pressure Vessel Codes, SEC 9 - Qualification Standard for Welding and Brazing Procedures, Welders, Brazers, and Welding and Brasing Operators.

B. ASME B16.22 - Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.

C. ASME B31.9 - Building Services Piping.

D. ASTM A53 - Pipe, Steel, Black and Hot-Dipped, Zinc coated Welded and Seamless.

E. ASTM A234 - Piping Fitting of Wrought Carbon Steel and Alloy Steel for Moderate and Elevated Temperatures.

F. ASTM B32 - Solder Metal.

G. ASTM B88 - Seamless Copper Water Tube.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Accept valves on site in shipping containers. Protect machined surfaces.

B. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.

1.5 ENVIRONMENTAL REQUIREMENTS

A. Do not install underground piping when bedding is wet or frozen.

1.6 SUBMITTAL

A. Restrained joint calculations; submit complete calculations for all underground ductile iron pipe joints indicating the requirements for restrained and push-type joints. Unless submitted, all joints shall be restrained type. Submission of output data from an approved vendor computer selection/calculation program will be required to justify the use of push-type joints in certain locations. This program shall utilize the depth of cover of a minimum of 3 feet, the specified test pressure for the system, a 1.5 safety factor and ANSI/AWWA C150/A21.50 Type 4 laying condition.

PART 2 - PRODUCTS

2.1 REQUIREMENTS:

A. All piping material shall be manufactured in the USA.

2.2 HEATING WATER, CHILLED WATER, ABOVE GROUND

A. Steel Pipe: ASTM A53, Schedule 40, (0.375-inch (10 mm) wall for sizes 2-1/2 inch (300 mm) and over,) black.

1. Fittings: ASTM B16.3, malleable iron or ASTM A234, forged steel welding typed fittings.
2. Joints: Threaded or welded.

B. Copper Tubing: ASTM B88, Type L hard drawn for pipe sizes 2" and smaller.

1. Fittings: ASME B16.18, cast brass, or ASME B16.22, solder, wrought copper.
2. Joints: Solder, lead free 95-5 tin-antimony, or tin and silver, with melting range 430 to 535 degrees F.

2.3 HEATING WATER, CHILLED WATER, BURIED

A. Pre-Insulated Carrier Steel Pipe suitable for use in Chilled and Heating Hot Water: ASTM A53, Schedule 40, black.

1. Fittings: ASTM B16.3, malleable iron or ASTM A234, forged steel welding typed fittings. All fittings to be factory pre-insulated.
2. Joints: Butt welded for line sizes 2 ½" and larger.
3. Pre-insulated system with 2" closed cell polyurethane insulation minimum, covered with HDPE seamless insulating jacket.

2.4 CONDENSER WATER PIPING, ABOVE GROUND INSIDE OR OUTSIDE BUILDING

A. Steel Pipe: ASTM A53, Schedule 40, black.

1. Fittings: ASTM B16.3, malleable iron or ASTM A234, forged steel welding typed fittings.
2. Joints: Threaded or welded.

2.5 CONDENSER WATER PIPING, BURIED

A. Ductile Iron Pipe: The pipe and fittings shall be suitable for a minimum working pressure of 150 psi, ANSI C151/A21.51, with asphalt coating and cement mortar lining ANSI/AWWA C104/A21.4.

B. Fittings shall be ductile iron mechanical joint type manufactured in accordance with ANSI/AWWA C110/A21-10, rated for 150 psi working pressure. Straight pipe joints and fittings to be a combination of push-type and restrained joint-type. Joints and fittings shall be flexible and shall be designed to provide positive restraint against end-wise separation due to thrust.

C. Push type joints shall be equal to American Fastite joint or U.S. Pipe Tyton joint, ANSI/AWWA C111/A21.11, tapered bell opening, 5 degrees lateral offset capability. Gasket material shall be SBR with two hardness: 85 durometer hardness for smaller end of gasket and 65 durometer hardness for larger end of gasket.

D. Restrained type joint fittings shall be equal to EBBA Iron Series 1100 Megalug restraint systems for mechanical joint ductile iron piping, fittings, and valves. Gasket material shall be SBR.

2.6 EQUIPMENT DRAINS AND OVERFLOWS

A. Drains:

1. Copper tubing, ASTM B-88, Type L hard drawn.

a. Fittings: ASME B16.18, cast brass, or ASME B16.22, solder wrought copper.
b. Joints: Solder, lead free 95-5 tin-antimony, or tin and silver, with melting range 430 to 535 degrees F.

2.7 UNIONS, FLANGES, AND COUPLING

A. Union for Pipe 2 inches and Under:

1. Ferrous Piping: 150 psig malleable iron, threaded.
2. Copper Pipe: Bronze, soldered joints.

B. Flanges for Pipe Over 2 inches:

1. Ferrous Piping: 150 psig forged steel, slip-on.
2. Copper Piping: Bronze.
3. Gaskets: 1/16-inch-thick preformed neoprene.

2.8 VALVES

A. Furnish and install all valves as called for, shown on drawings or as required for proper operation and servicing of the equipment. Valves shall be of manufacturer as noted or equivalent.

B. Butterfly valves; “bubble tight” at 150 psi and 200 degrees. Construction shall be:

1. Body - Ductile Iron.
2. Seat - E.P.D.M.
3. Disc - Ductile iron or aluminum-bronze.
4. Stem - 304, 316 or 17-4PH S.S.
5. Hammond 6000 Series, Victaulic, Nibco LD-1000 or equivalent.
6. Provide 9” lever handle with infinitely adjustable throttling plate with lock nut and memory stop. Valves in insulated piping shall have 2” extended neck. VALVES 8” and larger; screw or gear operator. All butterfly valves shall be “lug” type for bolting to a standard flange.

C. Ball Valves - 600# W.O.G., 3-piece, full port:

1. Body – Bronze.
2. Seat – Teflon.
3. Ball - 304 or 316 stainless steel.

4. Stem - 304 or 316 stainless steel.
5. O-Ring - Viton or Teflon.
6. Hammond 8303, Victaulic, Nibco 595-Y-66 or equivalent.
7. Valves in insulated piping; 2" extended neck.

D. Globe valves 0-2" - 300# Bronze, Rising Stem:

1. Body – Bronze.
2. Stem - Silicon Bronze.
3. Disc – Bronze.
4. Handwheel - Malleable iron.
5. Packing - Teflon impregnated, asbestos-free.
6. Hammond IB412, Nibco T-275 or equivalent.

E. Globe valves over 2" - 125# O.S.&Y, Rising Stem:

1. Body – Iron.
2. Stem - Brass or Bronze.
3. Disc – Bronze.
4. Seat Ring – Bronze.
5. Yoke Bushing – Bronze.
6. Packing - Teflon impregnated, asbestos-free.
7. Hammond IR116, Nibco F-718-B or equivalent.

F. Swing Check Valves 0 - 2" - 150# bronze:

1. Body – Bronze.
2. Disc – Bronze.
3. Hammond IB 904, Nibco T-433 or Victaulic equivalent.

G. Swing Check Valves 2" and over - 125# iron:

1. Body – Iron.
2. Disc – Bronze.
3. Seat ring – Bronze.
4. Hammond IR1124, Nibco F-918 or Victaulic equivalent.

H. Non-slam check valves:

1. Body – Iron.
2. Disc – Bronze.
3. Seat – Bronze.
4. Spring - Stainless Steel.
5. Mueller No. 105, Williams-Hagen, Victaulic or equivalent.

PART 3 - EXECUTION

3.1 PREPARATION

A. Ream pipe and tube ends. Remove burrs.

B. Remove scale and dirt on inside and outside before assembly.

C. Make piping connections to equipment with flanges or unions.

D. Keep open ends of pipe free from scale and dirt. Protect open ends with temporary plugs or caps.

E. After completion, fill, clean, and treat systems. Refer to Section 232500.

3.2 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. All chilled, hot, and condenser water piping shall be hydrostatically tested for pressure of 1-1/2 times the working pressure of the line, but not less than 150 psig for a minimum period of 24 hours. This hydrostatic test shall be witnessed by the Engineer.

C. Route piping in orderly manner, parallel to building structure, and maintain gradient.

D. Install piping to conserve building space, and not interfere with use of space and other trades.

E. Group piping whenever practical at common elevations.

F. Sleeve pipe passing through masonry partitions, walls, and floors.

G. Slope piping and arrange to drain at low points.

H. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.

I. Inserts:

1. Provide inserts for placement in concrete formwork.
2. Where concrete slabs form finished ceiling, locate inserts flush with slab surface.
3. Where inserts are omitted, drill concrete slab from below and provide expansion anchor or use an appropriate powder driven stud where permitted.

J. Pipe Hangers and Supports:

1. Install in accordance with ASTM B31.9.
2. Support horizontal piping as scheduled.
3. Install hangers to provide minimum 1/2-inch space between finished covering and adjacent work.
4. Place hangers within 30 inches of each horizontal elbow or tee.
5. Use hangers with 1-1/2-inch minimum vertical adjustment. Arrange hangers for pipe movement without disengagement of supported pipe.
6. Support vertical piping at every other floor. Support riser piping independently of connected horizontal piping.
7. Where several pipes can be installed insulated parallel and at same elevation, provide trapeze hangers.

8. Prime coat exposed steel hangers and supports and prepare for finish painting. Hangers and supports located in crawl spaces, pipe shafts, and suspended ceiling spaces are not considered exposed.

K. Provide clearance in hangers and from structure and other equipment for installation of insulation and access to valves and fittings.

L. Provide access where valves and fittings are not exposed.

M. Slope piping and arrange system to drain at low points. Use eccentric reducers to maintain proper grade.

N. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welds.

O. Install valves with stems upright or horizontal, not inverted.

P. Pipe Joints: Unless otherwise specified, join pipes as follows:

1. Steel pipe 2-1/2" to 4", screwed or welded joints.
2. Steel pipe 4" and larger, welded, or flanged joints.
3. For welded joints, use only welding type fittings and welding neck flanges with the following exception:

    a. "Weldolet" or "Threadolet" type of welding fittings for intersection welding of small branches to mains may be used where branch is two-pipe sizes smaller than the main.

Q. Do not make direct welded connections to valves, expansion joints, strainers, apparatus, or any other units which are intended to be removable.

R. Copper tube, Type "K" and "L" shall have soldered joints with sweat joint type bronze or copper fittings up through 1-1/2” size. Fitting sizes 2” and larger shall be brazed joints. Flared joints with flare type bronze fittings may be used where approved for specific service.

S. For screwed joints, use Teflon tape or approved pipe joint compound; apply only on male threads.

T. For buried water piping provide buried utility warning and identification tape. Polyethylene plastic tape manufactured specifically for warning and identifying buried utility lines shall be supplied and installed. Tape shall be buried above the pipe during the trench backfilling operation and shall be buried approximately 12” below grade. Tape shall be (0.004-inch-thick polyethylene) (polyethylene with a metallic core). Tape shall be 6” wide and printed with a caution and identification of the piping system over the entire tape length. Tape shall be yellow with bold black letters. Tape color and lettering shall be unaffected by moisture and other substances contained in the backfill materials.

3.3 SCHEDULES

A. Pipe Hanger Spacing:

Pipe Size **Inches**	Max Hanger Spacing **Feet**	Diameter **Inches**
1/2 to 1-1/4	6.5	3/8
1-1/2 to 2	10	3/8
2-1/2 to 3	10	1/2
4 to 6	10	5/8
8 to 12	12	7/8
14 and Over	12	1
Non-metallic (All Sizes)	6	3/8

END OF SECTION 232113

SECTION 232116 - HYDRONIC SPECIALTIES

PART 1 - GENERAL

1.1 SECTION INCLUDES:

A. Expansion tanks.

B. Air vents.

C. Air separators.

D. Glycol Make-up Unit (GMU).

E. Strainers.

F. Pump suction fittings.

G. Flow indicators, controls, meters.

H. Pressure Reducing valves.

I. Relief valves.

J. Flexible coupling.

1.2 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing the products specified in this section with minimum three years' experience.

1.3 DELIVERY, STORAGE, AND HANDLING

A. Accept valves on site in shipping containers with labeling in place. Inspect for damage.

B. Provide temporary protective coating on cast iron and steel valves.

C. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.

D. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.

PART 2 - PRODUCTS

2.1 EXPANSION TANKS

A. Construction: System Connection – Forged Steel, Shell – Carbon Steel, Bladder – Heavy Duty Butyl Rubber, Designed and constructed per ASME section VIII, Division I. The tank shall be fitted with lifting rings and a floor mounted skirt for vertical installation.

B. Provide pre-charged steel expansion tank with replaceable heavy duty Butyl rubber bladder/diaphragm.

C. Provide charging valve to facilitate on-site charging of the tank to meet system requirements. Charge bladder tanks to minimum fill pressure as shown on plans.

2.2 AIR VENTS

A. Manual Type: Short vertical sections of 2-inch diameter pipe to form air chamber, with one-piece, 1/4" ball valve at top of chamber.

2.3 AIR SEPARATORS

A. Combination Air Separators/Strainers:

1. Steel, tested and stamped in accordance with ASME SEC 8-D for 1125 psig operating pressure, with integral bronze strainer, tangential inlet and outlet connections, and internal stainless steel air collector tube.

2.4 GLYCOL MAKE-UP UNIT (GMU)

A. Glycol Make-up Unit (GMU):

1. Provide as shown on the plans and as described in these specifications: provide a packaged, automatic 25% propylene glycol solution make-up unit model GMU-30 as manufactured by ITT Bell & Gossett or approved equal by Taco or Armstrong. The package shall consist of a base, 55-gallon polyethylene reservoir with removable lid, visible solution level scale in gallons and liters, y-strainer, isolation valve, pump, open drip-proof motor, pump isolation, check and balance valve, expansion tank, discharge pressure gage, motor contactor and control circuit in a NEMA 4 panel, and necessary interconnecting piping.
2. Green light shall indicate power supplied to unit. Pump shall start based on falling pressure. System shall require a 115/1/60 single power connection and a ¾” NPT system piping connection. GMU shall provide 10 GPM and maintain a fill pressure of 30 PSI. Unit includes low level cutout, with red indicator light and 110V contact for alarm indication, to stop the pump during low level condition. Mechanical contractor shall provide application specific pressure reducing valve between GMU and connection to the system piping.

2.5 STRAINERS

A. Size 2 inch and Under:

1. Screwed brass or iron body for 175 psig working pressure, Y pattern with 1/32-inch stainless steel perforated screen.

B. Size 2-1/2 inch to 4 inch:

1. Flanged iron body for 175 psig working pressure, basket pattern with 1/8 in stainless steel perforated screen.

2.6 PUMP SUCTION FITTINGS

A. Fitting: Angle pattern, cast-iron body, threaded for 2 inch and smaller, flanged for 2-1/2 inch and larger, rated for 175 psig working pressure, with inlet vanes, cylinder strainer with 3/16-inch diameter openings, disposable fine mesh strainer to fit over cylinder strainer, and permanent magnet located in flow stream and removable for cleaning.

B. Accessories: Adjustable foot support, blowdown tapping in bottom, gage tapping inside.

2.7 AUTOMATIC FLOW CONTROLS

A. Automatic Flow Control Valves: Automatic flow control valve cartridges shall automatically control flow rates with +/- 5% accuracy over an operating pressure differential range of at least 14 times the minimum required for control. Valve internal control mechanism shall consist of a stainless-steel one-piece cartridge with segmented port design and full travel linear coil spring. Manufacturer shall be able to provide certified independent laboratory tests verifying accuracy of performance. All flow control valve cartridges shall be warranted by the manufacturer for five years Meter kit shall be provided as a single hose portable or double hose portable kit; pressure gauge with 4.5” dial shall have a range of –14.7 to 150 psig. Kit shall have end connections for either pressure or pressure/temperature test valves and shall include carrying cases. All kits shall include flow rate chart for determining flow rate.

2.8 COMBINATION BALANCING FITTING (WITH FLOW READ OUT)

A. Manufacturers:

1. Bell & Gossett.
2. Taco.
3. Armstrong.

B. Construction: Bronze body/brass ball construction with glass and carbon filled TFE seat rings.

C. Functions: 1/4” Pressure/temperature readout ports.

1. Flow measurement.
2. Flow balancing.
3. Positive shut-off.
4. Drain port.

D. Control Mechanism: Calibrated ball valve with hand wheel indicating balance positions and memory stop.

E. Working Pressure: 200 PSI.

2.9 PRESSURE REDUCING VALVE

A. Iron body, low inlet pressure check valve, removable strainer. 125 psi working pressure.

2.10 RELIEF VALVES

A. Bronze body, Teflon seat, stainless steel stem and springs, automatic, direct pressure actuated, capacities ASME certified and labeled.

2.11 FLEXIBLE COUPLINGS & VIBRATION ISOLATION

A. Rotating and reciprocating equipment provided with suitable vibration isolating system. Isolation for all equipment above the ground floor designed for at least 95% absorption efficiency. Select isolators for proper loading to obtain desired efficiency.

B. Provide flexible duct connections at inlet and outlet of all fans or cabinets containing fans.

C. Piping connections to pieces of equipment containing rotating or reciprocating machinery (except inline pumps) provided with isolators to prevent transmission of vibration or noise to building structure. Water lines shall be provided with flexible Teflon coupling designed for service and operating pressure. Flexible metal hose shall be of approved design. Where such flexible connections do no accomplish full desired result, piping shall be suspended by means of properly loaded and distributed vibration eliminators design for support rods.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install specialties in accordance with manufacturer’s instructions.

