ENCSD MAYFIELD HALL
HVAC UPGRADES

WILSON, NORTH CAROLINA

SCO# 22-24314-01A
PDC PROJECT #22035

JUNE 2023

Prepared by
Progressive Design Collaborative, Ltd.
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ENCSD MAYFIELD
SCO# 22-24314-01A

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DIVISION 09 - FINISHES

DIVISION 23 - HEATING, VENTILATING, AND AIR-CONDITIONING (HVAC)

DIVISION 26 - ELECTRICAL

ADVERTISEMENT FOR BIDS

Sealed proposals will be received until 2:00 PM on Thursday, July 13, 2023, to the attention of Jon D. Long, Eastern NC School for the Deaf, MASSEY BUILDING, 1311 U.S. Hwy 301 N, Wilson, NC 27893 for the construction of EASTERN NC SCHOOL FOR THE DEAF, MAYFIELD HALL HVAC UPGRADES, WILSON, NC SCO# 22-24314-01 at which time and place bids will be opened and read.

Pre-Bid Meeting will be at 10:30am on Monday, June 26th, 2023 at the Massey Building Game Room at the ENCSD campus.

All visitors nust check in at the Woodard Admin Building (1st building on the left) prior to the Pre-Bid.

Please bring a valid driver's license and arrive 15 minutes early.

Complete plans and specifications for this project can be obtained from Department of Public Instruction, Progressive Design Collaborative, Ltd. and HUBSCO.

Plan Deposit $250.00

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

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

Sealed proposals will be received by the School Planning Section NC Department of Public Instruction Raleigh, NC, to the attention of Jon D. Long, Eastern NC School for the Deaf, MASSEY BUILDING, 1311 U.S. Hwy 301 N, Wilson, NC 27893 up to *2:00pm on Thursday, July 13 2023* and immediately thereafter publicly opened and read for the furnishing of labor, material and equipment entering into the construction of

EASTERN NC SCHOOL FOR THE DEAF
MAYFIELD HALL HVAC UPGRADES
WILSON, NC
SCO# 22-24314-01

The project includes: Providing 4 new split system heat pumps above the existing lay-in ceiling. Remove existing HVAC systems as noted.

Bids will be received for Single prime - All proposals shall be lump sum.

Pre-Bid Meeting

An open pre-bid meeting will be held for all interested bidders on *Monday, June 26, 2023 at 10:30am* The meeting will address project specific questions, issues, bidding procedures and bid forms.

Complete plans, specifications and contract documents will be open for inspection in the offices of Department of Public Instruction and Progressive Design Collaborative, Ltd. and HUBSCO.

Or may be obtained by those qualified as prime bidders, upon deposit of $250.00 in cash or certified check. The full plan deposit will be returned to those bidders provided all documents are returned in good, usable condition within ten (10) days after the bid date.

NOTE: 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.

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_____

NOTE--SINGLE PRIME CONTRACTS: 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. **EXCEPT**: 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:	Owner:
Progressive Design Collaborative, Ltd.	*NC Department of Public Instruction*
3101 Poplarwood Court, Suite 320 *Raleigh, NC 27604*	
919-790-9989	

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

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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.

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: _____

SUPPLEMENTARY GENERAL CONDITIONS

TIME OF COMPLETION

The Contractor shall commence work to be performed under this Contract on a date to be specified in written order from the Designer/Owner and shall fully complete all work hereunder within 180 consecutive calendar days from the Notice to Proceed. For each day in excess of the above number of days, the Contractor shall pay the Owner the amount of Two Hundred Fifty Dollars ($ 250) as liquidated damages reasonably estimated in advance to cover the losses to be incurred by the Owner should the Contractor fail to complete the Work within the time specified.

Understanding the current and ongoing issues related to the national supply chain issues, the Owner offers the following procedure related to this project. The Owner intends to offer a contract and a Notice to Proceed as soon as possible post bid. This will allow the Contractor the ability to commence subcontracts for materials and equipment immediately. The contractor will then develop a construction schedule once buy out is complete and the contractor will be given additional Contract Time as part of a no-cost Change Order to accommodate the final agreed upon schedule. It is anticipated the buy out period will take no longer than 60 days.

If the Contractor is delayed at anytime in the progress of his work by any act or negligence of the Owner, his employees or his 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 days following the cause for delay. 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.

PRE-BID CONFERENCE

Meeting: On Monday, June 26, 2023, a MANDATORY Pre-bid meeting will be held at the Massey Building Game Room at Eastern NC School for the Deaf, 1311 US 301, Wilson, NC at 10:30am for all interested parties.

CONTRUCTION SCHEDULE

The Contractor shall commence work to be performed under this Contract on a date to be specified in written order from the Designer/Owner and shall fully complete all work hereunder within one hundred eighty (180) consecutive calendar days from the Notice to Proceed.

PAYMENTS

The Owner will use e-procurement for all payments to be made to the contractor. The contractor shall carry any fees required in his bid. The Owner will make two payments at the beginning of the shutdown after material is onsite and after final inspection and close-out material is provided and accepted.

REMEDIES FOR BREACH

The Owner reserves all rights and privileges under the applicable laws and regulations with respect to this Agreement in the event of breach of contract by either party.

TERMINATION FOR CAUSE AND FOR CONVENIENCE BY OWNER.

The Owner reserves the right to immediately terminate this Agreement in the event of a breach or default of the agreement by Contractor, in the event Contractor fails to: (1) meet schedules, deadlines, and/or delivery dates within the time specified by this Agreement and/or an IPPA; (2) make any payments owed; or (3) otherwise perform in accordance with the Agreement and/or the IPPA. The Owner also reserves the right to terminate the Agreement immediately, with written notice to Contractor, for convenience, if the Owner believes, in its sole discretion that it is in the best interest of the Owner to do so. The Contractor will

be compensated for work performed and accepted and goods accepted by the Owner as of the termination date if the Agreement is terminated for convenience of the Owner. The award of this Agreement is not exclusive and the Owner reserves the right to purchase goods and services from other vendors when it is in the best interest of the Owner.

EQUAL EMPLOYMENT OPPORTUNITY.

Except as otherwise provided under 41 CFR Part 60, when funds will be expended by the Owner pursuant to this Agreement that meet the definition of "federally assisted construction contract" in 41 CFR Part 60-1.3, Contractor certifies it will comply with the equal opportunity clause provided under 41 CFR 60-1.4(b), in accordance with Executive Order 11246, "Equal Employment Opportunity" (30 FR 12319, 12935, 3 CFR Part, 1964-1965 Comp., p. 339), as amended by Executive Order 11375, "Amending Executive Order 11246 Relating to Equal Employment Opportunity," and implementing regulations at 41 CFR part 60, "Office of Federal Contract Compliance Programs, Equal Employment Opportunity, Department of Labor."