B. Where large air quantities can accumulate, provide enlarged air collection standpipes.

C. Provide manual air vents at system high points and as indicated.

D. Provide air separator on suction side of system pumps and connect to expansion tank.

E. Provide valved drain and hose connection on strainer blow down connection.

F. Provide pump suction fitting on suction side of base mounted centrifugal pumps. Remove temporary strainers after cleaning systems.

G. Provide combination pump discharge valve on discharge side of base mounted centrifugal pumps.

H. Provide relief valves on pressure tanks, low pressure side of reducing valves, heat exchangers, and expansion tanks.

I. Select equipment relief valve capacity to exceed rating of connected equipment.

J. Pipe relief valve outlet to nearest floor drain.

END OF SECTION 232116

SECTION 232123 - PUMPS

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Furnish and install centrifugal type pumps with the following characteristics:

1. End Suction.
2. Suctions pumps.
3. Flexible coupled.
4. Bronze fitted.
5. Non-overloading.
6. Singe stage.
7. Drive by single-speed, squirrel-cage motors, suitable for VFD control.

1.2 QUALITY ASSURANCE

A. Pump manufacturer accepts responsibility for performance and operation at specified conditions and compatibility of components consisting of pump, motor, coupling, and base plate.

B. Motor HP indicated on schedule to allow non-overloading operation of pump.

C. Pumps requiring larger motors are not acceptable.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Bell & Gossett.

B. Armstrong.

C. Taco.

2.2 BASE MOUNTED PUMPS

A. Flexible coupled connected as scheduled. Designed to back pull-out. Flexible connected pumps to have rigid base.

B. Non-overloading, centrifugal, end suction type with casings design for a working pressure of not less than 125# per sq. in. or 1-1/2 times the actual discharge pressure (Pump head plus static head) whichever is greater. Pressure classification of flange connection shall correspond to casing working pressure. High points of pump casing provided with air vent cocks. Where

pumps are insulated extend vent cocks outside insulation. Coupling guard for flexible connected pumps.

C. Impeller shall be cut to provide capacities called for in schedules.

D. Fully bronze fitted with enclosed impeller, dynamically balanced. Bronze wear ring or impeller runner provided on the suction side of the impeller.

E. Shaft shall be stainless steel or carbon steel with bronze sleeve extending through seal assembly.

F. Ball or roller bearings with ample oil reservoirs. Bearing effectively sealed to prevent loss of lubricant and entrance of dirt or water.

G. Mechanical seals or packing gland seal as noted in the schedule.

H. Integral horsepower motors to have double shielded, deep-groove, grease lubricated bearings. Motor sized not to overload at any point within range of impeller and piping system.

I. Cast iron or steel base for flexible connected pumps. Base to have a raised lip and drain tapping or bearing brackets to have integral drip pockets with drain tapping. Coupling shall impose no restriction on normal end play or expansion.

J. Set on concrete foundation pads at least 4" high.

2.3 DOUBLE SUCTION PUMPS

A. Horizontal or vertical split case with horizontal or vertical flange connection as shown.

B. Carbon/ceramic seal or stuffing box as called for.

C. Grease lubricated ball or roller bearings.

D. Pump casing, Class 30 cast iron, 125 psi flanges.

E. Impeller; enclosed, double suction, bronze.

F. Shaft; 18-8 stainless steel.

G. Flexible coupling, drop-out design, with guard.

H. Pump and motor mounted on welded steel or cast-iron base. Factory aligned and tested.

2.4 CENTRIFUGAL VERTICAL IN-LINE PUMPS

A. Provide Vertical In-Line pumps, single stage, single or double suction type, with pump characteristics which provide rising heads to shut off. Refer to pump schedule for pump flows, heads, motor speed, enclosure, efficiency, and power requirements.

B. Pump Casing - Cast iron for working pressure below 175 psig at 150□F (125 psig ANSI flange rating) or 1-1/2 times the actual discharge pressure (pump head plus static head) whichever is greater. Suction and Discharge connections shall be flanged and the same size and shall be drilled and tapped for seal flush and gauge connections. Pressure classification of flange connection shall correspond to casing work pressure. High points of pump casing provided with air vent cocks. Where pumps are insulated, extend vent cocks outside insulation.

C. All pumps one horsepower and large shall have impellers cut to provide capacities called for.

D. The contractor shall have the impellers trimmed to match actual flow conditions on all pumps 10 H.P. and greater after the system is balanced to minimize throttling losses per NC State Building Code Volume X current edition.

E. Fully bronzed fitted with enclosed impellers dynamically balanced. Bronze wearing ring or impeller runners provided on the suction side of the impellers.

F. Shafts stainless steel.

G. Coupling - Rigid spacer type of high tensile aluminum alloy. Couplings shall be split to allow removal from pump and motor shafts, leaving space between the shafts sufficient to replace all mechanical seal components without disturbing the pump or motor.

H. Motor sized not to overload at any point within the operating range of impeller and piping system.

I. Provide and install combination starter with circuit breaker to match motor.

2.5 MECHANICAL SEALS

A. All metal parts 304 stainless steel with Buna-N Elastomers, ceramic seat, and carbon seal ring.

B. For Split Coupled Pumps, shall be ceramic type with stationary seats. Provide factory installed flush line with manual vent.

C. Suitable for 225° F continuous operation.

2.6 NAMEPLATE

A. Provide pump and motor with stainless steel nameplate securely fastened to casing.

B. Nameplates to provide all data necessary for equipment identification and replacement.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install pumps where shown, in accordance with manufacturer's written instructions and with recognized industry practices to ensure that pumps comply with requirements and serve intended purposes. Comply with NEMA standards and requirements of NEC.

B. Provide pumps with base plates or feet carefully leveled and bolted in place on concrete pads or foundations with vibration isolation devices as specified or shown on drawings.

C. Grout bedplates with expanding type grout containing catalyzed metallic aggregate.

D. After grout has set, cut flush with bedplate and seal to prevent deterioration at edges.

E. Provide Suction Diffusers on each pump unless specifically noted otherwise.

F. Decrease from line size with long radius reducing elbows or reducers. Support piping adjacent to pump so no weight is carried on pump casings. Provide supports under elbows on pump suction and discharge line sizes 4 inches and larger.

G. Provide air cock and drain connection on horizontal pump casings. Provide drains for bases and seals.

H. Provide drains for bases and seals.

I. Manufacturer's representative and/or technician certified by the manufacturer shall be required to provide alignment of motor and pump, a laser alignment tool is required for this service. The pump and motor shall be aligned in the vertical angular, horizontal angular, vertical parallel and horizontal parallel. The alignment shall be within the recommended value by pump manufacturer but not over 0.002 (in) parallel and 0.005 (in) angular per radius inch. A printout of the alignment procedure, the pump manufacturer's alignment specifications, and the correct alignment shall be provided to the engineer.

J. The contractor shall record and submit all results of alignment procedure and the pump manufacturer's alignment specifications to the design engineer. The specifications should also require this approved submittal information is included in the O&M Manual.

END OF SECTION 232123

SECTION 233100 - DUCTWORK

PART 1 - GENERAL

1.1 PERFORMANCE REQUIREMENTS

A. Variation of duct configuration or sizes permitted for job conditions. Size ducts installed in accordance with ASHRAE table of equivalent rectangular and round ducts.

1.2 REFERENCES

A. NFPA 90A - Installations of Air Conditioning and Ventilating Systems.

B. SMACNA – HVAC Air Duct Leakage Test Manual.

C. SMACNA – HVAC Duct Construction Standards – Metal and Flexible.

D. SMACNA – Fibrous Glass Duct Construction Standards.

E. UL 181 – Factory-Made Air Ducts and Connectors.

1.3 REGULATORY REQUIREMENTS

A. Construct ductwork to NFPA 90A, NFPA 96 and SMACNA standards.

1.4 EVNIRONMENTAL REQUIREMENTS

A. Do not install duct sealants or adhesives when temperatures are less than those recommended by manufacturer.

B. Maintain temperatures during and after installation of duct sealants.

1.5 SUBMITTALS

A. Product Data:

1. Provide the following information for each sealant system furnished on the Project:

a. Sealant name and type.
b. Sealant system design pressure.
c. Duct material.
d. Duct gage.
e. Transverse joint methods.
f. Longitudinal seam type.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Galvanized Steel Ducts: ASTM A623 and ASTM A623M galvanized steel sheet, lock-forming quality, having G60 zinc coating in conformance with ASTM A90.

B. Stainless Steel: ASTM A480, Type 304, sheet form, with No. 1 finish.

C. Uninsulated Flexible Ducts (Exhaust or Return):

1. Manufacturers: Flexmaster Type NI35.
2. UL-181, Class I: corrosion resistant galvanized steel helix permanently bonded to an impregnated, coated woven fiberglass cover.
3. Pressure rating: 10” positive, 4” negative.
4. Maximum velocity: 5000 fpm.
5. Operating temperature: 0° to 200°F.

D. Insulated Low Pressure Flexible Ducts:

1. Manufacturer: Flexmaster Type 8M.
2. UL-181, Class I: coated, woven glass fiber mesh liner bonded permanently to corrosion resistant, galvanized steel helix, thick glass fiber insulation and low-perm vapor barriers of glass fiber reinforced metalized laminate with 3 plg standing seam and brass grommets.
3. Pressure rating: 4” positive, 2” negative.
4. Maximum Velocity: 3500 fpm.
5. Operating Temperature: 0° to 180°F.
6. Thermal Conductance: .23 @ 75°F.

E. Insulated Medium Pressure Flexible Ducts:

1. Manufacturer: Flexmaster Type 4M.
2. UL-181, Class I: a heavy coated fiberglass cloth locked permanently to a galvanized steel helix, glass fiber insulation with fiberglass scrim on the outside; polyolefin vapor barrier jacket.
3. Pressure rating: 10” positive.
4. Maximum Velocity: 5000 fpm.
5. Operating Temperature: -20° to 200°F.
6. Thermal Conductance: .23 @ 75°F.

F. Fasteners: Rivets, bolts, or sheet metal screws; stainless steel for stainless steel ductwork.

G. Sealants:

1. Non-hardening, water resistant, fire resistive, compatible with mating materials; liquid used alone or with tape, or heavy mastic.
2. Sealant shall be water based latex UL 181A-M, B-M reinforced sealant conforming to the product specifications.

3. Sealant shall be water based latex UL 181 B-M non-reinforced sealant conforming to the product specifications.
4. All ductwork in a UL classified rolled mastic duct sealant rated tape system shall be comprised of:

    a. Rolled Mastic Sealant 2 mil foil faced with 15 mils of butyl adhesive/sealant conforming to the product specifications for UL classified sealants.
    b. Rolled Mastic Sealant 2 mil foil faced with 15 mils of modified butyl mastic/sealant meeting UL-181 BFX (pressure sensitive tapes for use with flexible air ducts) for UL listed sealants.

H. Hanger Rod: ASTM A36; steel, threaded both ends, threaded one end, or continuously threaded.

2.2

2.3 DUCTWORK FABRICATION

A. Fabricate and support in accordance with SMACNA HVAC Duct Construction Standards – Metal and Flexible, and as indicated. Provide duct material, gages, reinforcing, and sealing for operating pressures indicated. Unless noted otherwise, pressure class shall be determined by fan rating.

B. Construct T's, bends, and elbows with radius of not less than 1-1/2 times width of duct. Where not possible and where rectangular elbows are used, provide turning vanes. Where acoustical lining is indicated, provide turning vanes of perforated metal with glass fiber insulation.

C. Increase duct sizes gradually, not exceeding 15 degrees divergence wherever possible; maximum 30 degrees divergence upstream of equipment and 45 degrees convergence downstream.

D. Fabricate continuously welded round and oval duct fittings two (2) gages heavier than duct gages indicated in SMACNA Standard. Prime coat welded joints with zinc-rich paint.

E. Provide standard 45-degree lateral wye takeoffs or 90-degree conical tee connections.

F. Uninsulated panels of ducts over 12 inches wide shall be cross broken, except plenum casings, which shall be braced with angle iron as called for.

G. All ductwork must present a smooth interior and joints must be air tight.

H. Manual volume and splitter dampers to be furnished and installed where shown and where necessary for proper regulation of the air distribution. A quadrant and set screw equal to "Ventlock" #641 shall be installed for all dampers which are accessible.

I. When the system is in operation, the ductwork shall be free from rattles and air noises caused by unsecure duct construction.

J. All ductwork, low pressure supply, medium pressure supply, return, exhaust, and outside air ductwork shall be constructed to meet SMACNA seal class A.

K. Refer to section 3.3 for ductwork pressure class schedule.

2.4 MANUFACTURED DUCTWORK AND FITTINGS

A. Manufacture in accordance with SMACNA HVAC Duct Construction Standards – Metal and Flexible, and as indicated. Provide duct material, gages, reinforcing, and sealing for operating pressures indicated in paragraph 3.3.

B. Round or oval ducts upstream of terminal units shall be prefabricated spiral lock seam conduit with fabricated fittings. All ells shall be 5-piece type. Take-offs shall be formed conical “T”, or 45 degree “Y”.

C. Double wall insulated round ducts downstream of terminal boxes: Machine made from round spiral lockseam duct with light reinforcing corrugations, galvanized steel outer wall, 1” thick fiberglass insulation, perforated galvanized steel inner wall; fittings manufactured with solid inner wall.

D. Round Ducts:

1. Manufacturers:

   a. United Sheet Metal.
   b. Semco.
   c. Hamlin Sheet Metal.

2. Machine made from round spiral lockseam duct with reinforcing corrugations; fittings manufactured of at least two (2) gages heavier metal than duct.

E. Transverse Duct Connection System:

1. Manufacturers:

   a. Duct Mate.

2. SMACNA “E” rated rigid connection, interlocking angle and duct edge connection system with sealant, gasket, cleats, and corner clips.

F. Double Wall Insulated Duct:

1. Insulation (1” thick; refer to Duct Liner Insulation in Section 230700) with solid 20ga. outer liner and 22 ga. inner perforated liner tack welded to support channels. All steel surfaces, channels, and trim to be galvanized steel (G-60).
2. Inner liners shall be perforated with 3/32” holes.
3. Each panel shall be completely filled with noncombustible, mildew resistant insulation with flame spread no greater than 25 and smoke development no greater that 50. Thermal conductance no greater that 0.06 at a mean temperature of 75 deg. F.
4. Provide all structural components, beams, and columns, necessary to support second level of equipment.
5. Joint construction shall be tongue and groove.

2.5 ACCESS DOORS

A. All access doors shall close with air pressure. Small doors for access to dampers, etc., shall be 16” x 16” minimum. They need not be hinged but shall be held in place with sash type locks. They shall have a flanged frame that overlaps liner or insulation.

B. Ultra-low leakage doors. Nailor Model 0800 Type M1 Double Flange Frame for rectangular duct and Model 0895 for round duct, or equivalent. Knock-over tab frames are not permitted. Maximum leakage must not exceed British Standard DW144 Class A, B, and C.

C. Provide a safety chain for doors accessed by ladder. Provide grab handles for doors 18" x 10" and larger when there is a positive pressure greater than 3 i.w.c.

D. Provide long-life closed-cell gaskets.

E. Provide access door at all locations requiring service access.

2.6 DUCT LINER

A. “Nosing” sheet metal strip shall be installed on leading edge of all internal duct liner.

B. See section 230700 Insulation for liner specification.

2.7 DOUBLE WALL PLENUM

A. Plenum walls and roof shall be constructed of 20 ga. (G60) galvanized interior and exterior skins with 2” 1.5# cu. Ft. density foam insulation set on 4” wide, 4” high concrete curb (2000 psi).

B. All reinforcing members to be galvanized sized and spaced for 2” negative pressure with T-304 stainless steel fasteners. Maximum deflection shall not exceed 1/200 of any span.

C. Access door (24”x72) shall be same construction as wall and close with pressure. Access door shall have double gasketed seals around entire perimeter.

D. Provide two light fixtures (100W ea) with light switch at exterior of access door.

E. Fastening method to air handler as approved by air handler manufacturer.

PART 3 - EXECUTION

3.1 ISNTALLATION DUCTWORK

A. Install in accordance with manufacturer’s instructions.

B. Install and seal ducts in accordance with SMACNA HVAC Duct Construction Standards – Metal and Flexible. It is essential that all air ductwork be practically air tight. Before being insulated or concealed, all medium pressure air ducts and lab exhaust ducts, including the

terminal connections, shall be tested for leakage. Each duct, under an air pressure test shall have no noticeable leaks. The total amount of leakage in the medium pressure supply ductwork of any system shall not exceed 1% of the total cfm of that system as measured by a manometer and a calibrated orifice. Test pressure for medium pressure systems shall be 8" WG and 6" WG for lab exhaust system.

C. Duct sealant installation shall be in accordance with manufacturer's published recommendations. Allow duct sealant system to cure minimum 48 hours before pressure testing for the fluid applied mastics. Rolled mastic sealants can be tested immediately. All low, medium, and high-pressure duct systems (positive or negative) shall be pressure tested according to SMACNA test procedures (HVAC Air Duct Leakage Test Manual). Notify Owner minimum seven (7) calendar days in advance of leakage testing.

D. Duct sizes on plans are inside clear dimensions.

E. Provide openings in ductwork where required to accommodate thermometers and controllers. Provide pilot tube openings where required for testing of systems, complete with metal can with spring device or screw to ensure against air leakage. Where openings are provided in insulated ductwork, install insulation material inside a metal ring.

F. Locate ducts with sufficient space around equipment to allow normal operating and maintenance activities.

G. Use double nuts and lock washers on threaded rod supports.

H. Connect terminal units to supply ducts with maximum length of flexible duct as detailed on plans. Do not use flexible duct to change direction unless shown on drawings.

I. Connect diffusers to low pressure ducts with maximum length of flexible duct as detailed on plans. Duct to be held in place with strap or clamp.

J. Connect flexible ducts to metal ducts with adhesive and draw bands. Use sheet metal screws for positive pressure over 2".

K. Set plenum doors 6 to 12 inches above floor. Arrange door swings so that fan static pressure holds door in closed position.

L. During construction, provide temporary closures of metal or taped polyethylene on open ductwork to prevent construction dust or weather from entering ductwork system.

M. Manufactured casings shall be assembled and installed as noted in paragraph 3.1 A above.

3.2 CLEANING

A. Clean duct system and force air at high velocity through duct to remove accumulated dust. To obtain sufficient air, clean duct in sections of size approved by the Designer. Protect equipment which may be harmed by excessive dirt with temporary filters, or bypass during cleaning.

B. Clean new plenums and accessible ducts in Mechanical/Equipment Rooms with high power vacuum machines. Clean existing plenums and accessible ducts in Mechanical/Equipment

Rooms where indicated with high power vacuum machines. Protect equipment which may be harmed by excessive dirt with filters, or bypass during cleaning. Provide adequate access into ductwork for cleaning purposes.

3.3 DUCTWORK PRESSURE CLEANING SCHEDULE

Air System	Pressure Class **Inch**
Low Pressure Supply (HVAC Systems and downstream of terminal units)	2
Medium Pressure Supply (upstream of terminal units)	8
Space and Fume Hood Exhaust	6
All Other Ducts	2

END OF SECTION 233100

SECTION 233300 - DUCTWORK ACCESSORIES

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Duct Silencers (Sound Attenuators).

B. Air turning devices/extractors.

C. Backdraft dampers.

D. Duct test holes.

E. Flexible duct connections.

F. Volume control dampers.

1.2 REFERENCES

A. NFPA 90A - Installation of Air conditioning and Ventilating Systems.

B. NFPA 92A - Smoke Control Systems.

C. SMACNA - HVAC Duct Construction Standards - Metal and Flexible.

D. UL 33 - Heat Responsive Links for Fire-Protection Service.

E. UL 555 - Fire Dampers and Ceiling Dampers.

F. UL 555S - Leakage Rated Dampers for Use in Smoke Control Systems.

1.3 DELIVERY, STORAGE, AND HANDLING

A. Protect dampers from damage to operating linkages and blades.

PART 2 - PRODUCTS

2.1 DUCT SILENCERS (SOUND ATTENUATORS)

A. Manufacturers:

1. Vibro-Acoustics.
2. Price.
3. IAC.

B. Description: low frequency rectangular duct silencer fabricated in accordance with SMACNA HVAC Duct Construction Standards Metal.

C. Materials:

1. Outer Casing: Minimum 22 gage (0.8 mm) thick galvanized steel stiffened as required, with welded seams.
2. Inner Casing and Splitters: Minimum 26 gage (0.5 mm) thick perforated galvanized steel.
3. Fill: Fiberglass.

2.2 AIR TURNING DEVICES/EXTRACTORS

A. Multi-Blade device with radius blades attached to pivoting frame and bracket, steel, or aluminum construction, with push-pull operator strap. Provide air turning vanes in all supply and return square elbows. Vanes in medium pressure supply duct shall be double wall type.

B. Steel or fiberglass fixed vanes for 90 deg. Elbows.

2.3 BACKDRAFT DAMPERS

A. Manufactures:

1. Ruskin Manufacturing Co.
2. Arrow.
3. United Emertech.
4. Kinetics Noise Control.

B. Gravity backdraft dampers furnished with air moving equipment may be air moving equipment manufacturer’s standard construction.

C. Multi-Blade, Parallel Action Gravity Balanced Backdraft Dampers: galvanized steel, extruded aluminum, with felt or flexible vinyl sealed edges, linked together in rattle-free manner with 90-degree stop, and plated steel pivot pin adjustment device to permit setting for varying differential static pressure.

D.

2.4 DUCT TEST HOLES

A. Temporary Test Holes: Cut or drill in ducts as required. Cap with neat patches, neoprene plugs, threaded plugs, or threaded or twist-on metal caps.

B. Permanent Test Holes: Factory fabricated, airtight flanged fittings with screw cap. Provide extended neck fittings to clear insulation.

2.5 FLEXIBLE DUCT CONNECTIONS

A. Fabricate in accordance with SMACNA Medium Pressure Duct Construction Standards, and as indicated.

B. UL listed fire-retardant neoprene coated woven glass fiber fabric to NFPA 90A, minimum density 20 oz. per sq. yd., approximately 2 inches wide, crimped into metal edging strip.

2.6 VOLUME CONTROL DAMPERS

A. Manufactures:

1. Ruskin Manufacturing Co.
2. Arrow.
3. United Emertech.

B. Fabricate in accordance with SMACNA Low Pressure Duct Construction Standards, and as indicated.

C. Fabricate splitter dampers of material same gage as duct to 24 inches size in either direction, and two gages heavier for sizes over 24 inches.

D. Fabricate splitter of double thickness sheet metal to streamline shape. Secure blade with continuous hinge or rod. Operate with minimum 1/4-inch diameter rod in self aligning, universal joint action flanged bushing with set screw.

E. Fabricate single blade dampers for duct sizes to 12 x 48 inch.

F. Fabricate multi-blade damper of opposed blade pattern with maximum blade sizes 122 x 72 inch. Assemble center and edge crimpled blades in prime coated or galvanized channel frame with suitable hardware.

G. Except in round ductwork 12 inches and smaller, provide end bearings. On multiple blade dampers, provide oil-impregnated nylon or sintered bronze bearings.

H. Provide locking, indicating quadrant regulators on single and multi-blade dampers.

I. On insulated ducts mount quadrant regulators on stand-off mounting brackets, bases, or adapters.

PART 3 - EXECUTION

3.1 PREPARATION

A. Verify that electric power is available and of the correct characteristics.

3.2 INSTALLATION

A. Install accessories in accordance with manufacturer’s instructions, NFPA 90A, and follow SMACNA HVAC Duct Construction Standards - Metal and Flexible.

B. Provide backdraft dampers on exhaust fans or exhaust ducts nearest to outside and where indicated.

C. Provide flexible connections immediately adjacent to equipment in ducts associated with fans and motorized equipment.

D. Provide duct test holes where indicated and required for testing and balancing purposes. Neoprene plugs.

E. Install automatic dampers in manner directed by Temperature Control Sub-Contractor.

F. Provide balancing dampers at points on supply, return, and exhaust systems where branches are taken from larger ducts as required for air balancing. Install minimum 2 duct widths from duct take-off.

G. Provide balancing dampers on duct take-off to diffusers, grilles, and registers, regardless of whether dampers are specified as part of the diffuser, grille, or register assembly.

END OF SECTION 233300

SECTION 236412 - WATER COOLED CHILLERS

PART 1 - GENERAL

1.1 PERFORMANCE REQUIREMENTS

A. This section is based on specific selections of equipment. These selections relate to the selection of related equipment HVAC Pumps and Induced Draft Cooling Tower. In substituting equipment, ensure that performance selection criteria matches that specified or that the selection of related equipment is acceptable or is revised to suit.

1.2 DELIVERY, STORAGE, AND PROTECTION

A. Comply with manufacturer's installation instructions for rigging, unloading, and transporting units.

B. Protect units from physical damage. Leave factory-shipping covers in place until installation.

1.3 REFERENCES

A. ARI 550 Centrifugal or Rotary Water Chilling Packages.

B. ASHRAE 15 Safety Code for Mechanical Refrigeration.

C. ASHRAE 90A Energy Conservation in New Building Design.

D. ASME SEC VIII Boiler and Pressure Vessel Code.

E. ASME B31.1 - 1983 Code for Pressure Piping and Refrigeration Piping.

F. NEMA MG1 - Motors and Generators.

G. UL 465 Central Cooling Air Conditioners.

H. UL 984 - Safety Standard for Hermetic Motor Compressors.

1.4 WARRANTY

A. Manufacturer's warranty shall commence at date of initial start-up and shall continue for a period of one (1) year, not to exceed eighteen (18) months from date of shipment. Manufacturer's warranty shall include all parts (including refrigerant) and labor.

B. Provide an additional four (4) year chiller warranty, including replacement parts and labor, refrigerant, and oil, etc. to get unit completely into service.

1.5 MAINTENANCE MATERIALS

A. Manufacturer shall provide operating instructions and parts list and provide instructions to Owner's personnel in operating and maintenance of the units.

PART 2 - PRODUCTS

2.1 Equipment is owner furnished. Submittals available upon request.

PART 3 - EXECUTION

3.1 ELECTRICAL CENTRIFUGAL CHILLERS

A. The following summarizes the general responsibilities of the Equipment Supplier and the Contractor for the project:
   1. Equipment Supplier:
      a. Provide shop drawings and submittal data.
      b. Provide the chillers and all appurtenances in accordance with the equipment schedule and specification.
      c. Delivery of chillers including coordination of exact delivery date.
      d. Coordinate chiller design with concrete housekeeping pads.
      e. Provide internal VFD cabling and wiring.
      f. Lead chiller and VFD check-out, refrigerant charging, testing, and start-up process.
      g. Furnish insulation required to Contractor.
      h. Provide touch up paint.
      i. Provide Owner training.
      j. Provide O&M documentation.
   2. The Contractor will perform the following work associated with the new chillers:
      a. Provide/modify concrete housekeeping pads.
      b. Rigging and setting of chillers including coordination of exact delivery date.
      c. Extend chilled water and auxiliary water piping to chillers.
      d. Insulate the connecting piping systems.
      e. Install controls devices, raceway system and/or wiring between the chillers and VFD’s and the Owners control system.
      f. Extend electrical service to the chillers including feeders to the VFD’s, motor and associated auxiliary devices.
      g. Touch up paint on the entire chiller prior to applying insulation.
      h. Insulate the chiller with Manufacturer provided insulation.
      i. Provide commissioning services.

3.2 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Provide for connection to electrical service. Provide lugs to meet electrical requirements. Refer to Division 26.

C. Align chiller on concrete foundations, sole plates, and subbases. Level, grout, and bolt in place.

D. Install units on vibration isolation.

E. Provide chilled water piping connections to evaporator:

1. On inlet, provide:

a. Thermometer well for temperature controller.
b. Thermometer well and thermometer.
c. Nipple and flow switch.
d. Flexible pipe connector.
e. Pressure gage.
f. Shut off valve.

2. On outlet, provide:

a. Thermometer well and thermometer.
b. Flexible pipe connector.
c. Pressure gage.
d. Shut off valve.

F. Furnish and install necessary auxiliary water piping for oil cooling units.

G. Insulate evaporator and cold surfaces if not factory insulated.

H. Provide condenser water piping connection to condenser.

1. On inlet, provide:

a. Thermometer well for temperature controller.
b. Thermometer well and thermometer.
c. Nipple and flow switch.
d. Flexible pipe connector.
e. Pressure gage.
f. Shut off valve.

2. On outlet, provide:

a. Thermometer well and thermometer.
b. Flexible pipe connector.
c. Pressure gage.
d. Shut off valve.

I. Arrange piping for easy dismantling to permit tube cleaning.

J. Provide piping from chiller relief valves to outdoors. Size as per ASHRAE 15.

3.3 MANUFACTURER'S FIELD SERVICES

A. Starting of Systems: Prepare and start systems.

B. Provide services of factory trained representative to leak test, refrigerant pressure test, evacuate, dehydrate, charge, start up, calibrate controls, and instruct Owner on operation and maintenance.

C. Supply initial charge of refrigerant and oil.

3.4 DEMONSTRATION AND INSTRUCTIONS

A. Demonstrate system operation and verify specified performance.

END OF SECTION 236412

SECTION 236413 - CHILLER EQUIPMENT ROOM

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Refrigeration gas monitor, with alarm and control operations.

B. Equipment Room safety.

1.2 REFERENCES

A. ANSI/ASHRAE STANDARD 34-1992: "Number Designation & Safety Classification of Refrigerants".

B. ASHRAE GUIDELINE 3-1990 AND ADDENDUM 3a--1992: "Reducing Emission of Fully Halogenated Chlorofluorocarbon (CFC) Refrigerants in Refrigeration and Air Conditioning Equipment and Applications".

C. ANSI/ASHRAE STANDARD 15-1976: "Standard Pumpdown Capacities".

1.3 REGULATORY REQUIREMENTS

A. ANSI/ASHRAE STANDARD 15-1994: "Safety Code for Mechanical Refrigeration".

1.4 SUBMITTALS

A. Submit shop drawings of equipment to be used to meet all safety requirements plus control operations and alarm interlock interfaces, under provisions of GENERAL CONDITIONS.

PART 2 - PRODUCTS

2.1 EQUIPMENT ROOM SAFETY

A. Provide easily legible and securely attached sign in the Chiller Equipment Room indicating (1) name and address of the installer, (2) the kind and initial charge of refrigerant, and (3) the field test pressure applied. Also, provide durable signs having letters not less than 0.5 inches in height, designating valves or switches for controlling the refrigerant flow, the ventilation, and refrigerant compressor(s).

B. Provide refrigerant gas monitor equipment with audible and visual alarms, and ventilation fan switch, outside of, and near, equipment room doors. All equipment shall be properly labeled to indicate their intended usage. In addition, a sign or other prompt shall indicate requirement for ventilation during occupancy, and another sign shall note that equipment room is restricted to

authorized personnel only. Further, emergency shutdown procedures, including precautions to be observed in case of a breakdown or leak, shall be provided and posted outside the equipment room door. These instructions shall list (1) procedures for shutting down the system in case of emergency, (2) the name, address, and day and night telephone numbers for obtaining service, and (3) the name, address, and telephone number of the local inspection department having jurisdiction, as well as instructions to notify said department immediately in case of emergency.

2.2 REFRIGERANT PRESSURE RELIEF PROTECTION

A. Refrigerant pressure-relief valves provided by chiller manufacturer, shall be piped to a location not less than fifteen (15) feet above the adjoining ground level and not less than twenty (20) feet from any vent opening, window, or building exit.

B. Discharge termination shall be positioned to protect personnel from direct spray, and to prevent foreign material or debris from entering the pipe.

C. Piping may be steel or DWV copper with flexible connections compatible with the vented refrigerant. Size piping per ASHRAE STANDARD 15-1994, and not less than the manufacturer's relief device sizes. Multiple discharges may be run into a common header, the area of which shall not be less than the sum of the areas of the connected pipes (not including areas of any "safety standby" relief devices).

2.3 REFRIGERANT GAS MONITORING-MULTIPOINT SENSING LEAK DETECTION SYSTEM

A. General: Provide a monitoring and multichannel scanning system to continuously draw gas samples from locations as shown on the floor plans and measure the gas concentration of the refrigerant being used. The system shall be capable of monitoring both R-123 and R-134A.

B. Measured Gas: The system shall measure (gas) in the concentration range of zero to 1000 parts per million full scale.

C. Monitor and Scanner Enclosures: Units shall be NEMA 4 wall mount type enclosures with full length front access doors and impact resistant windows for the purpose of viewing meter and indicating lights.

D. Monitor shall include audible alarms, and alarm silencing switch on enclosure. A readout display shall exhibit a self-diagnostics code when a fault exists. Faults shall include, but not be limited to, circuit failure, supply power loss, and saturated or absent sensor signal.

E. Scanner shall be a microprocessor operated unit with sequential measurement of gas concentration from each of three sample locations.

1. Four LED type lights shall be provided for each sample. One light shall be assigned to each of three independently adjustable alarm/control set point levels, with separate user interface relays. A fourth light for each sample point shall indicate when that location is being analyzed. Separate lights shall indicate when the system is in calibration mode.
2. Sample tubing connections shall be provided on the sides of the enclosure for use in connecting sample lines, calibration gases, and exhaust lines. Samples shall be

continuously drawn from all locations, regardless of which location is being analyzed, and adequately filtered in the scanner to protect the analyzer. Exhaust lines shall be provided and connected to the enclosure for use in attaching to sample and bypass flows. Calibration gas supply fittings allow for connection of zero and span gas supplies.

3. The analyzer shall be of the sample draw type with an internal pump and filter. Operation shall be of the infrared photo-acoustic absorption type.

    a. Analyzer Sensitivity - Analyzer shall be capable of monitoring over a range of 0-1000 rpm with a sensitivity of 1 rpm in the 0-100 rpm range and +/-10% of reading in the 100-1000 rpm range.
    b. Analyzer Linearity-Analyzer shall be capable of maintaining a linear response in the range of 0-100 rpm and +/-2% of full scale in the range of 100-1000 rpm.
    c. Analyzer Reproducibility- Analyzer shall be reproducible within the limits of +/-1% Full Scale.

4. Stability-The 24 hour zero or span drift shall be less than 2% without the aid of automatic or manual recalibration.

F. Relays from alarm levels of each refrigerant sensor and from refrigerant monitor and scanner self-diagnostic alarms, shall be available for future connection, to provide additional warnings to remote locations.

G. The system shall operate over a minimum range of 59 to 113 degrees Fahrenheit.

H. Monitor and Scanner shall operate on 120/240 VAC, @ 0.56/0.3 amps (monitor), and 2.0/1.0 amps (scanner).

I. Maintenance-With the exception of resupply of zero and span gas, no routine maintenance shall be required.

J. Manufacturer Capability Requirements (minimum):

1. Supply all equipment needed to calibrate the system.
2. Provide start-up assistance and training.
3. Be capable of providing on-site service with factory trained personnel.