DAVIS-BACON ACT, AS AMENDED (40 U.S.C. 3141-3148).

During the term of this Agreement, including any IPPAs issued pursuant to this Agreement, the Contractor certifies it will be in compliance with all applicable Davis-Bacon Act provisions. In accordance with the statute, Contractor shall pay wages to laborers and mechanics at a rate not less than the prevailing wages specified in a wage determination made by the Secretary of Labor. In addition, the Contractor shall pay wages not less than once a week, unless employees voluntarily agree to a different schedule. The Owner will report all suspected or reported violations to the Federal awarding agency. Contractor certifies it will comply with the Copeland "Anti-Kickback" Act (40 U.S.C. 3145), as supplemented by Department of Labor regulations (29 CFR Part 3, "Contractors and Subcontractors on Public Building or Public Work Financed in Whole or in Part by Loans or Grants from the United States"). The Act provides that each vendor or subrecipient must be prohibited from inducing, by any means, any person employed in the construction, completion, or repair of public work, to give up any part of the compensation to which he or she is otherwise entitled. The Owner will report all suspected or reported violations to the Federal awarding agency.

CONTRACT WORK HOURS AND SAFETY STANDARDS ACT (40 U.S.C. 3701-3708).

The Contractor certifies that during the term of an award for all contracts in excess of $100,000 that involve the employment of mechanics or laborers, the Contractor will be in compliance with all applicable provisions of the Contract Work Hours and Safety Standards Act. Under 40 U.S.C. 3702 of the Act, each vendor must be required to compute the wages of every mechanic and laborer on the basis of a standard work week of 40 hours. Work in excess of the standard work week is permissible provided that the worker is compensated at a rate of not less than one and a half times the basic rate of pay for all hours worked in excess of 40 hours in the work week. The requirements of 40 U.S.C. 3704 are applicable to construction work and provide that no laborer or mechanic must be required to work in surroundings or under working conditions which are unsanitary, hazardous or dangerous. These requirements do not apply to the purchases of supplies or materials or articles ordinarily available on the open market, or contracts for transportation or transmission of intelligence.

RIGHTS TO INVENTIONS MADE UNDER A CONTRACT OR AGREEMENT.

If the Federal award meets the definition of "funding agreement" under 37 CFR §401.2 (a) and Contractor wishes to enter into a contract with a small business firm or nonprofit organization regarding the substitution of parties, assignment or performance of experimental, developmental, or research work under that "funding agreement," Contractor agrees to comply with the requirements of 37 CFR Part 401, "Rights to Inventions Made by Nonprofit Organizations and Small Business Firms Under Government Grants, Contracts and Cooperative Agreements," and any implementing regulations issued by the awarding agency.

CLEAN AIR ACT (42 U.S.C. 7401-7671Q.) AND THE FEDERAL WATER POLLUTION CONTROL ACT (33 U.S.C. 1251-1387) COMPLIANCE.

The Contractor certifies that during the term of an award for all contracts by the Owner associated with this Agreement in excess of $150,000, the Contractor agrees to comply with all applicable standards, orders or regulations issued pursuant to the Clean Air Act (42 U.S.C. 7401-7671q) and the Federal Water Pollution

Control Act as amended (33 U.S.C. 1251- 1387). Violations must be reported to the Federal awarding agency and the Regional Office of the Environmental Protection Agency (EPA).

DEBARMENT AND SUSPENSION.

Contractor certifies that during the term of an award for all contracts by the Owner associated with this Agreement, the Contractor certifies that neither it nor its principals is presently debarred, suspended, proposed for debarment, declared ineligible, or voluntarily excluded from participation by any federal department or agency.

COMPLIANCE WITH BYRD ANTI-LOBBYING AMENDMENT (31 U.S.C. 1352).

When federal funds are expended by the Owner for a contract exceeding $100,000, the Contractor certifies that during the term and after the awarded term of all contracts by the Owner associated with this Agreement, the Contractor certifies that it is in compliance with all applicable provisions of the Byrd Anti-Lobbying Amendment (31 U.S.C. 1352). The Contractor further certifies that:

No Federal appropriated funds have been paid or will be paid for on behalf of the Contractor, to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of congress, or an employee of a Member of Congress in connection with the awarding of a Federal contract, the making of a Federal grant, the making of a Federal loan, the entering into a cooperative agreement, and the extension, continuation, renewal, amendment, or modification of a Federal contract, grant, loan, or cooperative agreement.

If any funds other than Federal appropriated funds have been paid or will be paid to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of congress, or an employee of a Member of Congress in connection with this Federal grant or cooperative agreement, the undersigned shall complete and submit Standard Form-LLL, “Disclosure Form to Report Lobbying”, in accordance with its instructions.

The Contractor shall require that the language of this certification be included in the award documents for all covered sub-awards exceeding $100,000 in Federal funds at all appropriate tiers and that all subrecipients shall certify and disclose accordingly.

COMPLIANCE WITH SOLID WASTE DISPOSAL ACT.

In the event the Agreement involves the purchase of more than $10,000 in items designed by guidelines of the Environmental Protection Agency at 40 C.F.R. Part 247, Contractor agrees to comply with the requirements of section 6002 of the Solid Waste Disposal Act. In particular, the Contractor certifies that the percentage of recovered materials to be used in the performance of the Agreement will be at least the amount required by applicable specifications or other contractual requirements.

PROHIBITION ON CERTAIN TELECOMMUNICATIONS AND VIDEO SURVEILLANCE SERVICES OR EQUIPMENT.

As detailed in 2 CFR § 200.216, Contractor certifies that any equipment, services, or systems provided through this Agreement shall not use covered telecommunications equipment or services as a substantial or essential component of a system or as part of any system.

DOMESTIC PREFERENCE.

As detailed in 2 CFR § 200.322, as appropriate and to the extent consistent with law, Contractor certifies that, to the greatest extent practicable, the goods, products, or materials furnished through this award will be produced in the United States (including but not limited to iron, aluminum, steel, cement, and other manufactured products).

RECORDS RETENTION REQUIREMENTS

The Contractor certifies that it will comply with the record retention requirements detailed in 2 CFR § 200.334. The Contractor further certifies that Contractor will retain all records as required by 2 CFR § 200.334 for a period of three years after grantees or subgrantees submit final expenditure reports or quarterly or annual financial reports, as applicable, and all other pending matters are closed.

CERTIFICATION OF NON-COLLUSION STATEMENT.

Contractor certifies under penalty of perjury that its response to this procurement solicitation is in all respects bona fide, fair, and made without collusion or fraud with any person, joint venture, partnership, corporation or other business or legal entity.

PROHIBITION ON GIFTS.