K. Operation-When activated at any level of alarm, purge rate ventilation of the Chiller Equipment Room shall be initiated, and audible and visual alarm signals outside of the Equipment Room shall be activated. Also, alarm contacts shall be available to provide remote alarm signals. Exhaust fan shall remain energized until manually deactivated by an operator.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install refrigerant leak detection equipment, equipment room fan switch, and all signs specified to be located where directed by owner's representative, and/or as indicated on drawings.

B. Clearances: Coordinate with engineer on chiller room equipment locations to provide ample access for servicing and repair.

C. Refrigerant Sensors (Quantity as shown on plans): Locate as recommended by chiller manufacturer at most likely points of discharge.

END OF SECTION 236413

SECTION 236500 - COOLING TOWERS

PART 1 - GENERAL-

1.1 SECTION INCLUDES

A. Cooling tower.

B. Controls.

C. Platforms and handrails.

1.2 REFERENCES

A. AFBMA 9 – Load Rating and Fatigue Life for Roller Ball Bearings.

B. AFBMA 11 - Load Rating and Fatigue Life for Roller Bearings.

C. ASME PTC-23 – Atmospheric Water-Cooling Equipment.

D. Cooling Tower Institute (CTI) ATC-105 – Acceptance Test Code for Water Cooling Towers.

E. Cooling Tower Institute (CTI) – Certified Standards STD-201.

F. NEMA 250 – Enclosures for Electrical Equipment (1000 Volts Maximum).

1.3 PERFORMANCE REQUIREMENTS

A. This section is based on specific selections of equipment. In substituting equipment, ensure that performance selection criteria matches that specified or that the selection of related equipment is acceptable or is revised to suit.

1.4 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.

B. Installer Qualifications: Company specializing in performing the work of this section THREE (3) years documented experience.

1.5 REGULATORY REQUIREMENTS

A. Products Requiring Electrical Connection: Listed and classified by testing firm acceptable to the authority having jurisdiction as suitable for the purpose specified and indicated.

1.6 DELIVERY, STORAGE, AND PROTECTION

A. Factory assemble entire unit. For shipping, disassemble into large sub-assemblies to minimize field work required for reassembly.

B. Comply with manufacturer's installation instructions for rigging, unloading, and transporting units.

PART 2 - PRODUCTS

2.1 Equipment is owner furnished. Submittals available upon request.

PART 3 - EXECUTION

3.1 COOLING TOWERS

A. The following summarizes the general responsibilities of the Equipment Supplier and the Contractor for the project:
   1. Equipment Supplier
      a. Provide shop drawings and submittal data.
      b. Provide the cooling towers and all appurtenances in accordance with the equipment schedule and specification.
      c. Delivery of cooling towers including coordination of exact delivery date.
      d. Coordinate cooling tower design with existing concrete supports.
      e. Lead tower and VFD check-out, testing, and start-up process.
      f. Provide touch up paint.
      g. Provide Owner training.
      h. Provide O&M documentation.
   2. The Contractor will perform the following work associated with the new towers:
      a. Provide/modify concrete supports.
      b. Rigging and setting of towers including coordination of exact delivery date.
      c. Extend condenser water and auxiliary water piping to towers.
      d. Insulate and heat trace the connecting piping systems.
      e. Install controls devices, raceway system, and/or wiring between the towers and VFD’s and the Owners control system.
      f. Extend electrical service to the towers, including feeders to the VFD’s, motors, and associated auxiliary devices.
      g. Touch up paint on the entire tower.
      h. Repair of cold water basin protective coating as necessary
      i. Provide commissioning services.

3.2 INSTALLATION

A. Install in accordance with manufacturer’s instructions.

B. Install tower on structural steel beams as instructed by manufacturer.

C. Connect condenser water piping with flanged connections to tower. Pitch condenser water supply to tower and condenser water suction away from tower.

D. Connect water-up water piping with flanged or union connections to water. Pitch to tower.

E. Connect overflow, bleed, and drain to hub drain.

3.3 FIELD QUALITY CONTROL

A. Test for capacity under actual operating conditions in accordance with CTI ATC-105 and verify specified performance.

3.4 MANUFACTURER'S FIELD SERVICES

A. Starting of Systems: Prepare and assist the contractor to start systems.

B. Inspect tower after installation and submit report prior to start-up, verifying installation is in accordance with specifications and manufacture's recommendations.

C. Supervise rigging and installation; include one (1) eight-hour day.

D. Assist in start-up tower in presence of and instruct Owners operating personnel.

END OF SECTION 236500

SECTION 237300 - SEMI-CUSTOM AIR HANDLING UNIT

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section of the work includes the design, fabrication, testing, cleaning, and packaging, shipment, and final assembly of air handling units by the unit manufacturer in complete accordance with the following specification.

B. The details outlined and component manufacturers named in this specification may not be deviated from in the air handling unit manufacturer's preparation of the bid, even where techniques are required which the manufacturer does not consider standard.

1.2 PRODUCT CLEANING, DELIVERY, STORAGE, AND HANDLING

A. Thoroughly clean equipment, components and subassemblies of water, dirt, debris, weld splatter, grease, oil, and other foreign matter prior to shipment.

B. Seal and protect all openings in unit casings, housings, and enclosures with thin gauge sheet metal closure sheets. Seal closures, caps, and plugs dust-tight and moisture-tight.

C. Protect pipe flanges with plywood coverings. Protect pipe threads with plastic end caps or plugs.

D. Protect machined surfaces with suitable, easily removable rust preventive.

E. Provide full charge of proper lubricant for grease lubricated bearings.

F. Provide desiccant bags or vapor phase inhibitors where required to keep components dry.

G. Units delivered with scratched, dented, or dirty surfaces or damage of any type shall be restored to “as new” condition as directed by the Architect/Engineer/Owner at no cost to Owner.

H. If equipment is to be stored before use, the shipping protection provided by the unit manufacturer shall remain on the unit until the unit is installed. In addition, manufacturer shall submit written recommendations for field storage, both indoor and outdoor.

I. Provide non-corrosive nameplate permanently attached to each piece of equipment containing the following information at a minimum.

1. Manufacturer’s project number.
2. Plant name and location.
3. Equipment number.
4. Date of manufacture.

1.3 PRECONSTRUCTION SUBMITTALS

A. Product Data: For each air-handling unit.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.
3. Include unit dimensions and weight.
4. Include cabinet material, metal thickness, finishes, insulation, and accessories.
5. Fans:

    a. Include certified fan-performance curves with system operating conditions indicated.
    b. Include certified fan-sound power ratings.
    c. Include fan construction and accessories.
    d. Include motor ratings, electrical characteristics, and motor accessories.

6. Include certified coil-performance ratings with system operating conditions indicated.
7. Include filters with performance characteristics.
8. Include dampers, including housings, linkages, and operators.

B. Shop Drawings: For each type and configuration of indoor, semi-custom air handling unit.

1. Include plans, elevations, sections, mounting and attachment details.
2. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
3. Detail fabrication and assembly of indoor, semi-custom air-handling units, as well as procedures and diagrams.
4. Include diagrams for power, signal, and control wiring.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For air-handling units to include in emergency, operation, and maintenance manuals.

1.5 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Filters: Two set(s) for each air-handling unit.
2. Gaskets: One set for each access door.

1.6 WARRANTY

A. All equipment, materials, and workmanship shall be warranted for twenty four (24) months from project acceptance.

B. During the warranty period, the manufacturer shall repair or replace, at no additional cost to the Owner, any equipment, material, or workmanship in which defects may develop.

PART 2 - PRODUCTS

Note: Air handling units are owner provided, contractor installed. Part 2 of this specification is being provided as information to the MC to aid in the coordination required for installation of the units.

2.1 ACCEPTABLE MANUFACTURERS

A. York

B. Carrier.

C. Trane.

D. Pre-approved Equivalent.

2.2 GENERAL DESCRIPTION

A. Fabricate air-handling units suitable for the scheduled capacities.

B. Factory fabricate and test air handling units of sizes, capacities, and configuration as indicated and specified.

C. Base performance on sea level conditions.

D. All internal components specified in the air handling unit schedule shall be factory furnished and installed. Unit(s) shall be completely factory assembled.

E. Units shall ship in one (1) piece whenever possible. A minimal number of shipping splits may be provided as required for installation. Lifting lugs will be supplied on each side of the split to facilitate rigging and joining of segments.

2.3 PERFORMANCE REQUIREMENTS

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. NFPA Compliance: Comply with NFPA 90A for design, fabrication, and installation of air-handling units and components.

C. UL Compliance: Comply with UL 1995 Heating and Cooling Equipment.

D. ASHRAE 62.1 Compliance: Applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment" and Section 7 - "Construction and Startup".

E. ASHRAE/IES 90.1 Compliance: Applicable requirements in ASHRAE/IES 90.1, Section 6 - "Heating, Ventilating, and Air-Conditioning".

F. Structural Performance: Casing panels shall be self-supporting and capable of withstanding positive/negative 8-inch wg of internal static pressure, without exceeding a midpoint deflection of 0.0042 inch/inch of panel span.

G. Casing Leakage Performance: ASHRAE 111, Class 6 leakage or better at [plus or minus 8 inch wg.

H. Seismic Performance: Air-handling units shall withstand the effects of earthquake motions determined according to ASCE/SEI 7. See Section 230548 "Vibration and Seismic Controls for HVAC".

1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event.
2. Component Importance Factor: 1.0.

2.4 UNIT CASING

A. The entire unit shall be provided with a full length, continuous, base rail channel. Base rail channels will be formed of a minimum of 18-gauge galvanized steel. The base channel shall have a minimum height of 6 inches. Units without a complete and continuous base rail (e. g. units with mounting legs) will not be acceptable. All segments shall be double wall and shall be constructed of G90 mill galvanized sheet steel, formed, and reinforced to provide a rigid assembly. The exterior casing shall be constructed of minimum 18-gauge steel. The interior lining (except in unit discharge panel) shall be a solid lining of a minimum of 20-gauge galvanized steel. Floor panels shall be double wall with minimum 18-gauge galvanized steel, reinforced to support the weight of maintenance personnel. All panels shall be completely gasketed prior to shipment and shall be completely removable for unit access and removal of components.

Commented [RSM1]: We have done perforated liners in supply sections before on M&C jobs. I don't see where that is called for in other places of this spec.

B. Provide double wall construction with encased insulation between exterior and interior panels such that no insulation is exposed to airstream. Insulate casing sections with injected polyurethane foam insulation with a thermal resistivity of no less than 20. The panel insulation must be a full 2" throughout the entire unit. In addition to panel insulation, insulate all structural channels connected to casing panels and cover openings in structural channels with galvanized steel. If structural channels are not internally insulated, then structural channels must be wrapped with flexible elastomeric insulation to maintain unit thermal performance and prevent sweating. Any portion of the unit that is not insulated (gaps) or has less than 2" of insulation shall be the responsibility of the contractor to modify.

C. Double wall access doors shall be provided on sections as shown on mechanical drawings. Doors shall have a minimum dimension of 18" wide. Doors shall be of the same thickness and construction as the wall panels. A gasket shall be provided around the entire door perimeter. Gaskets shall be ¾" x 5/16" neoprene or approved equal. Industrial style hinges shall permit a complete 180-degree door swing. All door hardware and handles shall be metal or handles and hinges are also permitted to be glass fiber reinforced, UV rated, nylon polyamide construction.

1. Belt Driven Fan(s)Fan segments shall be equipped with fan wheel type as scheduled. Fans shall have airfoil (AF) blades as scheduled.
2. All airfoil fans shall bear the AMCA Seal. Airfoil fan performance shall be based on tests made in accordance with AMCA standards 210 and comply with the requirements of the AMCA certified ratings program for air and sound. In addition, all airfoil wheels shall comply with AMCA standard 99 2408 69 and 99 2401 82.
3. Fan Balancing: All fans prior to shipment shall be run tested at the specified operating speed. Each fan shall be dynamically balanced as a complete unit in accordance with ANSI/AMCA 204-96 “Balance Quality and Vibration Levels for Fans” to Fan Application Category BV-3, Balance Quality Grade G6.3. Balance readings shall be taken electronically in the axial, vertical and horizontal directions. Records of each fan balance shall be maintained and a written copy shall be available upon request.
4. Fan and fan motor shall be internally mounted and isolated on a full width isolator support channel using 1" static deflection springs. The fan discharge shall be connected to the fan cabinet using a flexible connection to insure vibration free operation.

2.5 BEARINGS AND DRIVES

A. Provide bearings complying with ANSI/AFBMA 9 for fatigue life ratings.

B. Fan bearings shall be self-aligning, pillow block, or flanged type re-greaseable ball bearings, or rubber housed sealed bearings and shall be designed for an average life (L50) of at least 200,000 hours. All re-greaseable bearings shall be factory lubricated and equipped with hydraulic grease fittings and lube lines extended to the motor side of the fan.

Commented [RSM2]: this applies to belt driven only. Direct drive fans don’t have fan bearings, only motor bearings since the fan is attached to the motor shaft.

2.6 HEATING / COOLING COMPONENTS

A. Cooling coil segments shall have a full width, sloped drain pan that extends downstream of the coil a minimum of 8” to contain moisture carryover. The unit design and coil selection shall not require a drain pan in any downstream section to contain the coil condensate. Drain pans shall be sloped in a minimum of 2 planes; cross break interior pans and pitch toward drain connections to ensure complete condensate drainage. Units with cooling coils shall have drain pans under complete cooling coil section. A minimum of 1” clearance shall be provided from the bottom of the coil casing to the drain pan so that the drain pan can be visually inspected and physically cleaned, including underneath coil, without removal of the coil. All drain pan connections will be to one side of the unit to enable proper trapping. Drain pans that do not comply with these maintenance requirements will be the responsibility of the contractor to field modify. Each coil shall include a sloped, positive-draining stainless steel insulated condensate pan assembly. Drain pan to be constructed from minimum 16-gauge 304 stainless steel material. Coils shall set above the condensate pan for ease of removal. Intermediate condensate drain pan shall be minimum 1-1/2” deep; extending at least 2" upstream and at least 6" downstream of the coil face. Each drain pan shall be individually piped down to a sloped sump section in the unit base; extending at least 3" upstream and at least 18" downstream of the coil face. Drain pan to be provided with a drain connection of sufficient size to remove condensate.

B. Unit manufacturer shall ensure that air handler design shall have no moisture carryover from coils at design conditions. Do not exceed coil velocities in schedules.

C. Standard Coils with finned height greater than 48" shall have an intermediate drain pan extending the entire finned length of the coil. Cooling coils in excess of 48" in height shall not be acceptable unless provided with an intermediate drain pan. The intermediate pans shall have drop tubes to guide condensate to the main drain pan.

D. All cooling and/or heating coils shall be furnished to meet the performance requirements set forth in the schedule. All water and steam coils shall have performance certified in accordance with ARI Standard 410. Coils used with glycol are outside the scope of ARI-410 but shall be selected to meet scheduled performance.

E. All coils shall be slide out, "shipping" type, mounted on tracks and easily removable from the air handling unit by removing only one exterior panel. Coils that require additional disassembly of the unit or replacement of the entire coil section (e.g., "unit" type coils) for coil removal are unacceptable.

F. Drainable Water coils shall be designed to operate at 250 psig design working pressure and up to 300□F and shall be tested with 325 psig compressed air under water. Circuiting shall provide free and complete draining and venting when installed in the unit. All vent and drain connections shall be extended to the outside of the unit casing. Coils shall be circuited for counter flow of air and water. Water velocities shall not exceed 6 feet per second or be less than 4 feet per second and/or exceed the water pressure drops scheduled. All coils shall have same end connections regardless of the number of rows deep. Coils using turbulators are unacceptable. Units with staggered coil arrangements are unacceptable.

G. Intermediate casing supports shall be supplied for finned lengths that exceed 60 inches.

H. The primary surface shall be 1/2" O.D. copper tube, staggered in direction of airflow. Tubes shall be mandrel expanded to form fin bond and provide burnished, work-hardened interior surface. The tubes shall have a minimum tube wall thickness of 0.032". Specified thickness shall be maintained throughout the tube including brazed U-bends. Coils manufactured with hairpin bends shall provide increased nominal wall thickness as required to compensate for the thinning of tube walls that occurs at the exterior of each bend.

Commented [RSM3]: We only offer up to 0.032" in out ½" diameter tube. To get 0.035" we would need to use a 5/8" tube.

I. Extended surface shall consist of die-formed, continuous, aluminum fins. The fins shall have fully drawn collars to accurately space fins, and to form a protective sheath for the primary surface. The fin thickness shall be 0.0095".

J. Headers shall be of heavy seamless copper tubing, silver-brazed to tubes. Connections shall be of steel, with male pipe threads, silver-brazed to the headers. A 1/4" FPT, plugged, vent, or drain tap shall be provided on each connection. All vent and drain connections shall be factory extended to the outside of the unit casing.

K. Coil grommets shall be provided on all coils to completely seal the area between the coil connection and the unit casing.

2.7 FILTERS

A. Filters shall have nominal rating of 500 fpm. Mid-life pressure drop shall not exceed that indicated. Media shall be approved and listed as Underwriters Laboratories Class 2 when tested according to U.L. Standard 900 and as described below:

1. Prefilters: 2" thick 30% efficiency (MERV 8).
2. Final Filters: 12" rigid cartridge type, 65% (MERV 11).

B. Filters shall be upstream or side access removable. Filter sections shall be complete with holding frames and clips capable of holding pre-filters for the pre-filter bank or final filters for the final filter bank.

C. Filter holding frames shall be installed and individually sealed to prevent leakage around frames. Filter bank shall be reinforced with vertical stiffeners to assure rigidity. Unit manufacturer shall provide galvanized flashing between filter banks and unit casings to prevent air leakage or bypass around the frames. Installation techniques, sealing methods, and structural reinforcement eliminate unfiltered air bypass and assure system cleanliness based on filter efficiencies specified.

D. Unit manufacturer shall provide and install a Dwyer series 2000 magnehelic gauge complete with static pressure tips accessories for indicating the operating pressure drop of each filter bank. Indicating range of gauge shall be selected at two times the final resistance of the filter bank.

2.8 DAMPERS

A. Dampers shall be of low leak design having stamped 16-gauge galvanized steel blades. The damper blades shall be provided with a PVC coated polyester fabric mechanically locked into the blade edge. The jamb is a flexible metal, compression type. Leakage will not exceed 7.20 CFM/square foot at 1" w.g. and 14.0 CFM/square foot at 4" w.g. The blades shall be parallel acting unless otherwise scheduled.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install each unit on a 6" channel base or as indicated on the drawings, grouted to set level.

Commented [RSM4]: We have a 6" rail in most cases but I think we had a shorter rail in some cases (ie return fans), but will need to double check. I don't think AHUs are normally grouted in these days, but that may be what you want here. I can't recall the situation with house keeping pads on this job….

B. Coordinate the selection of the isolators with manufacturer of the air handling units to assure compatibility of mounting details.

C. Units to utilize internal vibration isolation.

D. Isolators for units mounted on intertia bases to be supplied by vibration isolation manufacturer.

E. Provide clearance at each unit for routine service including the changing of filters, removal of coils, bearing greasing, opening of access doors, and pulling of blower shaft.

F. Mechanical contractor shall provide Magnehelic type differential pressure gauge (Dwyer Series 2000 or approved equal; Accuracy within 2%, calculated operating point shall be at 50% of full range with minor divisions of 0.05" w.g.) across the following: each filter type, supply fan and the cooling coil. Each differential pressure gauge shall utilize copper tubing for sensing points. Mount pressure gauges on the exterior of the air handling unit. Gauges shall not be mounted into

the air-handling unit housing or onto doors. Mount gauges on the exterior of the air-handling unit at a fixed location. MC shall coordinate with AHU manufacturer for mounting and tap locations. Provide on-off-vent valves at each differential pressure gauge to provide static and differential pressure in each section of the air handling unit.

Commented [RSM5]: This is special and would require us to mount the DP gages in the field or defer to the MC to mount these. This looks like UNC spec (copper tubing, vent valves, surface mounted, etc.)

G. Duct Connection:

1. Duct connections to each unit to allow for straight and smooth airflow.
2. Do not install duct turns at the fan discharge which are in the opposite direction to a fan wheel rotation.
3. Provide flexible connections at duct connections to unit.

H. Piping Connections:

1. Support piping independently of coils and with adequate flexibility to prevent undue stress at coil header connections.
2. Install full size drain lines from the drain pan connection and trap to permit condensate to drain freely.
3. Route condensate drain piping to nearest floor drain.
4. Install service valves and companion flanges or unions on supply and return lines to coils.
5. Arrange piping such that valves can be shut off, a small section of pipe removed, and the coil pulled.

3.2 START-UP AND OWNER ORIENTATION

A. Equipment start-up and owner maintenance orientation shall be the responsibility of the unit manufacturer to activate equipment warranty and assure that the Owner and his facility personnel are comfortable and familiar with equipment maintenance.

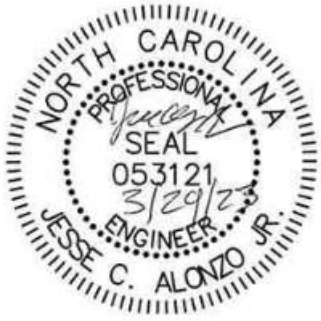
1. Manufacturer shall include a minimum of four hours on-site for owner maintenance training and orientation.

B. The air handling unit manufacturer shall be responsible for proper operation and shall be required to meet the scheduled capacities and specified performance for this equipment.

C. Equipment startup shall be in compliance with requirements listed in Mechanical General Specification.

END OF SECTION 237300

DIVISION 26 - ELECTRICAL SPECIFICATIONS
TABLE OF CONTENTS



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SECTION 26 05 00 – COMMON WORK RESULTS FOR ELECTRICAL

PART 1 GENERAL

1.1 REQUIREMENTS

A. General Conditions of the Contract, Supplementary General Conditions, Instructions to Bidders, and General Requirements sections contained in the contract documents are a part of these Specifications.

1.2 EXTENT OF THE WORK

A. This Contractor shall furnish all labor, materials, and equipment, and perform all operations necessary for installation of complete electrical work within the intent of, and as indicated on, the drawings and as herein specified.

1.3 REGULATIONS AND COMPLIANCE

A. Latest editions of the National Electrical Code and the North Carolina State Building Code govern this work. All their requirements shall be satisfied.

B. This Contractor shall secure and pay for all permits, fees, inspections, and licenses required. The electrical contractor shall notify the Office of the State Electrical Inspector at the State Construction Office (SCO) (authority having jurisdiction), to schedule required electrical inspections including, but not limited to, rough-in, above ceiling, and final inspections. Upon completion of the job he shall present to the Engineer a certificate of inspection and approval from the inspection authorities.

PART 2 PRODUCTS

2.1 MATERIALS

A. All materials shall be new, with required Underwriter's Laboratories (or other agency approved by the State) label, and with manufacturer's label or nameplate giving complete electrical data.

B. Where a manufacturer's catalog number is used, all parts shall be furnished to make it complete and to fit the construction intended.

C. Within ten days after award, Contractor shall submit to Engineer a complete list in triplicate of all materials he proposes to use. List shall show a single manufacturer with not only major materials and equipment, but also such items as conduit fittings, raceway supports, conductive pipe thread compound, asphaltum, sealing material, clamps, anchors, outlet boxes, gutters, terminal cabinets, wire-pulling compound, splice connectors, tape, wire markers, lamps, etc.

D. Material shall be the make and number given in these Specifications or shown on Drawings, or equivalent where specifically stated as being allowed. Equivalent items or materials will be subject to acceptance by the Engineer at submittal stage. If Contractor wishes to furnish a substitute for

the item(s) specified (or equivalent where allowed), he shall furnish complete, detailed data and obtain approval of the substitution in writing from the Engineer no later than ten (10) days prior to bid. In some cases, at the request of the Engineer, samples of the substitute items shall be submitted for review. Data (and sample if required) shall be submitted in a timely manner such that approval by Engineer can be returned to Contractor no later than ten (10) days prior to bid date. Data or sample not submitted in sufficient time to allow evaluation by Engineer will be automatically rejected.

E. Engineer's review of samples, cut sheets, shop drawings, and other matter submitted by the Contractor shall not relieve the Contractor of responsibility for full compliance with the Drawings and Specifications. If a submitted item does not comply in any way (color, style, quality, function, or performance), Contractor shall call the specific non-compliance to the attention of the Engineer in writing in a cover letter to the submittals requesting a deviation from specifications. This does not imply that approval of requested deviation will be given, only that it will be reviewed.

F. Engineer's review of submittals is not intended to confirm quantity counts of materials and equipment made by Contractor. Contractor is required to provide quantities of items as necessary for systems to function as described and shown on the plans and in these specifications.

G. Specialty systems such as fire alarm systems, etc., that are included as part of the Electrical Contract shall be furnished and installed by an authorized representative of the manufacturer of the equipment supplied. This includes use of factory trained and authorized installers where required to fulfill manufacturer's warranty provisions.

H. Submit cuts of fixtures, shop drawings on panels, and other descriptive materials requested, in six copies, or as required by the General Requirements section. Submittals will not be accepted or reviewed by the Engineer unless the electrical contractor's stamp signifying his review and approval is evident on the submittals.

I. Materials should be inspected upon their arrival at the site to be sure they are correct. No extension of time for completion will be allowed because materials received are wrong. Completely adequate housing shall be provided on the site for orderly and careful storage of all materials and equipment. Nothing shall be stored outside except conduit, which may be stored in racks so it is at least twelve (12) inches above ground and not subject to mud being spattered on it.

2.2 PAINTING

A. Suitable finish coatings shall be provided under this section of the Specifications on all items of electrical equipment and wiring which are exposed. This shall consist of either an approved factory applied finish, or an acceptable finish applied during or after installation. Equipment which is furnished in finishes such as stainless steel or satin aluminum are not to be painted. Exposed equipment and/or wiring in finished areas such as panel covers or surface raceway shall be supplied with factory applied prime coat and shall be professionally painted or enameled as directed to result in a completely coated and attractively finished manner. All such finishing shall be as directed by and shall be satisfactory to the Architect and Engineer.

PART 3 EXECUTION

3.1 GENERAL INSTALLATION

A. The electrical drawings are diagrammatic only, and are intended to explain system function and define quality of materials and installation. They are not intended to define construction methods.

B. Contractor shall keep on the site at all times one set of electrical drawings and specifications, and one set of drawings and specifications on the work of other trades. In addition, one complete set of all electrical submittals and shop drawings shall be maintained at the site by the electrical contractor.

C. The electrician shall check other trades' drawings, specifications, and shop drawings to see if there are any conflicts or discrepancies. If so, he shall contact the Engineer for instructions.

D. The Contractor shall properly protect his work against damage by weather or other trades. All work shall be left well cleaned, and damaged finishes shall be restored to original condition.

E. The Contractor shall place his own sleeves and notify other trades of chases and openings far enough ahead so they can be properly built in. Where any raceways, supports, etc., installed under the contract pierce the roof, suitable pitch pockets shall be provided and coordinated with the roofing contractor as necessary to be acceptable to the Engineer. Provide suitable fittings where any raceways or equipment cross expansion joints.

F. This contractor shall be responsible for all trenching, backfilling, cutting, core drilling, and patching related to his work.

G. Contractor shall provide firestops and smoke seals per Project Specifications and UL Details shown on drawings. All penetrations shall be sealed accordingly.

H. Contractor should not scale drawings for outlet and equipment locations. Unless specifically dimensioned on drawings or defined in specifications, outlets and equipment shall be located as evidently intended or as detailed on Architectural drawings. Lighting outlets are to be centered or spaced symmetrically unless they are dimensioned. Any dimensions shown on the drawings shall be verified in the field by the contractor prior to roughing. All outlet and equipment locations shall be coordinated with the other trades. If any doubt arises, contact the Engineer prior to roughing.

I. Contractor shall keep premises free of debris resulting from this work.

3.2 TESTS AND GUARANTEES

A. All current-carrying phase conductors and neutrals shall be tested as installed, and before connections are made, for insulation resistance and accidental grounds. Each fixture and item of equipment for connection under the Contract shall be tested for insulation resistance from its conductors to its grounded surface or contact. These tests shall be done with a 500 volt (minimum) high voltage "megger."

1. Minimum readings shall be one million (1,000,000) or more ohms for #6 AWG and smaller wire, 250,000 ohms or more for #4 AWG and larger wire, between conductors and between conductor and the grounding conductor.

2. After all fixtures, devices, and equipment are installed and all connections completed to each panel, the contractor shall disconnect the neutral feeder conductor from the neutral bar and take a megger reading between the neutral bar and the grounded enclosure or ground bar. If this reading in less than 250,000 ohms, the contractor shall disconnect the branch circuit

neutral wires from this neutral bar. He shall then test each one separately to the panel and until the low readings are found. The contractor shall correct troubles, reconnect and retest until at least 250,000 ohms from the neutral bar to the grounded panel can be achieved with only the neutral feeder disconnected.

3. The Contractor shall send a letter to the engineer certifying that the above has been done and showing the tabulation of the megger readings for each panel or feeder. This shall be done at least four (4) days prior to final walk-through by engineer, and SCO.

4. At final walk-through by the engineer and SCO, the contractor shall furnish a megger and demonstrate that the panels comply with the above requirements. He shall also furnish a clamp-on type ammeter and a voltmeter to take current and voltage readings as directed by the engineer, or SCO representatives.

B. Validity of the ground path shall be assured by constant and careful attention to the thorough tightening of all couplings, connectors, locknuts, screws, bolts, etc., and by frequent checking of the path resistance with a quality low-range ohmmeter. Resistance of the path should not exceed one ohm between any two points. If a reading in excess of this is observed, it shall be discussed with the Engineer for an appraisal of the condition.

C. Contractor shall guarantee that the work is done in accordance with drawings and specifications, and that it is free of imperfect materials or defective workmanship. Anything unsatisfactory shall be corrected immediately and at Contractor's expense.

D. All test results for items A. and B. above shall be included in Operation and Maintenance manuals for Owner future trending.

E. For the period of one year after acceptance by the Owner, the Contractor shall replace, without any expense to the Owner, any imperfect materials or defective workmanship.

3.3 RECORD DRAWINGS/MANUALS

A. Upon completion of the installation, Contractor shall submit to the Engineer marked prints of Drawings showing any changes made in circuits, location of equipment, panelboards, or any other revision in the Contract Drawings, for the Owner's use in maintenance work and for future additions and expansions. Marked changes shall also include changes due to change orders unless already recorded by revised drawing or bulletin drawing.

B. These record drawings shall be submitted in one of two formats: either a clean, legible, marked set of prints with all markings in distinguishable colored pencil such as red; or a set of reverse-run reproducible sepia prints marked in soft pencil so that blue-line prints can be reproduced as required. The format to be used shall be as defined in the General Requirements section of the contract documents. If no format is defined, the marked blue-line prints shall be submitted.

C. Operation and Maintenance manuals shall be submitted to the Engineer at the end of the project prior to closeout of the project. Information included shall be a copy of all submittal data, shop drawings, and necessary operating and maintenance instructions and wiring diagrams on all major items of equipment and all special systems (fire alarm, intercom, etc.). Submit these manuals in the quantities and format described in the General Requirements Section.

END OF SECTION 26 0500

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SECTION 26 05 19 – LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 GENERAL

1.1 REQUIREMENTS

A. All material shall be U.L. listed and shall be installed in conformance with the National Electrical Code.

PART 2 PRODUCTS

2.1 MATERIALS

A. Manufactured by Southwire, Rome, or Triangle, of as otherwise noted in the specifications.

B. Normal trade standard "building wire" of copper.

C. Power and lighting circuits #10 AWG and smaller shall have solid copper conductors. Conductor sizes #8 AWG and larger shall have Class B stranded copper conductors. Maximum conductor size shall be 500 KCMIL.

D. All sizes shall bear easily readable size and insulation grade marking along entire length.

E. Insulation on #6 and smaller shall be suitably colored in manufacturing. Conductors #4 and larger may be identified with bands of proper color plastic tape near each termination and in each junction box.

F. Insulation on service and feeders shall be 600 volt Type XHHW or THHN/THWN unless noted otherwise in the specifications, specifically noted on the drawings, or Code requires another type.

G. Branch circuits shall be a minimum of #12, with 600 volt THHN/THWN insulation unless noted otherwise in the specifications, specifically noted on the drawings, or Code requires another type. Circuit wires carried through rows of fluorescent fixtures shall be at least Type THHN.

H. Conductors in any location subject to temperatures higher than 60^{o}C shall have insulation of a type approved by NEC for temperature encountered.

I. Control and signal conductors shall be type and size indicated in those sections of the Specifications, or as specifically indicated on drawings.

J. Conductors for branch circuits shall be sized to prevent a voltage drop exceeding three percent (3%) at the farthest outlet of power, heating and lighting loads, or any combination of such loads. The maximum total voltage drop on both feeders and branch circuits combined to the farthest outlet shall not exceed five percent (5%). Where the conductor length from the panel to the first outlet on a 277V circuit exceeds 125 feet, the branch circuit conductors from the panel to the first outlet shall not be smaller than #10 AWG. Where the conductor length form the panel to the first outlet on a 120 volt circuit exceeds 50 feet, the branch circuit conductors from panel to the first outlet shall not

be smaller than #10 AWG. Where ungrounded conductors are increased in size from the minimum size that has sufficient ampacity for the intended installation, wire-type equipment grounding conductors shall be increased in size proportionately according to the circular mil area of the ungrounded conductor.

K. Conductors for VFDs shall meet the following requirements (unless noted otherwise in the specifications, specifically noted on the drawings, or where Code requires another type):

1. 12 AWG to 2 AWG:
   a) Belden Classic 300% Ground VFD Cable (or approved equivalent).
   b) Overall Duofoil® Shield + 85% TC Braid plus full size TC Drain Wire.
   c) One Full-sized Insulated Ground (Same AWG as Circuit Conductors).
   d) Three Stranded Class D Tinned Copper (TC)
   e) Circuit Conductors with XLPE Insulation.
   f) Black Sunlight- and Oil-Resistant PVC Jacket.
   g) 1000V UL Flexible Motor Supply
   h) 600V UL 1277 Type TC-ER
   i) 1000V UL 2277 Type WTTC
   j) 1000V CSA AWM I/II A/B FT4
   k) IEEE 1202
   l) UL Direct Burial
   m) XHHW-2, RHW-2 rated circuit conductors
   n) 90°C Wet/Dry
   o) Suitable for Class I, II & III, Division 2 hazardous locations
   p) MSHA
   q) UL 1685 Vertical Tray Flame Test
   r) RoHS compliant
   s) CE approved
   t) C(UL) 600V Type CIC TC

2. 1 AWG to 4/0 AWG:
   a) Belden Classic 100% Symmetrical Ground VFD Cable (or approved equivalent).
   b) Two Spiral Copper Tape Shields (100% Coverage).
   c) Three Symmetrical Bare Copper (BC) Grounds
   d) Three Stranded Class D Tinned Copper (TC)
   e) Circuit Conductors with XLPE Insulation
   f) Black Sunlight- and Oil-Resistant PVC Jacket.
   g) 1000V UL Flexible Motor Supply
   h) 600V UL 1277 Type TC-ER
   i) 1000V UL 2277 Type WTTC
   j) 1000V CSA AWM I/II A/B FT4
   k) IEEE 1202
   l) UL Direct Burial
   m) XHHW-2 rated circuit conductors
   n) 90°C Wet/Dry
   o) Suitable for Class I, II & III, Division 2 hazardous locations
   p) MSHA
   q) UL 1685 Vertical Tray Flame Test
   r) RoHS compliant
   s) CE approved

t) C(UL) 600V Type RW90 TC

PART 3 EXECUTION

3.1 INSTALLATION

A. All wiring shall be color coded:

1. On 120/208 volt, 3 phase, 4 wire systems - phase A, black; phase B, red; phase C, blue; neutral, white. On 277/480 volt, 3 phase, 4 wire systems - phase A, brown; phase B, orange; phase C, yellow; neutral, natural gray. Ground conductor on all systems shall be green.