Contractor certifies that it will comply with the prohibition against giving gifts, gratuities, favors or anything of monetary value to an officer, employee or agent of the School System. Contractor understands and agrees that violation of these standards will result in termination of the Agreement and may result in ineligibility for future contract awards.

In witness whereof, each individual executing this agreement acknowledges that he/she/it is authorized to execute this agreement on behalf of his/her/its principle and further acknowledges the execution of this agreement the day and year first written above.

PROJECT STORAGE

The contractor must store equipment in a bonded warehouse prior to installation. Prior to contractor receiving the new equipment, the existing building must remain operational.

UTILITIES

Contractor may use existing utilities and facilities at no additional costs. Owner will provide multiple parking spaces at building.

SECURITY

Please refer to the ENCSD Work Restrictions “ATTACHMENT B” for school-specific restrictions.

USE OF SITE

Refer to time of completion for work schedule information.

NO SMOKING POLICY

The campus is a tobacco-free zone. This includes vaping.

PERFORMANCE AND PAYMENT BONDS

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 (Forms 307 & 308). An authorized agent of the bonding company who is licensed to do business in North Carolina shall countersign all bonds.

MINORITY BUSINESS PARTICIPATION

Refer to attached Minority Business Employment Requirements.

BID/ACCEPTANCE FORM

for

EASTERN NC SCHOOL FOR THE DEAF

MAYFIELD HALL HVAC UPGRADES

The project includes disconnecting the building from the existing steam supply and condensate return systems, providing four new split system heat pumps with electric heat and standalone controls, demolition of existing ceilings in areas to faciliate the work, new ceilings in areas where ceiling is required to be removed, patching holes in exterior walls where thru-the-wall AC units are removed, and minor patching and painting. The building electrical service will also be upgraded to support the additional HVAC load.

We are in receipt of

Addendum 1 _____ Addendum 2 _____ Addendum 3 _____

Addendum 4 _____ Addendum 5 _____ Addendum 6 _____

The undersigned, as bidder, proposes and agrees if this bid is accepted to contract with the State of North Carolina through NC Department of Public Instruction for the furnishing of all materials, equipment, and labor necessary to complete the construction of the work described in these documents in full and complete accordance with plans, specifications, and contract documents, and to the full and entire satisfaction of the Owner for the sum of:

BASE BID: _____Dollars $_____

ALTERNATE 1: REMOVAL AND REPLACEMENT OF CEILING AS NOTED ON DWGS

Dollars $_____

_____ _____

General Subcontractor License #:

_____ _____

Electrical Subcontractor License #:

Respectively submitted this _____ day of _____ 202_

_____

(Contractor's Name)

By:

Title: _____(Owner, partner, corp. Pres. Or Vice President)

Address:

Email Address:

(Corporate Seal)

License #:

Title:

ACCEPTED by _____

Total amount of accepted by the owner: _____

TITLE:

END OF SECTION

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 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:

_____
(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)

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:

_____
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

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

Sheet for Attaching Power of Attorney

Sheet for Attaching Insurance Certificates

APPROVAL OF THE ATTORNEY GENERAL

ATTACHMENT 'B'

ENCSD Work Restrictions

Nature of the Facilities

The Eastern North Carolina School for the Deaf (ENCSD) campus serves as the home as the state school for the deaf. As such, the entire ENCSD campus is classified as a school zone. The school is a residential school, with students on campus overnight from Sunday night until Friday during the school year. The contractor should always be aware while working and traveling around campus most students and some staff may not hear a vehicle approaching or equipment operating. Thus it is imperative each contractor take precautions to ensure the safety of those on campus during the work.

Patient/Student/Client Contact:

All contractors are always to behave in a professional manner. The contractors shall refrain from yelling or loud speech. The playing of music is prohibited.

Contractor should always carry a picture identification and shall either have ID visible or a company uniform (hat, hard hat or soft shirt) that clearly identifies that employee is working on this project. Likewise, contractor vehicles should be identifiable by company name with vehicle mounted signage or an 8 1/2" x 11" placard on the dashboard.

The contractor foreman shall check into the main desk at Woodard Hall at the commencement of work each day and provide the receptionist a list of all workers on site for that day. The foreman is responsible to ensure all workers have vacated the campus at the end of the workday and all work areas are secured.

Prohibited Items or Actions:

Violation of any of the following items will result in immediate discharge from the Campus and may result in criminal prosecution.

Do not tell anyone, or even acknowledge the presence of a student or adult client that you may recognize on this campus.

Do not give, take buy or accept anything from students or clients (example: cigarette, matches, money, food, etc..).

Do not bring any weapons, alcohol, or drugs on ENCSD campus.

Do not transport students or adult clients anywhere.

Do not photograph adult clients or students.

Per NCGS 14-208.18 registered sex offenders are not to be on campus unless meeting specific exceptions of the statute.

Do not assault anyone here (even if someone follows you here). Due to the type of facility, and the location the status may change the seriousness of the crime.

Do not communicate (verbally, non-verbally, written or electronically with students or adult clients.

Do not harass state or county employees

Direct communication with students and staff should only occur in the event of an imminent life threatening emergency.

If there is an interaction between a vehicle with a student or adult they should have right of way. Give them time to evaluate the decision. If necessary, signal to let them know they are clear to proceed.

Dress Code

All contractors should be appropriately dressed in work clothes and shoes considering safety and the work they are performing. At no time should shirts be removed. Persons with inappropriate clothing and or with inflammatory markings will be asked to change immediately or leave the site.

Smoking

ENCSD is a tobacco-free campus. Smoking and the use of tobacco related products is forbidden on campus.

Safety

The contractor is fully responsible for ensuring a safe worksite is maintained at all times.

The ENCSD Safety Officer(s) are obligated by accreditation, standards and related safety laws, to inspect the perimeter of all work sites for safety and security of students, adult clients and staff on a random basis. The Safety Officer may also inspect inside a work site if it is a patient or staff occupied building. If the Safety Officer or other staff determine that a dangerous safety violation exist (Examples: ladder left unattended, no required fencing around construction work area, equipment left unattended in vehicles or job site) he is obligated to report to appropriate ENCSD staff. Safety Officer may stop a construction activity immediately if violation is considered a threat to life.

All contractors, subcontractors and support staff are expected to follow OSHA Safety Guidelines fully and without exception.

Prime contractors shall be responsible to inform all subcontractors' and support staff of safety guidelines.

All demolition/abatement activities in occupied areas shall follow all applicable standards.

All ladders, scaffolds and lift type equipment used outside a secured area shall have a person standing at the base to prevent unauthorized use.

Building shall be secured from unauthorized entry at all times.

Fencing shall be required around storage and staging areas. Fence shall be a minimum of 4' high.