2. Unless noted or accepted otherwise, busses in panels and switchgear shall be considered "A", "B", and "C" from left to right, top to bottom, or front to back when facing equipment.

3. Control wiring shall not use black, red, or blue; but shall use white for neutrals and green for grounding. Any other colors may be used but the coding shall provide same color between any two terminals being joined.

4. Switchlegs, including "travelers" in 3-way and 4-way switching systems, shall be same color as phase leg.

B. Joints in #10 and smaller wire may be either made with approved twist-type connectors such as Ideal, Buchanan, T&B, Scotch, etc. “Stakon” or other permanent type crimp connectors shall not be used for branch circuit wiring.

C. Joints in #8 and larger wire shall be made with approved Burndy, T&B, or O.Z. Manufacturing Co., mechanical pressure type connectors or lugs along with their UL approved insulating covers.

D. Manufactured insulators for connectors may be used, provided they cover completely and securely all exposed metal. If joints and splices are taped, they shall be carefully covered with top-grade Okonite, Scotch Brand, or approved equivalent plastic or rubber and friction, laid on with half laps to result in a joint insulation equivalent to that of the conductor insulation.

E. Circuit joints shall not be made on twin screws of convenience receptacles. Make joints as described above and run single leads to receptacle.

F. All wiring lugs throughout the project, including, but not limited to, breakers, panelboard/switchboard lugs, safety switch lugs, and transformers lugs, shall be rated for use with 75 degree conductors sized in accordance with NEC Table 310.15(B)(16).

G. Wm. Brady Co., or approved equivalent, labels or the type made with a punch on plastic tape, giving the circuit number, shall be securely fastened to each branch circuit conductor within panelboards. They shall also be installed on all conductors within junction boxes, pull boxes, gutters, wireways, cabinets, or equipment where two or more wires of the same color occur.

H. Where connected under screw or bolt heads, stranded wire shall be fitted with a lug of proper size. Make solid conductor loops clockwise so as to be forced closed as screw is tightened. Only one solid wire loop may be held under a single screw.

I. Make all connections tight.

J. Wires within panelboards, terminal cabinets, and similar equipment shall be neatly squared.

K. Where paralleling of conductors is shown for feeders or service entrance, it is absolutely required they be exactly the same length between points of bonding together. Lay out side by side and cut to same length before drawing into raceways. Provide for each end of run a Burndy Q2A or W3A lug, or approved equal, and terminate parallels in these without cutting.

L. Individual branch circuits shall not have shared neutrals.

END OF SECTION 26 0519

SECTION 26 05 23 – CONTROL VOLTAGE ELECTRICAL POWER CABLES

PART 1 GENERAL

1.1 REQUIREMENTS

A. Shall conform with Article 700 and 725 of NEC.

PART 2 PRODUCTS

2.1 MATERIALS

A. Shall also conform with the following unless noted otherwise on drawings or in other sections of these Specifications:

1. Conductors shall be run in metal conduit, unless specifically stated otherwise. These shall be complete with outlet boxes, junction boxes, fittings, etc., conforming in all respects with Section 26 05 33.

2. Conductors shall be #14 AWG minimum, stranded copper, and insulated with type THHN thermoplastic insulation rated for 600 volts unless noted otherwise in the specifications, specifically noted on the drawings, or Code requires another type.

3. Conductors shall be colored in manufacture. Black, red, and blue shall be used only for connections of these wiring systems to proper phase in main wiring system. Color code throughout remainder of system shall be other colors selected by This Contractor, but same color shall be used between points of connection. In other words - do not change color at splices, in junction boxes, etc. White shall be reserved for neutral and green for grounding.

4. In lieu of color coding, or in conjunction with, this Contractor shall identify each conductor using a label system, such as Brady labels, or equal. Each conductor shall be individually labeled with a distinctive number or number/letter combination at each termination point, including wire nut connections. A table shall be made identifying each conductor, its function, its origin, its final termination, etc. This table shall be typewritten and included in the final Operation and Maintenance Manuals and with a copy left in the main point of origin cabinet (such as fire alarm panel).

B. Joints and connections shall be made as specified in Section 26 05 19.

PART 3 EXECUTION

3.1 INSTALLATION

A. This section is not used.

END OF SECTION 26 0523

SECTION 26 05 26 – GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.1 REQUIREMENTS

A. All systems and equipment shall be grounded in accordance with NEC Article 250.

PART 2 PRODUCTS

2.1 MATERIALS

A. Manufactured by Thomas & Betts, Harger Lightning Protection, Lightning Master Corporation or approved equivalent.

B. Bonding shall be done with #3800 series insulated bonding bushings and compression type lugs.

C. Grounding conductor shall be THHN/THWN run in heavy wall conduit, and of size shown on drawings or required by NEC.

PART 3 EXECUTION

3.1 INSTALLATION

A. Any raceway anywhere in the system which enters a box or cabinet through part of a concentric or oversized knockout shall be fitted with an insulated bonding bushing and jumper. These bushings shall also be used wherever conduits stub into switchboards or transformer cabinets. Grounding type insulated bushings shall always be used on both ends of conduits feeding panelboards. The bonding jumper shall be sized by NEC Section 250 and lugged to the box.

B. EMT couplings and connectors shall be compression-gland type of malleable steel, galvanized or sherardized. Connectors shall be insulated-throat type. Set screw, indentor, or cast type fittings are not acceptable.

C. Attach rigid metal conduits with double locknuts - one inside and one outside - and fiber bushing, or in a threaded hub.

D. The raceway system shall not be relied on for ground continuity. A green grounding conductor, properly sized per NEC Table 250.122, shall be run in ALL raceways except for telecommunications, data and audio conductors raceway.

E. Ground all fixed and portable appliances and equipment connected under this Contract with a green grounding conductor. This wire shall be carried inside the raceway and flex from equipment to nearest grounded portion of raceway system. Connect at both ends with suitable lugs.

F. All grounding type receptacles shall have a green wire jumper from their grounding terminal to box in which mounted. Attach jumper to box, not plaster ring, with a bolt or grounding clip. Jumper shall be sized by NEC with #12 minimum.

END OF SECTION 26 0526

SECTION 26 05 33 – RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.1 REQUIREMENTS

A. All material shall be UL listed and shall be installed in conformance with the National Electrical Code.

1.2 SUBMITTALS

A. Shop drawings for:

1. Conduits
2. Couplings and fittings
3. Boxes
4. Floor boxes
5. Conduit seals

B. Provide list of conduit types indicating where each type is used.

PART 2 PRODUCTS

2.1 RACEWAYS

A. Manufactured by Allied Tube & Conduit, Wheatland, Western Tube & Conduit, or approved equivalent, or as otherwise noted in the specifications.

B. Galvanized Steel Rigid Metal Conduit (RMC):

1. Heavy wall tubing with hot dipped galvanized coating

2. Connections shall be made with double locknuts and bushings. Bushings to be steel with integral insulator except conduits 2” and below may have high impact thermoplastic Phenolic insulating bushings.

C. Intermediate Metal Conduit (IMC):

1. Intermediate grade metallic tubing with hot dipped galvanized coating.

2. Connections shall be made with double locknuts and bushings. Bushings to be steel with integral insulator except conduits 2” and below may have high impact thermoplastic Phenolic insulating bushings.

D. Electrical Metallic Tubing (EMT) Conduit:

1. Thin wall tubing with hot dipped galvanized coating.

2. Couplings and connections shall be threaded steel, watertight gland compression type.

3. All connectors shall have insulated throat.

E. Rigid Nonmetallic Conduit:

1. Heavy wall rigid, type 40, listed for underground encased and above ground applications.

2. Heavy wall rigid, type 80, listed for underground encased and above ground applications.

F. PVC Coated Conduit:

1. RMC or IMC Conduit

2. 40 MIL PVC exterior coating

3. 2 MIL Urethane coating on interior and treads

4. Plastic tread protector caps

G. Flexible Metal Conduit (FMC):

1. Electro-galvanized single strip steel.

H. Liquid Tight Flexible Metal Conduit:

1. Electro-galvanized single strip steel with PVC coating.

I. Stainless Steel Conduit:

1. Type 304 or 316

2. Standard and special radius elbows

3. Threaded couplings

2.2 BOXES

A. Manufactured by Midland Ross/Steel City, T&B, Raco, or Appleton.

B. Galvanized or aluminum of gauge required by NEC.

C. All junction and pull boxes shall be 4 inch square by 2-1/8 inch deep minimum.

D. Stamped steel boxes with knockouts are not acceptable for surface mounting in finished spaces in the building.

E. PVC coated or stainless steel.

2.3 FASTENINGS AND SUPPORTS

A. Shall be of good quality, galvanized steel or other non-corroding material.

PART 3 EXECUTION

3.1 RACEWAY INSTALLATION

A. All wire and cable shall be run in raceway.

B. Minimum raceway size shall be 3/4" (interior) and 1" (below grade) unless noted otherwise. Half inch flexible conduit may be used from junction box to above ceiling light fixtures (6' maximum length).

C. All runs of empty conduit only shall have a 100# nylon pull rope installed in the conduit.

D. Rigid metal conduit shall be made up with full threads to which T&B "Kopre-Shield" compound has been applied, and butted in couplings.

E. Z. Split or "Erickson" couplings where necessary.

F. No conduit shall be run in poured concrete floors or slabs. Conduit runs shall normally be run overhead. Where it is necessary to run underneath a concrete slab poured on-grade, conduit shall be buried in trench beneath gravel base and turned up through slab. Where it is necessary to run underneath a floor above a crawl space or another floor, conduit shall be run along ceiling space under floor and stubbed through floor using appropriate methods, such as "poke-through" devices or other means U.L. approved for such purpose.

G. Underground runs, except under concrete floor slabs, shall be encased by a minimum of three (3) inches of concrete on all sides and shall have a minimum of eighteen (18) inch (non-roadway) and twenty-four (24) inch (roadway) cover, except for raceways containing circuits above 600V, which shall have a minimum cover of 30". Backfill shall be made in six (6) inch layers - tamping each layer to a density of 95% of maximum possible. Red dye shall be applied to the top of freshly placed concrete in all underground duct banks as a warning of electrical hazard in the event of future excavation. In addition, all underground raceway shall be identified by underground line marking tape located directly above the raceway at sin (6) to eight (8) inches below finish grade. Tape shall be permanent, bright-colored, continuous printed, plastic tape compound for direct burial not less than 6" wide and 4 mils thick. Printed legend shall be indicative of general type of underground line below.

H. Where passing through a below grade wall from a conditioned interior building space, raceways shall be sealed utilizing fittings similar and equal to OZ/Gedney type "FSK" through wall fitting with "FSKA" membrane clamp adapter if required.

I. Attach rigid metal conduits with double locknuts - one inside and one outside - and fiber bushing.

J. Grounding type insulated bushings shall be used where raceway enters boxes with concentric or oversized knockouts. These bushings shall also be used wherever conduits stub into switchboards or transformer cabinets. Grounding type insulated bushings shall always be used on both ends of conduits feeding panelboards.

K. Provide suitable fittings where raceway crosses building expansion joints.

L. Securely fasten in place using approved strap or hanger within three (3) feet of each termination and not over ten feet apart in runs.

M. Run concealed in finished areas unless otherwise noted.

N. Make all cuts square with hacksaw. Remove any burrs or shoulders by reaming.

O. All runs exposed and all runs above accessible ceilings shall be neat and square with building structure such as walls and ceiling/roof structures. Multiple parallel runs shall use trapeze supports where possible.

P. "Flex" and "Sealtite" connections with T&B "Tite-Bite" and "Super-Tite" or approved equivalent fittings. Shall have insulated throats.

Q. Where installing raceway on interior surface of exterior walls. Mount raceway ¼" from wall with clamp-backs or strut.

3.2 APPLICATION

A. Galvanized Steel Rigid Metal Conduit (RMC) Conduit required:

1. Installations below grade (and in or under slabs where approved), except where specifically noted otherwise.
2. Below 6 ft AFF in exposed areas of mechanical equipment rooms, except where specifically noted otherwise.

B. Electrical Metallic Tubing (EMT) Conduit required:

1. Interior panel feeders, except where specifically noted otherwise, etc.
2. Interior partitions
3. Above suspended ceilings
4. Above 6 ft AFF in exposed areas of mechanical equipment rooms, except where specifically noted otherwise.
5. Sizes 2" and smaller except as approved, except where specifically noted otherwise.
6. EMT shall not be used for outdoor applications.

C. Nonmetallic Rigid Conduit required:

1. Direct burial, concrete encased.
2. Direct burial, in sand fill on bottom and top.
3. Corrosive atmospheres, except where specifically noted otherwise.

D. Liquid Tight Flexible Metal Conduit required, not over 4 ft in length, for final connections to:

1. Equipment in wet locations.
2. Equipment with vibration isolation mounting.
3. Equipment housing ferromagnetic cores or with integral moving components, capable of generating noise or vibrations including transformers and motors.
4. Pumps and associated equipment.
5. Instruments and control devices.
6. All flexible connections to equipment in fire pump room below 60" AFF.

E. Flexible Metal Conduit required, not over 4 ft in length, for final connections to:

1. Equipment in dry locations.

2. Equipment in dry locations with vibration isolation mounting.

F. PVC Coated Conduit shall be used:

1. In corrosive atmospheres as noted on plans.
2. In exterior environments needing additional protection.

G. Stainless Steel Conduit shall be used for:

1. Exposed conduits in GMP Clean Room or Wash Down environments.

H. Aluminum Surface Mounted Raceway (Labs)

1. Surface mounted in labs with receptacles, data outlets as required per the drawings.
2. Provide with all necessary components for complete professionally installed system including, but not limited to, base, cover, clips, elbows, couplings, seam clips, entrance fittings, device plates, devices, etc.

3.3 BOX INSTALLATION

A. Attach EMT with connector only.

B. Outlet boxes shall be sized in accord with NEC Section 314. All lighting outlet boxes shall have fixture studs. Device boxes shall be sectional type or 4" square equipped with plaster rings as required to mount the device. Set edge flush with finished surface. Boxes may be installed at top or bottom of a masonry course. Raco, or approved equivalent, masonry boxes in sawed block. 1-1/4" and deeper plaster rings may be of die-cast aluminum of Steel City make, or approved equivalent.

C. Where installed in metal stud partitions, wall boxes shall be supported from two adjacent studs using a system such as Caddy Bar Hanger Assembly, or approved equivalent. Support on a single stud is not acceptable.

D. Fixtures weighing more than six pounds shall be supported from the fixture stud.

E. Where not shown differently on the drawings, mount:

1. Switch boxes 46" from finished floor to center. Boxes beside doors shall be mounted so edge of trim plate is 2" from edge of door trim on strike side.
2. Telephone boxes 18" from finished floor to center and vertical. Boxes for wall phones shall be 46" from finished floor and vertical.
3. Bracket light boxes as indicated on plans or as directed by Engineer.
4. Clock outlet boxes 7'-0" from finished floor, or 6" below finished ceiling, to center.
5. Panel cans 6'-4" ($\pm$4" in concrete block construction) from finished floor to top of can.
6. Fire alarm pull stations 46" from finished floor to center.
7. Fire alarm chimes, horns, strobes, etc., 80" above finished floor or 6" below finished ceiling, whichever is lower, and shall comply with ADA requirements.

F. Where not shown differently on the drawings, mount boxes for receptacles to receive device in a vertical position and be:

1. Centered 18" above finished floor.

2. Centered 6" above counters, shelves, or cabinets where apparently intended to be so placed.
3. Centered 4" above high edge of backsplashes.
4. Where devices are to be ganged, provide boxes to receive devices trimmed with a gang plate.

G. As soon as installed, all raceway openings shall be closed with plastic inserts to prevent entrance of foreign matter during construction. All enclosures shall be kept clean of any foreign matter. Install Jordan "Kover-All" plastic covers over outlet boxes ahead of plastering or painting.

H. Conduit(s) from all boxes installed on exterior walls or in areas going from conditioned to unconditioned space shall have conduit(s) sealed with duct seal or equivalent to prevent moisture formation. Duct seal or equivalent shall also be installed in all raceways entering from exterior of building.

3.4 FASTENINGS AND SUPPORTS INSTALLATION

A. Inserts in masonry shall be lead, fiber, or plastic types installed in drilled holes. Wooden plugs shall not be used. Lead only shall be used on all exterior masonry or interior masonry subject to permanent moisture. Hung raceways shall be supported from the structure with rod supports at least 5/16" in diameter.

B. All equipment and flat raceways attached to outside wall or interior walls subject to permanent moisture shall be shimmed out with non-corrodible material so as to provide 1/4" air space between wall and equipment or raceway.

C. All materials, whether exposed or concealed, shall be firmly and adequately held in place. Fastening and support shall afford safety factor of three or higher.

D. All fixtures, raceways, and equipment shall be supported from the structure. Nothing may be supported on suspended ceilings, including the hanger wires, unless definitely noted so on the drawings or specifically permitted by the Engineer.

E. Recessed fixtures shall be supported at the two (2) opposite ends to the structure. Supports shall be provided with the same type of wire as used to support the lay-in ceiling track. Attach one end of the wire to one corner of the fixture and the other end to the building’s structural system. Lay-in fixtures shall also be screwed to the main runners of the lay-in ceiling track at all four corners using sheet metal screws.

F. Recessed ceiling speakers, where specified with an enclosure, shall have the enclosure supported directly from the structure with a minimum of two 10 gauge wires run perpendicular to the ceiling and not pulling to one side. If recessed ceiling speaker is specified without an enclosure and is mounted in a suspended ceiling, the speaker shall be supported using T-Bar bridges such as Soundolier No. 81-8, or other device specifically designed for such support. In addition, each of the four corners of the ceiling grid block enclosing the speaker shall be supported from the structure using 10 gauge steel wire run perpendicular to the ceiling plane.

G. Other devices using octagonal or 4" square ceiling boxes, such as smoke detectors, dome lights, exit signs, etc., where installed in suspended ceilings shall be supported from the ceiling system using Caddy, or other, hangers specifically designed for such support. In addition, each of the four corners of the grid block enclosing the box shall be supported from the structure using 10 gauge steel wires run perpendicular to the ceiling plane.

H. Support for pipe straps or clamps shall be toggle bolts on hollow masonry; metal expansion shields and machine screws, or standard pre-set inserts, on concrete or solid masonry; machine screws or bolts on metal surfaces; and wood screws on wood construction. The resulting fastening shall be completely secure.

END OF SECTION 26 0533

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SECTION 26 05 53 – IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.1 NAMEPLATES

A. Furnish and install engraved laminated phenolic nameplates for all safety switches, panelboards, transformers, switchboards, motor control centers, and other electrical equipment supplied for the project for the following: identification of equipment controlled or served, phase, voltage, panel and circuit(s) feeding equipment.

Example:

1A
120/208V, 3Ø, 4W
FED FROM MDP-1

B. Furnish and install permanently mounted label on each device plate for receptacles indicating its panelboard and circuit number. Labels shall be made using electronic labeling system with black letters on clear background. Write-on labels are prohibited.

PART 2 PRODUCTS

2.1 NAMEPLATE MATERIALS

A. Nameplate material colors shall be (conforms with State Construction Office requirements):

1. Blue surface with white core for 120/208 volt equipment.
2. Black surface with white core for 277/480 volt equipment.
3. Bright red surface with white core for all equipment related to fire alarm system.
4. Brown surface with white core for all equipment related to data systems.
5. Green surface with white core for all equipment related to emergency system.

B. All empty conduit runs and conduit with conductors for future use shall be identified for use and shall indicate where they terminate. Identification shall be by phenolic tags with wire attached to conduit or outlet.

C. All outlet boxes, junction boxes and pull boxes shall have their covers and exterior visable surfaces painted with colors to match color scheme outlined above. This includes covers on boxes above all type ceilings.

PART 3 EXECUTION

3.1 NAMEPLATE INSTALLATION

A. Nameplates shall be securely attached to equipment with self-tapping stainless steel screws, if sharp end is protected; otherwise, rivets shall be used. Nameplates shall identify equipment controlled, attached, etc. Letters shall be ½" high minimum for panel identification. Letters for

other information shall be ¼" high minimum. Embossed, self-adhesive plastic tape is NOT acceptable for marking equipment.

END OF SECTION 26 0553

SECTION 26 05 93 – ELECTRICAL SYSTEMS FIRESTOPPING

PART 1 GENERAL

1.1 REFERENCE

A. The work under this section is subject to the Contract Documents including General Conditions, Supplementary Conditions, and under Division 1 – General Requirements.

1.2 SCOPE

A. Furnish and install work under this section including, but not limited, to the following:

1. Penetrations through fire-resistance-rated floor, roof, walls and partitions including openings containing conduits, cables, cable bundles, cable tray and other penetrating items.

1.3 SYSTEM PERFORMANCE REQUIREMENTS

A. Firestopping systems shall be UL Classified for the application and correspond to those indicated by reference to designations listed by UL Fire Resistance Directory.

B. Firestopping systems and installation shall meet requirements of ASTM E-814, UL 1479 or UL 2079 tested assemblies that provide fire rating equal to that of construction being penetrated.

C. Proposed firestop materials and methods shall conform to applicable code authority having local jurisdiction.

1.4 SUBMITTALS

A. Manufacturer's specifications and technical data for each material including composition and limitations, documentation of UL firestop systems to be used and manufacturer's installation instructions.

B. Material safety data sheets provided with product delivered to job-site.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Engage an experienced Installer who has completed firestopping that is similar in material, design and intent to that indicated for Project and that has performed successfully.

B. A manufacturer's direct representative to be on-site during initial installation firestop systems to train appropriate contractor personnel in proper selection and installation procedures.

1.6 DELIVERY, STORAGE AND HANDLING

A. Deliver products to Project site in original, unopened containers or packages with intact and legible manufacturers’ labels identifying product, type and UL label where applicable.

B. Store materials to prevent deterioration or damage due to moisture, temperature changes, contaminants or other causes.

C. Handle with recommended procedures, precautions or remedies described in material safety data sheets as applicable.

1.7 PROJECT CONDITIONS

A. Do not install firestopping when ambient or substrate temperatures are outside limits permitted by firestopping manufacturer or when substrates are wet due to rain, frost, condensation or other causes.

B. Ventilate firestopping per manufacturers' instructions by natural means or, where this is inadequate, forced air circulation.

1.8 SEQUENCING AND SCHEDULING

A. Do not cover up those fire stopping installations that will become concealed behind other construction until authorities having jurisdiction, if required, have examined each installation.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. 3M, Hilti, Tremco, Nelson Firestop Products, Specified Technologies, Inc, or Rectorseal Corp.

2.2 MATERIALS

A. Use only firestop products that have been UL 1479, ASTM E-814 tested for specific fire-rated construction conditions conforming to construction assembly type, penetrating item type, annular space requirements and fire-rating involved for each separate instance.

B. Materials shall not contain flammable solvents.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions, for compliance with requirements for opening configurations, penetrating items and other conditions affecting performance of firestopping. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 PREPERATION

A. Clean out openings immediately prior to installing firestopping to comply with recommendations of firestopping manufacturer.

B. Provide masking and temporary covering to prevent soiling of adjacent surfaces by firestopping materials.

C. Comply with manufacturer's recommendations for temperature and humidity conditions before, during and after installation of firestopping.

D. Do not proceed until unsatisfactory conditions have been corrected.

3.3 INSTALLATION

A. Comply with "System Performance Requirements" article in Part 1 and manufacturer's installation instructions and drawings.

B. Install forming/backing materials and other accessories of types required to support fill materials during application as required. After installing fill materials, remove forming materials and other accessories no indicated as permanent components of firestop systems.

C. Avoid multiple penetrations of common fire barrier opening. When possible, seal each penetration in accordance with project details. When multiple penetrations are unavoidable, seal openings with appropriate UL Classified firestoppihg systems.

3.4 FIELD QUALITY CONTROL

A. Do not proceed to enclose firestopping with other construction until reports of examinations are issued.

B. Where deficiencies are found, repair or replace firestopping so that it complies with requirements.

3.5 CLEANING

A. Clean surfaces adjacent to sealed holes and joints to be free of excess firestop materials and soiling as work progresses.

END OF SECTION 26 0593

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SECTION 26 27 26 – WIRING DEVICES

PART 1 GENERAL

1.1 WIRING METHOD FOR BRANCH CIRCUITS

A. Outlets in the same general area are circuited together. Circuit numbers are shown as noted in symbol schedule.

B. Unless shown differently, 120 or 277 volt branch circuits on single or three phase systems shall be limited to three phase conductors per raceway. Three phase circuits shall be limited to one circuit per raceway (three different phase wires and neutral(s) if needed).

C. Individual neutral wires shall be provided for each circuit (no sharing of neutrals between circuits).

D. The neutral carrying all or any part of the current of any specific load or run shall be contained in the same raceway or enclosure with the phase wire or wires also carrying that current. No split neutrals permitted.

E. Circuits shall be connected to panels as shown in the panel schedule. Any deviation shall be approved in advance by the engineer.

F. Under the above requirements and with required color coding system no feeder or branch circuit raceway will contain more than one wire of the same color, except for switch legs and control circuits.

G. Conductors feeding lighting outlets may be combined in the same raceway with conductors feeding convenience receptacles; but lighting outlets and convenience receptacles shall not be put on the same circuit unless specifically indicated.

H. Toggle switches shall be single pole, three-way, or four-way as indicated on drawings. Switches shall be of grounding type, with hex-head grounding screw, rated 20A, 120/277V, AC only. All switches shall have quiet operating mechanisms without the use of mercury switches. All switches shall be listed by an “approved” third party agency, approved for the voltage and amperage indicated.

I. Duplex receptacles shall be of the grounding type, arranged for back and side wiring, with separate single and double grounding terminals. Receptacles shall be straight blade, rated 20A, 125V and the face configuration shall conform to the NEMA Standard WD-1, NEMA WD-6, DSCC W-C-596G and UL-498, and shall be “approved” third party listed. Self-grounding or automatic type grounding receptacles are not acceptable in lieu of receptacles with separate grounding screw lugs and a direct, green insulated conductor connection to the equipment grounding system.

J. Receptacles shall be industrial specification grade or heavy duty grade, mounted vertically. Receptacles mounted over counters, back-splashes and where specifically noted otherwise shall be mounted horizontally.

K. Receptacles shall not be mounted back to back.

PART 2 PRODUCTS

2.1 WIRING DEVICES

A. Switches considered equivalent are as follows:

1. Single Pole:
   Hubbell 1221
   Bryant 4901
   P & S 20AC1
   Leviton 1221
   Eagle 2221

B. Duplex receptacles considered equivalent are as follows:

1. Heavy Duty Specification Grade:
   Hubbell 5362
   Bryant 5362
   P & S 5362
   Leviton 5362
   Eagle 5362

C. The color of all devices shall be white (subject to verification with Architect during submittal stage). Samples will be required prior to acceptance of any proposed equivalents not specifically mentioned above. All like devices shall be by the same manufacturer (i.e.; all switches, all duplex receptacles, etc.).

D. Unless noted or specified otherwise, device trim plates shall be type 302 stainless steel to suit device. All plates in the job shall be same make and match throughout.

E. Ground fault interrupter type duplex receptacles shall be heavy duty specification grade. Where used outdoors, they shall be the weather-resistant type, as well as ground fault unless otherwise indicated. They shall have metallic extra duty rated weather proof while-in-use protective covers (Hubbell WP26E/WP26EH series or equivalent).

PART 3 EXECUTION

3.1 INSTALLATION

A. Devices shall be mounted tightly to boxes and be adjusted plumb and level.

B. Receptacles are to be installed in the vertical position with the ground terminal on top.

C. Two or more devices ganged shall be trimmed with gang plate.

END OF SECTION 26 2726

SECTION 26 29 00 – LOW-VOLTAGE CONTROLLERS

PART 1 GENERAL

1.1 REQUIREMENTS

A. Motors, controllers, and other special equipment are sometimes provided and installed by other trades. This section specifies typical connections to that equipment.

B. All individual combination motor starters, VFD's, motor starters, or disconnects for mechanical equipment (fans, pumps, etc.) shall be furnished and installed under Divisions 23 (Mechanical Contractors) unless indicated as a part of a motor control center. Motor starters for mechanical equipment provided in motor control centers shall be furnished under Division 26 (Electrical Contractor). Under Division 26, power wiring shall be provided up to a termination point consisting of a junction box, trough, starter, VFD or disconnect switch. Under Division 26 line side terminations shall be provided. Wiring from the termination point to the plumbing or mechanical equipment, including final connections shall be provided under Divisions 23.

C. Where electrical wiring is required by trades other than covered by Division 26, the installer shall refer to the wiring materials and methods as specified under Division 26.

PART 2 PRODUCTS

2.1 EXHAUST FANS

A. Exhaust fans are indicated by special symbol on plans. Unless otherwise noted, they will be furnished and set by others and connected by the Mechanical Contractor. Controller will be provided by others unless controller is specified on electrical drawings. Electrical contractor shall provide a local disconnect switch at fan if unit is not provided with one.

2.2 UNIT HEATERS

A. Unit heater, ventilator, cooler, or similar outlets - designated by special symbol - are located approximately on drawings. Exact location of outlet shall be obtained from Heating, Ventilating, and Air Conditioning Contractor. Unless indicated otherwise, outlet shall be a 4" box fitted with an oversized blank cover with 1/2" center knockout, mounted in wall or ceiling, and fed on circuit shown beside symbol. These outlets shall be located behind or within equipment cabinets where possible and still be accessible. Provide local disconnect switch if one is not provided with unit. Unless specified otherwise herein or on drawings, power connection from outlet to equipment will be by Mechanical Contractor. Control wiring will be done by the Mechanical Contractor.

2.3 TROUGHS

A. Electrical troughs, junction boxes, switches, or breakers for air conditioning, heating, or plumbing equipment are indicated on drawings. Exact locations shall be obtained from Heating and Air Conditioning or Plumbing Contractors but Code clearances shall be maintained. Unless specifically noted otherwise, all power wiring for equipment and controllers beyond these points

will be done by Heating and Air Conditioning or Plumbing Contractors. Control wiring will be by Heating and Air Conditioning or Plumbing Contractors.

2.4 OTHER

A. Other equipment connections are generally indicated on drawings by a circled black triangle with a letter suffix. These are then defined in notes or details. Where catalog numbers, models, or types, and manufacturer's name are given, these items of equipment shall be furnished and installed by the Electrical Contractor, unless specifically noted otherwise.

B. Junction box - designated as a circled J. Size of such boxes is generally noted on drawings. Where this is not done, they shall be sized in accord with NEC and purpose evidently intended.

C. Where unscheduled junction boxes are used by Contractor to facilitate wiring or to comply with limits of elbows and bends, they shall be concealed if at all possible to do so and still be left accessible. If this is impossible, they shall be recessed in walls or ceilings and provided with an oversized cover which shall be painted out to match adjacent surfaces. If it is necessary to mount such boxes exposed, the location shall be approved by the Engineer.

D. All contactors, motor starters and combination type starters specified under this contract shall be equipped with Hand-Off-Automatic switches, pilot (run indicating) light, 120 volt control transformer, and two sets of auxiliary contacts. The switch and light shall be located on the unit cover. Starters shall be Square D, Cutler-Hammer, General Electric Co., or equivalent by others.

E. All safety switches shall be heavy-duty type, NEMA 1 for indoor and NEMA 3R for outdoor use unless specifically stated otherwise. They shall be fused type unless specifically indicated otherwise on plans. Fused type (600 volts or less) shall be equipped with the following: Service Entrance and Feeder Circuits over 600A – Class L, UL Listed, current limiting with 200K interrupting rating; Service Entrance and Feeder Circuits 600A and less – Class RK1 or J, UL Listed, current limiting with 200K interrupting rating; Motor, Motor Controller and Transformer Circuits – Class RK5, UL Listed, current limiting time delay with 200K interrupting rating; and individual Equipment where fault current does not exceed 50kA – Class K5, UL Listed, with 50K interrupting rating. Fusible safety switches with short circuit withstand rating of 100K or 200K shall include Class R or Class J rejection fuse block feature. Switches shall be equipped with defeatable door interlocks and padlocking provisions in the on and off positions. Padlocks shall be provided for switches located in public areas. Switches shall be by Square D, Cutler-Hammer, General Electric Co., or equivalent by others. In addition, safety switches shall be provided with the following requirements or features:

1. Safety switches shall be third party listed.
2. Switches shall have door interlocks that prevent the door from opening when the operating handle is in the “on” position.
3. Switches shall have handles whose positions are easily recognizable in the “on” or “off” position. For safety reasons, padlock shall be provided for switches unless they are located in a locked electrical room.
4. Switches shall have positive quick make-quick break mechanisms.
5. Switches shall be properly labeled. Refer to Specification 260553.
6. The Electrical contractor is to provide to the Owner as spares, 10% of the quantity of fuses used of each type and rating, with a minimum of one (1) set of each type.

F. All safety switches, motor starters, or other boxes or panels, designated as NEMA 3R or otherwise intended for outdoor use or use in wet areas, shall use raintight conduit hub fittings with bonding screw.

G. Control wiring shall not be installed in the same raceways as power wiring.

PART 3 EXECUTION

THIS SECTION NOT USED

END OF SECTION 26 2900

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F O R M O F P R O P O S A L

Project: Bryan Center HVAC Replacement Contract: Single Prime

PBS North Carolina Bidder: _____

SCO-ID # 22-24543-01A Date: _____

The undersigned, as bidder, hereby declares that the only person or persons interested in this proposal as principal or principals is or are named herein and that no other person than herein mentioned has any interest in this proposal or in the contract to be entered into; that this proposal is made without connection with any other person, company or parties making a bid or proposal; and that it is in all respects fair and in good faith without collusion or fraud. The bidder further declares that he has examined the site of the work and the contract documents relative thereto, and has read all special provisions furnished prior to the opening of bids; that he has satisfied himself relative to the work to be performed. The bidder further declares that he and his subcontractors have fully complied with NCGS 64, Article 2 in regards to E-Verification as required by Section 2.(c) of Session Law 2013-418, codified as N.C. Gen. Stat. § 143-129(j).