Trenches shall not be left unattended unless properly marked and protected.

Trenches shall not be left open overnight without Owner's approval.

Always lock secured doors/gates behind you after you pass through. Any keys for contractors will be assigned by Central Regional Maintenance Office. At owner shall be provided access to the building in at least point...

Debris shall be removed in a timely manner in contractor provided containers. 3 feet inside perimeter of fence shall be debris free.

Tools and Equipment

Hand tools powered and non-powered shall be inside of work area or staging area and secured when leaving site.

Tools outside staging area shall be locked in vehicles, storage trailers and tool boxes.

Do not leave tools, sharp objects, small metals, and glass in unsecured trucks.

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.

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 _____

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 _____

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 00 52 00 - BID/ACCEPTANCE FORM

for

EASTERN NC SCHOOL FOR THE DEAF

MAYFIELD HALL HVAC UPGRADES

The project includes disconnecting the building from the existing steam supply and condensate return systems, providing four new split system heat pumps with electric heat and standalone controls, demolition of existing ceilings in areas to faciliate the work, new ceilings in areas where ceiling is required to be removed, patching holes in exterior walls where thru-the-wall AC units are removed, and minor patching and painting. The building electrical service will also be upgraded to support the additional HVAC load.

We are in receipt of

Addendum 1 _____ Addendum 2 _____ Addendum 3 _____

Addendum 4 _____ Addendum 5 _____ Addendum 6 _____

The undersigned, as bidder, proposes and agrees if this bid is accepted to contract with the State of North Carolina through NC Department of Public Instruction for the furnishing of all materials, equipment, and labor necessary to complete the construction of the work described in these documents in full and complete accordance with plans, specifications, and contract documents, and to the full and entire satisfaction of the Owner for the sum of:

BASE BID: _____ Dollars $_____

ALTERNATE 1: REMOVAL & REPLACEMENT OF CEILING AS NOTED ON DWGS__

_____ Dollars $_____

ALTERNATE 2: OWNER PREFERRED BRAND OF DOOR HARDWARE - SCHLAGE

_____ Dollars $_____

_____ _____

General Subcontractor License #:

_____ _____

Electrical Subcontractor License #:

Respectively submitted this _____ day of _____ 202_

_____

(Contractor's Name)

By:

Title: _____(Owner, partner, corp. Pres. Or Vice President)

Address:

Email Address:

(Corporate Seal)

License #:

Title:

ACCEPTED by _____

Total amount of accepted by the owner: _____

TITLE:

END OF SECTION 00 52 00

Section 01 10 00 - Summary

PART 1 GENERAL

CONTRACT DESCRIPTION

Contract Type: A single prime contract based on a Stipulated Price as described in Document 00 52 00 - Agreement Form.

OWNER OCCUPANCY

Owner will not occupy building until all work is complete and accepted by SCO.

CONTRACTOR USE OF SITE AND PREMISES

Arrange use of site and premises to allow:

Owner occupancy.

Provide access to and from site as required by law and by Owner:

Emergency Building Exits During Construction: Keep all exits required by code open during construction period; provide temporary exit signs if exit routes are temporarily altered.

Do not obstruct roadways, sidewalks, or other public ways without permit.

Utility Outages and Shutdown:

Limit disruption of utility services to hours the building is unoccupied.

Do not disrupt or shut down life safety systems, including but not limited to fire sprinklers and fire alarm system, without 7 days notice to Owner and authorities having jurisdiction.

The Contractor is delegated all owner responsibilities for fire protection required by 2018 NC Fire Code Chapter 3308, including establishment of fire prevention program and identification of fire protection superintendent.

Prevent accidental disruption of utility services to other facilities.

END OF SECTION 01 10 00

SECTION 01 20 00
PRICE AND PAYMENT PROCEDURES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Procedures for preparation and submittal of applications for progress payments.

B. Documentation of changes in Contract Sum and Contract Time.

C. Procedures for preparation and submittal of application for final payment.

1.02 SCHEDULE OF VALUES

A. Use Schedule of Values Form: AIA G703.

B. Electronic media printout including equivalent information will be considered in lieu of standard form specified; submit draft to Architect for approval.

C. Forms filled out by hand will not be accepted.

D. Submit Schedule of Values in duplicate within 20 days after date of Owner-Contractor Agreement.

E. Format: Utilize the Table of Contents of this Project Manual. Identify each line item with number and title of the specification section. Identify site mobilization.

F. Revise schedule to list approved Change Orders, with each Application For Payment.

1.03 APPLICATIONS FOR PROGRESS PAYMENTS

A. Payment Period: Submit at intervals stipulated in the General and Supplementary Conditions.

B. Use Form AIA G702 and Form AIA G703.

C. Forms filled out by hand will not be accepted.

D. Execute certification by signature of authorized officer.

E. Use data from approved Schedule of Values. Provide dollar value in each column for each line item for portion of work performed and for stored products.

F. List each authorized Change Order as a separate line item, listing Change Order number and dollar amount as for an original item of work.

G. Submit one electronic and three hard-copies of each Application for Payment.

H. Include the following with the application:
   1. Transmittal letter as specified for submittals in Section 01 30 00.
   2. Construction progress schedule, revised and current as specified in Section 01 30 00.
   3. State Tax form if required

1.04 MODIFICATION PROCEDURES

A. For minor changes not involving an adjustment to the Contract Sum or Contract Time, Architect will issue instructions directly to Contractor.

B. For changes for which advance pricing is desired, Architect will issue a document that includes a detailed description of a proposed change with supplementary or revised drawings and specifications, a change in Contract Time for executing the change with a stipulation of any overtime work required and the period of time during which the requested price will be considered valid. Contractor shall prepare and submit a fixed price quotation within 7 days.

C. Computation of Change in Contract Amount: As specified in the Agreement and Conditions of the Contract.

1.05 APPLICATION FOR FINAL PAYMENT

A. Prepare Application for Final Payment as specified for progress payments, identifying total adjusted Contract Sum, previous payments, and sum remaining due.

B. Application for Final Payment will not be considered until the following have been accomplished:
   1. All closeout procedures specified in Section 01 70 00.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION 01 20 00

SECTION 01 23 00
ALTERNATES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. ALTERNATE 1: REMOVAL & REPLACEMENT OF CEILING AS NOTED ON DWGS

B. ALTERNATE 2: OWNER PREFERRED BRAND OF DOOR HARDWARE - SCHLAGE

C. Procedures for pricing Alternates.

1.02 ACCEPTANCE OF ALTERNATES

A. Alternates quoted on Bid Forms will be reviewed and accepted or rejected at Owner's option. Accepted Alternates will be identified in the Owner-Contractor Agreement.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION 01 23 00

SECTION 01 25 00
SUBSTITUTION PROCEDURES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Procedural requirements for proposed substitutions.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 GENERAL REQUIREMENTS

A. A Substitution Request for products, assemblies, materials, and equipment constitutes a representation that the submitter:
   1. Has investigated proposed product and determined that it meets or exceeds the quality level of the specified product, equipment, assembly, or system.
   2. Agrees to provide the same warranty for the substitution as for the specified product.
   3. Agrees to coordinate installation and make changes to other work that may be required for the work to be complete, with no additional cost to Owner.
   4. Waives claims for additional costs or time extension that may subsequently become apparent.

B. Document each request with complete data substantiating compliance of proposed substitution with Contract Documents. Burden of proof is on proposer.

C. Content: Include information necessary for tracking the status of each Substitution Request, and information necessary to provide an actionable response.
   1. Forms indicated in the Project Manual are adequate for this purpose, and must be used.

D. Limit each request to a single proposed substitution item.
   1. Submit an electronic document, combining the request form with supporting data into single document.

3.02 SUBSTITUTION PROCEDURES DURING PROCUREMENT

A. Submittal Form (before award of contract):
   1. Submit substitution requests by completing the form attached to this section. See this form for additional information and instructions. Use only this form; other forms of submission are unacceptable.

B. Owner will consider requests for substitutions only if submitted at least 10 days prior to the date for receipt of bids.

3.03 RESOLUTION

A. Architect may request additional information and documentation prior to rendering a decision. Provide this data in an expeditious manner.

B. Architect will notify Contractor in writing of decision to accept or reject request.

3.04 ACCEPTANCE

A. Accepted substitutions change the work of the Project. They will be documented and incorporated into work of the project by Change Order, Construction Change Directive, Architectural Supplementary Instructions, or similar instruments provided for in the Conditions of the Contract.

END OF SECTION 01 25 00

SECTION 01 30 00
ADMINISTRATIVE REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. General administrative requirements.

B. Preconstruction meeting.

C. Progress meetings.

D. Construction progress schedule.

E. Submittals for review, information, and project closeout.

F. Number of copies of submittals.

G. Requests for Interpretation (RFI) procedures.

H. Submittal procedures.

1.02 GENERAL ADMINISTRATIVE REQUIREMENTS

A. Comply with requirements of Section 01 70 00 - Execution and Closeout Requirements for coordination of execution of administrative tasks with timing of construction activities.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 PRECONSTRUCTION MEETING

A. Architect will schedule a meeting after Construction Contracts are finalized.

B. Attendance Required:
   1. Owner.
   2. Architect.
   3. Contractor.

C. Agenda:
   1. Execution of Owner-Contractor Agreement.
   2. Submission of executed bonds and insurance certificates.
   3. Distribution of Contract Documents.
   4. Submission of list of subcontractors, list of products, schedule of values, and progress schedule.
   5. Designation of personnel representing the parties to Contract and Engineer.
   6. Procedures and processing of field decisions, submittals, substitutions, applications for payments, proposal request, Change Orders, and Contract closeout procedures.
   7. Scheduling.

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

3.02 PROGRESS MEETINGS

A. Schedule and administer meetings throughout progress of the work at maximum bi-monthly intervals.

B. Make arrangements for meetings, prepare agenda with copies for participants, preside at meetings.

C. Attendance Required:
   1. Contractor.
   2. Owner.
   3. Architect.
   4. Contractor's superintendent.
   5. Major subcontractors.

D. Agenda:
   1. Review minutes of previous meetings.

2. Review of work progress.
3. Field observations, problems, and decisions.
4. Identification of problems that impede, or will impede, planned progress.
5. Review of submittals schedule and status of submittals.
6. Maintenance of progress schedule.
7. Corrective measures to regain projected schedules.
8. Planned progress during succeeding work period.
9. Maintenance of quality and work standards.
10. Effect of proposed changes on progress schedule and coordination.
11. Other business relating to work.

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

3.03 CONSTRUCTION PROGRESS SCHEDULE - SEE SECTION 01 32 16

A. Within 10 days after date of the Agreement, submit preliminary schedule defining planned operations for the first 60 days of work, with a general outline for remainder of work.

3.04 SUBMITTALS FOR REVIEW

A. When the following are specified in individual sections, submit them for review:
1. Product data.
2. Shop drawings.
3. Samples for selection.
4. Samples for verification.

B. Submit to Architect for review for the limited purpose of checking for compliance with information given and the design concept expressed in Contract Documents.

C. Samples will be reviewed for aesthetic, color, or finish selection.

D. After review, provide copies and distribute in accordance with SUBMITTAL PROCEDURES article below and for record documents purposes described in Section 01 78 00 - Closeout Submittals.

3.05 SUBMITTALS FOR INFORMATION

A. When the following are specified in individual sections, submit them for information:
1. Design data.
2. Certificates.
3. Test reports.
4. Inspection reports.
5. Manufacturer's instructions.
6. Manufacturer's field reports.
7. Other types indicated.

B. Submit for Architect's knowledge as contract administrator or for Owner.

3.06 SUBMITTALS FOR PROJECT CLOSEOUT

A. Submit Correction Punch List for Substantial Completion.

B. Submit Final Correction Punch List for Substantial Completion.

C. When the following are specified in individual sections, submit them at project closeout in compliance with requirements of Section 01 78 00 - Closeout Submittals:
1. Project record documents.
2. Operation and maintenance data.
3. Warranties.
4. Bonds.
5. Other types as indicated.

D. Submit for Owner's benefit during and after project completion.

3.07 NUMBER OF COPIES OF SUBMITTALS

A. Electronic Documents: Submit one electronic copy in PDF format; an electronically-marked up file will be returned. Create PDFs at native size and right-side up; illegible files will be rejected.

1. PDFs are to be bookmarked with approriate sections.

B. Samples: Submit the number specified in individual specification sections; one of which will be retained by Architect.
   1. After review, produce duplicates.
   2. Retained samples will not be returned to Contractor unless specifically so stated.

3.08 SUBMITTAL PROCEDURES

A. General Requirements:
   1. Use a single transmittal for related items.
   2. Sequentially identify each item. For revised submittals use original number and a sequential numerical suffix.
   3. Identify: Project; Contractor; subcontractor or supplier; pertinent drawing and detail number; and specification section number and article/paragraph, as appropriate on each copy.
   4. Apply Contractor's stamp, signed or initialed certifying that review, approval, verification of products required, field dimensions, adjacent construction work, and coordination of information is in accordance with the requirements of the work and Contract Documents.
   5. Deliver each submittal on date noted in submittal schedule, unless an earlier date has been agreed to by all affected parties, and is of the benefit to the project.
      a. Send submittals in electronic format via email to Architect.
   6. Schedule submittals to expedite the Project, and coordinate submission of related items.
      a. For each submittal for review, allow 10 business days excluding delivery time to and from the Contractor.
      b. For sequential reviews involving Architect's consultants, Owner, or another affected party, allow an additional 7 days.
   7. Identify variations from Contract Documents and product or system limitations that may be detrimental to successful performance of the completed work.
   8. Provide space for Contractor and Architect review stamps.
   9. When revised for resubmission, identify all changes made since previous submission.