The Bidder proposes and agrees if this proposal is accepted to contract with the

State of North Carolina through PBS North Carolina

in the form of contract specified below, to furnish all necessary materials, equipment, machinery, tools, apparatus, means of transportation and labor necessary to complete the construction of

Bryan Center HVAC Replacement in full in complete accordance with the plans, specifications and contract documents, to the full and entire satisfaction of the State of North Carolina, PBS North Carolina and McKim & Creed Inc

with a definite understanding that no money will be allowed for extra work except as set forth in the General Conditions and the contract documents, for the sum of:

SINGLE PRIME CONTRACT: _____

Base Bid:

_____ Dollars($) _____

General Subcontractor:

_____ Lic _____

Plumbing Subcontractor:

_____ Lic _____

Mechanical Subcontractor:

_____ Lic _____

Electrical Subcontractor:

_____ Lic _____

GS143-128(d) requires all single prime bidders to identify their subcontractors for the above subdivisions of work. A contractor whose bid is accepted shall not substitute any person as subcontractor in the place of the subcontractor listed in the original bid, except (i) if the listed subcontractor's bid is later determined by the contractor to be non-responsible or non-responsive or the listed subcontractor refuses to enter into a contract for the complete performance of the bid work, or (ii) with the approval of the awarding authority for good cause shown by the contractor.

ALTERNATES:

Should any of the alternates as described in the contract documents be accepted, the amount written below shall be the amount to be "added to" or "deducted from" the base bid.

Alternate No. A-1: Metal screens at intake and relief vents

_____ Dollars($)

Alternate No. A-2: Resinous Flooring at Mech Room 2075

_____ Dollars($)

Alternate No. A-3: Resinous Flooring at Mech Room 1072

_____ Dollars($)

Alternate No. M-1: Primary CHW Pumps

_____ Dollars($)

Alternate No. M-2: Secondary CHW Pumps

_____ Dollars($)

Alternate No. M-3: Cooling Tower Filtration System

_____ Dollars($)

The bidder further proposes and agrees hereby to commence work under this contract on a date to be specified in a written order of the designer and shall fully complete all work thereunder within the time specified in the Supplementary General Conditions Article 23. Applicable liquidated damages amount is also stated in the Supplementary General Conditions Article 23.

MINORITY BUSINESS PARTICIPATION REQUIREMENTS

Provide with the bid - Under GS 143-128.2(c) the undersigned bidder shall identify **on its bid** (Identification of Minority Business Participation Form) the minority businesses that it will use on the project with the total dollar value of the bids that will be performed by the minority businesses. **Also** list the good faith efforts (Affidavit **A**) made to solicit minority participation in the bid effort.

NOTE: A contractor that performs all of the work with its own workforce may submit an Affidavit (**B)** to that effect in lieu of Affidavit (**A)** required above. The MB Participation Form must still be submitted even if there is zero participation.

After the bid opening - The Owner will consider all bids and alternates and determine the lowest responsible, responsive bidder. Upon notification of being the apparent low bidder, the bidder shall then file within 72 hours of the notification of being the apparent lowest bidder, the following:

An 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 10% goal established. This affidavit shall give rise to the presumption that the bidder has made the required good faith effort and Affidavit **D** is not necessary;

*** OR ***

If less than the 10% goal, Affidavit (**D**) of its good faith effort to meet the goal shall be provided. The document must include evidence of all good faith efforts that were implemented, including any advertisements, solicitations

and other specific actions demonstrating recruitment and selection of minority businesses for participation in the contract.

Note: Bidders must always submit **with their bid** the Identification of Minority Business Participation Form listing all MB contractors, vendors and suppliers that will be used. If there is no MB participation, then enter none or zero on the form. Affidavit A **or** Affidavit B, as applicable, also must be submitted with the bid. Failure to file a required affidavit or documentation with the bid or after being notified apparent low bidder is grounds for rejection of the bid.

Proposal Signature Page

The undersigned further agrees that in the case of failure on his part to execute the said contract and the bonds within ten (10) consecutive calendar days after being given written notice of the award of contract, the certified check, cash or bid bond accompanying this bid shall be paid into the funds of the owner's account set aside for the project, as liquidated damages for such failure; otherwise the certified check, cash or bid bond accompanying this proposal shall be returned to the undersigned.

Respectfully submitted this day of _____

_____
(Name of firm or corporation making bid)

WITNESS:

By:_____
Signature

_____
(Proprietorship or Partnership)

Name: _____
Print or type

Title_____
(Owner/Partner/Pres./V.Pres)

Address_____

ATTEST:

_____

By:_____

License No._____

Title:_____
(Corp. Sec. or Asst. Sec. only)

Federal I.D. No. _____

Email Address: _____

(CORPORATE SEAL)

Addendum received and used in computing bid:

Addendum No. 1 _____ Addendum No. 3 _____ Addendum No. 5_____ Addendum No. 6_____

Addendum No. 2 _____ Addendum No. 4 _____ Addendum No. 6 _____ Addendum No. 7 _____

Identification of HUB Certified/ Minority Business Participation

I,_____,
(Name of Bidder)
do hereby certify that on this project, we will use the following HUB Certified/ minority business as construction subcontractors, vendors, suppliers or providers of professional services.

Firm Name, Address and Phone #	Work Type	*Minority Category	**HUB Certified (Y/N)

*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.**

The total value of minority business contracting will be ($)_____.

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:_____

SEAL

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: _____

SEAL

State of _____, County of _____

Subscribed and sworn to before me this _____ day of _____ 20___

Notary Public _____

My commission expires _____

Do not submit with bid Do not submit with bid Do not submit with bid Do not submit with bid

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:_____

SEAL

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 Name)

Project ID#_____ 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:_____

SEAL

State of _____, County of _____

Subscribed and sworn to before me this _____day of _____20____

Notary Public_____

My commission expires _____

FORM OF BID BOND

KNOW ALL MEN BY THESE PRESENTS THAT _____ _____ as principal, and _____, as surety, who is duly licensed to act as surety in North Carolina, are held and firmly bound unto the State of North Carolina through _____ as obligee, in the penal sum of _____ DOLLARS, lawful money of the United States of America, for the payment of which, well and truly to be made, we bind ourselves, our heirs, executors, administrators, successors and assigns, jointly and severally, firmly by these presents.

Signed, sealed and dated this ____ day of _____ 20__

WHEREAS, the said principal is herewith submitting proposal for and the principal desires to file this bid bond in lieu of making the cash deposit as required by G.S. 143-129.

NOW, THEREFORE, THE CONDITION OF THE ABOVE OBLIGATION is such, that if the principal shall be awarded the contract for which the bid is submitted and shall execute the contract and give bond for the faithful performance thereof within ten days after the award of same to the principal, then this obligation shall be null and void; but if the principal fails to so execute such contract and give performance bond as required by G.S. 143-129, the surety shall, upon demand, forthwith pay to the obligee the amount set forth in the first paragraph hereof. Provided further, that the bid may be withdrawn as provided by G.S. 143-129.1

_____(SEAL)

_____(SEAL)

_____(SEAL)

_____(SEAL)

_____(SEAL)

FORM OF CONSTRUCTION CONTRACT

(ALL PRIME CONTRACTS)

THIS AGREEMENT, made the _____ day of _____ in the year of 20__ by and between _____

_____

hereinafter called the Party of the First Part and the State of North Carolina, through the_____

_____ hereinafter called the Party of the Second Part.

WITNESSETH:

That the Party of the First Part and the Party of the Second Part for the consideration herein named agree as follows:

1. Scope of Work: The Party of the First Part shall furnish and deliver all of the materials, and perform all of the work in the manner and form as provided by the following enumerated plans, specifications and documents, which are attached hereto and made a part thereof as if fully contained herein: advertisement; Instructions to Bidders; General Conditions; Supplementary General Conditions; specifications; accepted proposal; contract; performance bond; payment bond; power of attorney; workmen's compensation; public liability; property damage and builder's risk insurance certificates; approval of attorney general; certificate by the Office of State Budget and Management, and drawings, titled:

_____

_____

_____

Consisting of the following sheets: _____

_____

_____

_____

Dated: _____ and the following addenda:

Addendum No _____ Dated: _____ Addendum No. _____ Dated: _____

Addendum No _____ Dated: _____ Addendum No. _____ Dated: _____

Addendum No _____ Dated: _____ Addendum No. _____ Dated: _____

Addendum No _____ Dated: _____ Addendum No. _____ Dated: _____

2. That the Party of the First Part shall commence work to be performed under this agreement on a date to be specified in a written order of the Party of the Second Part and

shall fully complete all work hereunder within _____ consecutive calendar days from said date. For each day in excess thereof, liquidated damages shall be as stated in Supplementary General Conditions. The Party of the First Part, as one of the considerations for the awarding of this contract, shall furnish to the Party of the Second Part a construction schedule setting forth planned progress of the project broken down by the various divisions or part of the work and by calendar days as outlined in Article 14 of the General Conditions of the Contract.

3. The Party of the Second Part hereby agrees to pay to the Party of the First Part for the faithful performance of this agreement, subject to additions and deductions as provided in the specifications or proposal, in lawful money of the United States as follows:

_____

_____ ($ _____).

Summary of Contract Award:

4. In accordance with Article 31 and Article 32 of the General Conditions of the Contract, the Party of the Second Part shall review, and if approved, process the Party of the First Party's pay request within 30 days upon receipt from the Designer. The Party of the Second Part, after reviewing and approving said pay request, shall make payments to the Party of the First Part on the basis of a duly certified and approved estimate of work performed during the preceding calendar month by the First Party, less five percent (5%) of the amount of such estimate which is to be retained by the Second Party until all work has been performed strictly in accordance with this agreement and until such work has been accepted by the Second Party. The Second Party may elect to waive retainage requirements after 50 percent of the work has been satisfactorily completed on schedule as referred to in Article 31 of the General Conditions.

5. Upon submission by the First Party of evidence satisfactory to the Second Party that all payrolls, material bills and other costs incurred by the First Party in connection with the construction of the work have been paid in full, final payment on account of this agreement shall be made within thirty (30) days after the completion by the First Party of all work covered by this agreement and the acceptance of such work by the Second Party.

6. It is further mutually agreed between the parties hereto that if at any time after the execution of this agreement and the surety bonds hereto attached for its faithful performance, the Second Party shall deem the surety or sureties upon such bonds to be unsatisfactory, or if, for any reason, such bonds cease to be adequate to cover the performance of the work, the First Party shall, at its expense, within five (5) days after the receipt of notice from the Second Party so to do, furnish an additional bond or bonds in such form and amount, and with such surety or sureties as shall be satisfactory to the Second Party. In such event no further payment to the First Party shall be deemed to be due under this agreement until such new or additional security for the faithful performance of the work shall be furnished in manner and form satisfactory to the Second Party.

7. The Party of the First Part attest that it and all of its subcontractors have fully complied with all requirements of NCGS 64 Article 2 in regards to E-Verification as required by Section 2.(c) of Session Law 2013-418, codified as N.C. Gen. Stat. § 143-129(j).

IN WITNESS WHEREOF, the Parties hereto have executed this agreement on the day and date first above written in _____ counterparts, each of which shall without proof or accounting for other counterparts, be deemed an original contract.

Witness:

_____
Contractor: (Trade or Corporate Name)

_____
(Proprietorship or Partnership)

By: _____

Title: _____
(Owner, Partner, or Corp. Pres. or Vice Pres. only)

Attest: (Corporation)

By: _____

Title: _____
(Corp. Sec. or Asst. Sec. only)

The State of North Carolina through*

(CORPORATE SEAL)

_____
(Agency, Department or Institution)

Witness:

_____

By: _____

Title: _____

FORM OF PERFORMANCE BOND

Date of Contract: _____

Date of Execution: _____

Name of Principal (Contractor) _____

Name of Surety: _____

Name of Contracting Body: _____

Amount of Bond: _____

Project

KNOW ALL MEN BY THESE PRESENTS, that we, the principal and surety above named, are held and firmly bound unto the above named contracting body, hereinafter called the contracting body, in the penal sum of the amount stated above for the payment of which sum well and truly to be made, we bind, ourselves, our heirs, executors, administrators, and successors, jointly and severally, firmly by these presents.

THE CONDITION OF THIS OBLIGATION IS SUCH, that whereas the principal entered into a certain contract with the contracting body, identified as shown above and hereto attached:

NOW, THEREFORE, if the principal shall well and truly perform and fulfill all the undertakings, covenants, terms, conditions and agreements of said contract during the original term of said contract and any extensions thereof that may be granted by the contracting body, with or without notice to the surety, and during the life of any guaranty required under the contract, and shall also well and truly perform and fulfill all the undertakings, covenants, terms, conditions and agreements of any and all duly authorized modifications of said contract that may hereafter be made, notice of which modifications to the surety being hereby waived, then, this obligation to be void; otherwise to remain in full force and virtue.

IN WITNESS WHEREOF, the above-bounden parties have executed this instrument under their several seals on the date indicated above, the name and corporate seal of each corporate party being hereto affixed and these presents duly signed by its undersigned representative, pursuant to authority of its governing body.

Executed in _____ counterparts.

Witness:

_____
Contractor: (Trade or Corporate Name)

_____
(Proprietorship or Partnership)

By: _____

Attest: (Corporation)

Title: _____
(Owner, Partner, or Corp. Pres. or Vice Pres. only)

By: _____

Title: _____
(Corp. Sec. or Asst. Sec. only)

(Corporate Seal)

_____
(Surety Company)

Witness:

By: _____

_____

Title: _____
(Attorney in Fact)

Countersigned:

_____

(Surety Corporate Seal)

_____
(N.C. Licensed Resident Agent)

_____

_____
Name and Address-Surety Agency

_____

_____
Surety Company Name and N.C. Regional or Branch Office Address

FORM OF PAYMENT BOND

Date of Contract: _____

Date of Execution: _____

Name of Principal (Contractor) _____

Name of Surety: _____

Name of Contracting Body: _____

Amount of Bond: _____

Project _____

KNOW ALL MEN BY THESE PRESENTS, that we, the principal and surety above named, are held and firmly bound unto the above-named contracting body, hereinafter called the contracting body, in the penal sum of the amount stated above for the payment of which sum well and truly to be made, we bind ourselves, our heirs, executors, administrators, and successors, jointly and severally, firmly by these presents.

THE CONDITION OF THIS OBLIGATION IS SUCH, that whereas the principal entered into a certain contract with the contracting body identified as shown above and hereto attached:

NOW, THEREFORE, if the principal shall promptly make payment to all persons supplying labor/material in the prosecution of the work provided for in said contract, and any and all duly authorized modifications of said contract that may hereafter be made, notice of which modifications to the surety being hereby waived, then this obligation to be void; otherwise to remain in full force and virtue.

IN WITNESS WHEREOF, the above-bounden parties have executed this instrument under their several seals on the date indicated above, the name and corporate seal of each corporate party being hereto affixed and these presents duly signed by its undersigned representative, pursuant to authority of its governing body.

Executed in _____ counterparts.

Witness:

_____
(Proprietorship or Partnership)

Attest: (Corporation)

By: _____

Title: _____
(Corp. Sec. or Asst. Sec.. only)

(Corporate Seal)

_____
Contractor: (Trade or Corporate Name)

By: _____

Title_____
(Owner, Partner, or Corp. Pres. or Vice Pres. only)

_____
(Surety Company)

Witness:

_____

By: _____

Title: _____
(Attorney in Fact)

Countersigned:

_____

_____
(N.C. Licensed Resident Agent)

_____

_____
Name and Address-Surety Agency

_____

_____
Surety Company Name and N.C.
Regional or Branch Office Address

(Surety Corporate Seal)

Sheet for Attaching Power of Attorney

Sheet for Attaching Insurance Certificates

APPROVAL OF THE ATTORNEY GENERAL

CERTIFICATION BY THE OFFICE OF STATE BUDGET AND MANAGEMENT

Provision for the payment of money to fall due and payable by the

_____

under this agreement has been provided for by allocation made and is available for the purpose of carrying out this agreement.

This _____day of _____ 20___.

Signed _____
Budget Officer

STATE OF NORTH CAROLINA
COUNTY SALES AND USE TAX REPORT
SUMMARY TOTALS AND CERTIFICATION

CONTRACTOR: _____ Page __1____ of _____

PROJECT: _____ FOR PERIOD: _____

	TOTAL FOR COUNTY OF:	TOTAL FOR COUNTY OF:	TOTAL FOR COUNTY OF:	TOTAL FOR COUNTY OF:	TOTAL FOR COUNTY OF:	TOTAL FOR COUNTY OF:	TOTAL ALL COUNTIES
CONTRACTOR							
SUBCONTRACTOR(S)*							
COUNTY TOTAL							

* Attach subcontractor(s) report(s)
** Must balance with Detail Sheet(s)

I certify that the above figures do not include any tax paid on supplies, tools and equipment which were used to perform this contract and only includes those building materials, supplies, fixtures and equipment which actually became a part of or annexed to the building or structure. I certify that, to the best of my knowledge, the information provided here is true, correct, and complete.

Sworn to and subscribed before me,

This the _____ day of _____, 20____

_____
Signed

_____
Notary Public

_____
Print or Type Name of Above

My Commission Expires: _____

Seal

NOTE:
This certified statement may be subject to audit.

STATE OF NORTH CAROLINA
SALES AND USE TAX REPORT DETAIL

CONTRACTOR: _____

SUBCONTRACTOR _____ FOR PERIOD: _____

PROJECT: _____

PURCHASE DATE	VENDOR NAME	INVOICE NUMBER	TYPE OF PROPERTY	INVOICE TOTAL	COUNTY TAX PAID	COUNTY OF SALE *
				$	$	
				TOTAL:	$	

* If this is an out-of-state vendor, the County of Sale should be the county to which the merchandise was shipped.