B. Shop Drawing Procedures:
   1. Prepare accurate, drawn-to-scale, original shop drawing documentation by interpreting Contract Documents and coordinating related work.
   2. Do not reproduce Contract Documents to create shop drawings.
   3. Generic, non-project-specific information submitted as shop drawings do not meet the requirements for shop drawings.

3.09 SUBMITTAL REVIEW

A. Submittals for Review: Architect will review each submittal, and approve, or take other appropriate action.

B. Submittals for Information: Architect will not acknowledge receipt, and take no other action.

C. Architect's actions will be reflected by marking each returned submittal using virtual stamp on electronic submittals.
   1. Notations may be made directly on submitted items and/or listed on appended Submittal Review cover sheet.

D. Architect's and consultants' actions on items submitted for review:
   1. Authorizing purchasing, fabrication, delivery, and installation:
      a. "Approved", or language with same legal meaning.
      b. "Approved as Noted, Resubmission not required", or language with same legal meaning.
         1) At Contractor's option, submit corrected item, with review notations acknowledged and incorporated.
         2) A corrected submittal shall be included in the closeout documents.
      c. "Approved as Noted, Resubmit for Record", or language with same legal meaning.
         1) Resubmit corrected item, with review notations acknowledged and incorporated. Resubmit separately, or as part of project record documents.
   2. Not Authorizing fabrication, delivery, and installation:
      a. "Revise and Resubmit".

1) Resubmit revised item, with review notations acknowledged and incorporated.

b. "Rejected".

1) Submit item complying with requirements of Contract Documents.

E. Architect's and consultants' actions on items submitted for information:

1. Items for which no action was taken:
   a. "Received" - to notify the Contractor that the submittal has been received for record only.
2. Items for which action was taken:
   a. "Reviewed" - no further action is required from Contractor.

END OF SECTION 01 30 00

SECTION 01 32 16
CONSTRUCTION PROGRESS SCHEDULE

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Preliminary schedule.

B. Construction progress schedule, bar chart type.

1.02 SUBMITTALS

A. Within 10 days after date of Agreement, submit preliminary schedule.

B. If preliminary schedule requires revision after review, submit revised schedule within 10 days.

C. Within 20 days after review of preliminary schedule, submit draft of proposed complete schedule for review.

D. Submit updated schedule with each Application for Payment.

1.03 SCHEDULE FORMAT

A. Listings: In chronological order according to the start date for each activity. Identify each activity with the applicable specification section number.

B. Diagram Sheet Size: Maximum 22 x 17 inches.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 PRELIMINARY SCHEDULE

A. Prepare preliminary schedule in the form of a horizontal bar chart.

3.02 CONTENT

A. Show complete sequence of construction by activity, with dates for beginning and completion of each element of construction.

B. Identify each item by specification section number.

C. Show accumulated percentage of completion of each item, and total percentage of Work completed, as of the first day of each month.

D. Provide legend for symbols and abbreviations used.

3.03 BAR CHARTS

A. Include a separate bar for each major portion of Work or operation.

B. Identify the first work day of each week.

3.04 UPDATING SCHEDULE

A. Maintain schedules to record actual start and finish dates of completed activities.

B. Indicate progress of each activity to date of revision, with projected completion date of each activity.

C. Annotate diagrams to graphically depict current status of Work.

D. Identify activities modified since previous submittal, major changes in Work, and other identifiable changes.

E. Indicate changes required to maintain Date of Substantial Completion.

F. Submit reports required to support recommended changes.

3.05 DISTRIBUTION OF SCHEDULE

A. Distribute copies of updated schedules to Contractor's project site file, to subcontractors, suppliers, Architect, Owner, and other concerned parties.

B. Instruct recipients to promptly report, in writing, problems anticipated by projections indicated in schedules.

END OF SECTION 01 32 16

SECTION 01 40 00
QUALITY REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. References and standards.

B. Control of installation.

C. Defect Assessment.

1.02 REFERENCES AND STANDARDS

A. For products and workmanship specified by reference to a document or documents not included in the Project Manual, also referred to as reference standards, comply with requirements of the standard, except when more rigid requirements are specified or are required by applicable codes.

B. Comply with reference standard of date of issue current on date of Contract Documents, except where a specific date is established by applicable code.

C. Obtain copies of standards where required by product specification sections.

D. Maintain copy at project site during submittals, planning, and progress of the specific work, until Substantial Completion.

E. Should specified reference standards conflict with Contract Documents, request clarification from Architect before proceeding.

F. Neither the contractual relationships, duties, or responsibilities of the parties in Contract nor those of Architect shall be altered from Contract Documents by mention or inference otherwise in any reference document.

PART 3 EXECUTION

2.01 CONTROL OF INSTALLATION

A. Monitor quality control over suppliers, manufacturers, products, services, site conditions, and workmanship, to produce work of specified quality.

B. Comply with manufacturers' instructions, including each step in sequence.

C. Should manufacturers' instructions conflict with Contract Documents, request clarification from Architect before proceeding.

D. Comply with specified standards as minimum quality for the work except where more stringent tolerances, codes, or specified requirements indicate higher standards or more precise workmanship.

E. Have work performed by persons qualified to produce required and specified quality.

F. Verify that field measurements are as indicated on shop drawings or as instructed by the manufacturer.

G. Secure products in place with positive anchorage devices designed and sized to withstand stresses, vibration, physical distortion, and disfigurement.

2.02 DEFECT ASSESSMENT

A. Replace Work or portions of the Work not complying with specified requirements.

END OF SECTION 01 40 00

SECTION 01 60 00
PRODUCT REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Transportation, handling, storage and protection.

B. Product option requirements.

C. Substitution limitations.

D. Maintenance materials, including extra materials, spare parts, tools, and software.

1.02 REFERENCE STANDARDS

A. NEMA MG 1 - Motors and Generators 2021.

1.03 SUBMITTALS

A. Product Data Submittals: Submit manufacturer's standard published data. Mark each copy to identify applicable products, models, options, and other data. Supplement manufacturers' standard data to provide information specific to this Project.

B. Shop Drawing Submittals: Prepared specifically for this Project; indicate utility and electrical characteristics, utility connection requirements, and location of utility outlets for service for functional equipment and appliances.

C. Sample Submittals: Illustrate functional and aesthetic characteristics of the product, with integral parts and attachment devices. Coordinate sample submittals for interfacing work.
   1. For selection from standard finishes, submit samples of the full range of the manufacturer's standard colors, textures, and patterns.

PART 2 PRODUCTS

2.01 NEW PRODUCTS

A. Provide new products unless specifically required or permitted by Contract Documents.

B. Use of products having any of the following characteristics is not permitted:
   1. Containing lead, cadmium, or asbestos.

C. Motors: Refer to Section 21 05 13 - Common Motor Requirements for Fire Suppression Equipment, NEMA MG 1 Type. Specific motor type is specified in individual specification sections.

2.02 PRODUCT OPTIONS

A. Products Specified by Reference Standards or by Description Only: Use any product meeting those standards or description.

B. Products Specified by Naming One or More Manufacturers: Use a product of one of the manufacturers named and meeting specifications, no options or substitutions allowed.

C. Products Specified by Naming One or More Manufacturers with a Provision for Substitutions: Submit a request for substitution for any manufacturer not named.

2.03 MAINTENANCE MATERIALS

A. Furnish extra materials, spare parts, tools, and software of types and in quantities specified in individual specification sections.

B. Deliver to Project site; obtain receipt prior to final payment.

PART 3 EXECUTION

3.01 SUBSTITUTION LIMITATIONS

A. See Section 01 25 00 - Substitution Procedures.

3.02 TRANSPORTATION AND HANDLING

A. Package products for shipment in manner to prevent damage; for equipment, package to avoid loss of factory calibration.

B. If special precautions are required, attach instructions prominently and legibly on outside of packaging.

C. Coordinate schedule of product delivery to designated prepared areas in order to minimize site storage time and potential damage to stored materials.

D. Transport and handle products in accordance with manufacturer's instructions.

E. Transport materials in covered trucks to prevent contamination of product and littering of surrounding areas.

F. Promptly inspect shipments to ensure that products comply with requirements, quantities are correct, and products are undamaged.

G. Provide equipment and personnel to handle products by methods to prevent soiling, disfigurement, or damage, and to minimize handling.

H. Arrange for the return of packing materials, such as wood pallets, where economically feasible.

3.03 STORAGE AND PROTECTION

A. Designate receiving/storage areas for incoming products so that they are delivered according to installation schedule and placed convenient to work area in order to minimize waste due to excessive materials handling and misapplication. See Section 01 74 19.

B. Store and protect products in accordance with manufacturers' instructions.

C. Store with seals and labels intact and legible.

D. Store sensitive products in weathertight, climate-controlled enclosures in an environment favorable to product.

E. For exterior storage of fabricated products, place on sloped supports above ground.

F. Protect products from damage or deterioration due to construction operations, weather, precipitation, humidity, temperature, sunlight and ultraviolet light, dirt, dust, and other contaminants.

G. Comply with manufacturer's warranty conditions, if any.

H. Cover products subject to deterioration with impervious sheet covering. Provide ventilation to prevent condensation and degradation of products.

I. Prevent contact with material that may cause corrosion, discoloration, or staining.

J. Provide equipment and personnel to store products by methods to prevent soiling, disfigurement, or damage.

K. Arrange storage of products to permit access for inspection. Periodically inspect to verify products are undamaged and are maintained in acceptable condition.

END OF SECTION 01 60 00

SECTION 01 70 00
EXECUTION AND CLOSEOUT REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Examination, preparation, and general installation procedures.

B. Requirements for alterations work, including selective demolition, _____.

C. Cutting and patching.

D. Cleaning and protection.

E. Starting of systems and equipment.

F. Demonstration and instruction of Owner personnel.

G. Closeout procedures, including Contractor's Correction Punch List, except payment procedures.

1.02 REFERENCE STANDARDS

A. NFPA 241 - Standard for Safeguarding Construction, Alteration, and Demolition Operations 2022, with Errata (2021).

1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Cutting and Patching: Submit written request in advance of cutting or alteration that affects:
   1. Structural integrity of any element of Project.
   2. Integrity of weather exposed or moisture resistant element.
   3. Efficiency, maintenance, or safety of any operational element.
   4. Visual qualities of sight exposed elements.
   5. Work of Owner or separate Contractor.

C. Project Record Documents: Accurately record actual locations of capped and active utilities.

1.04 PROJECT CONDITIONS

A. Ventilate enclosed areas to assist cure of materials, to dissipate humidity, and to prevent accumulation of dust, fumes, vapors, or gases.

B. Dust Control: Execute work by methods to minimize raising dust from construction operations. Provide positive means to prevent air-borne dust from dispersing into atmosphere and over adjacent property.
   1. Provide dust-proof barriers between construction areas and areas continuing to be occupied by Owner.

PART 2 PRODUCTS

2.01 PATCHING MATERIALS

A. New Materials: As specified in product sections; match existing products and work for patching and extending work.

B. Type and Quality of Existing Products: Determine by inspecting and testing products where necessary, referring to existing work as a standard.

C. Product Substitution: For any proposed change in materials, submit request for substitution described in Section 01 60 00 - Product Requirements.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that existing site conditions and substrate surfaces are acceptable for subsequent work. Start of work means acceptance of existing conditions.

B. Verify that existing substrate is capable of structural support or attachment of new work being applied or attached.

C. Examine and verify specific conditions described in individual specification sections.

D. Take field measurements before confirming product orders or beginning fabrication, to minimize waste due to over-ordering or misfabrication.

E. Verify that utility services are available, of the correct characteristics, and in the correct locations.

F. Prior to Cutting: Examine existing conditions prior to commencing work, including elements subject to damage or movement during cutting and patching. After uncovering existing work, assess conditions affecting performance of work. Beginning of cutting or patching means acceptance of existing conditions.

3.02 PREPARATION

A. Clean substrate surfaces prior to applying next material or substance.

B. Seal cracks or openings of substrate prior to applying next material or substance.

C. Apply manufacturer required or recommended substrate primer, sealer, or conditioner prior to applying any new material or substance in contact or bond.

3.03 GENERAL INSTALLATION REQUIREMENTS

A. Install products as specified in individual sections, in accordance with manufacturer's instructions and recommendations, and so as to avoid waste due to necessity for replacement.

B. Make vertical elements plumb and horizontal elements level, unless otherwise indicated.

C. Install equipment and fittings plumb and level, neatly aligned with adjacent vertical and horizontal lines, unless otherwise indicated.

D. Make consistent texture on surfaces, with seamless transitions, unless otherwise indicated.

E. Make neat transitions between different surfaces, maintaining texture and appearance.

3.04 ALTERATIONS

A. Drawings showing existing construction and utilities are based on casual field observation and existing record documents only.
   1. Verify that construction and utility arrangements are as indicated.
   2. Report discrepancies to Architect before disturbing existing installation.
   3. Beginning of alterations work constitutes acceptance of existing conditions.

B. Remove existing work as indicated and as required to accomplish new work.
   1. Remove items indicated on drawings.
   2. Relocate items indicated on drawings.
   3. Where new surface finishes are to be applied to existing work, perform removals, patch, and prepare existing surfaces as required to receive new finish; remove existing finish if necessary for successful application of new finish.
   4. Where new surface finishes are not specified or indicated, patch holes and damaged surfaces to match adjacent finished surfaces as closely as possible.

C. Services (Including but not limited to HVAC, Plumbing, Fire Protection, Electrical, and Telecommunications): Remove, relocate, and extend existing systems to accommodate new construction.
   1. Maintain existing active systems that are to remain in operation; maintain access to equipment and operational components; if necessary, modify installation to allow access or provide access panel.
   2. Where existing systems or equipment are not active and Contract Documents require reactivation, put back into operational condition; repair supply, distribution, and equipment as required.
   3. Where existing active systems serve occupied facilities but are to be replaced with new services, maintain existing systems in service until new systems are complete and ready for service.
      a. Disable existing systems only to make switchovers and connections; minimize duration of outages.
      b. Provide temporary connections as required to maintain existing systems in service.
   4. Verify that abandoned services serve only abandoned facilities.

5. Remove abandoned pipe, ducts, conduits, and equipment , including those above accessible ceilings; remove back to source of supply where possible, otherwise cap stub and tag with identification; patch holes left by removal using materials specified for new construction.

D. Protect existing work to remain.
   1. Prevent movement of structure; provide shoring and bracing if necessary.
   2. Perform cutting to accomplish removals neatly and as specified for cutting new work.
   3. Repair adjacent construction and finishes damaged during removal work.

E. Adapt existing work to fit new work: Make as neat and smooth transition as possible.

F. Patching: Where the existing surface is not indicated to be refinished, patch to match the surface finish that existed prior to cutting. Where the surface is indicated to be refinished, patch so that the substrate is ready for the new finish.

G. Refinish existing surfaces as indicated:
   1. Where rooms or spaces are indicated to be refinished, refinish all visible existing surfaces to remain to the specified condition for each material, with a neat transition to adjacent finishes.
   2. If mechanical or electrical work is exposed accidentally during the work, re-cover and refinish to match.

H. Clean existing systems and equipment.

I. Remove demolition debris and abandoned items from alterations areas and dispose of off-site; do not burn or bury.

J. Do not begin new construction in alterations areas before demolition is complete.

K. Comply with all other applicable requirements of this section.

3.05 CUTTING AND PATCHING

A. Whenever possible, execute the work by methods that avoid cutting or patching.

B. See Alterations article above for additional requirements.

C. Perform whatever cutting and patching is necessary to:
   1. Complete the work.
   2. Fit products together to integrate with other work.
   3. Provide openings for penetration of mechanical, electrical, and other services.
   4. Match work that has been cut to adjacent work.
   5. Repair areas adjacent to cuts to required condition.
   6. Repair new work damaged by subsequent work.
   7. Remove samples of installed work for testing when requested.
   8. Remove and replace defective and non-complying work.

D. Execute work by methods that avoid damage to other work and that will provide appropriate surfaces to receive patching and finishing. In existing work, minimize damage and restore to original condition.

E. Employ original installer to perform cutting for weather exposed and moisture resistant elements, and sight exposed surfaces.

F. Cut rigid materials using masonry saw or core drill. Pneumatic tools not allowed without prior approval.

G. Restore work with new products in accordance with requirements of Contract Documents.

H. Fit work air tight to pipes, sleeves, ducts, conduit, and other penetrations through surfaces.

I. At penetrations of fire rated walls, partitions, ceiling, or floor construction, completely seal voids with fire rated material in accordance with Section 07 84 00, to full thickness of the penetrated element.

J. Patching:
   1. Finish patched surfaces to match finish that existed prior to patching. On continuous surfaces, refinish to nearest intersection or natural break. For an assembly, refinish entire unit.
   2. Match color, texture, and appearance.

3. Repair patched surfaces that are damaged, lifted, discolored, or showing other imperfections due to patching work. If defects are due to condition of substrate, repair substrate prior to repairing finish.

3.06 PROGRESS CLEANING

A. Maintain areas free of waste materials, debris, and rubbish. Maintain site in a clean and orderly condition.

B. Remove debris and rubbish from pipe chases, plenums, attics, crawl spaces, and other closed or remote spaces, prior to enclosing the space.

C. Broom and vacuum clean interior areas prior to start of surface finishing, and continue cleaning to eliminate dust.

D. Collect and remove waste materials, debris, and trash/rubbish from site periodically and dispose off-site; do not burn or bury.

3.07 PROTECTION OF INSTALLED WORK

A. Protect installed work from damage by construction operations.

B. Provide special protection where specified in individual specification sections.

C. Provide temporary and removable protection for installed products. Control activity in immediate work area to prevent damage.

D. Provide protective coverings at walls, projections, jambs, sills, and soffits of openings.

E. Protect finished floors, stairs, and other surfaces from traffic, dirt, wear, damage, or movement of heavy objects, by protecting with durable sheet materials.

F. Prohibit traffic or storage upon waterproofed or roofed surfaces. If traffic or activity is necessary, obtain recommendations for protection from waterproofing or roofing material manufacturer.

G. Remove protective coverings when no longer needed; reuse or recycle coverings if possible.

3.08 SYSTEM STARTUP

A. Coordinate schedule for start-up of various equipment and systems.

B. Verify that each piece of equipment or system has been checked for proper lubrication, drive rotation, belt tension, control sequence, and for conditions that may cause damage.

C. Verify tests, meter readings, and specified electrical characteristics agree with those required by the equipment or system manufacturer.

D. Verify that wiring and support components for equipment are complete and tested.

E. Execute start-up under supervision of applicable Contractor personnel and manufacturer's representative in accordance with manufacturers' instructions.

F. Submit a written report that equipment or system has been properly installed and is functioning correctly.

3.09 DEMONSTRATION AND INSTRUCTION

A. Demonstrate start-up, operation, control, adjustment, trouble-shooting, servicing, maintenance, and shutdown of each item of equipment at scheduled time, at equipment location.

B. For equipment or systems requiring seasonal operation, perform demonstration for other season within six months.

C. Provide a qualified person who is knowledgeable about the Project to perform demonstration and instruction of Owner's personnel.

3.10 ADJUSTING

A. Adjust operating products and equipment to ensure smooth and unhindered operation.

3.11 FINAL CLEANING

A. Use cleaning materials that are nonhazardous.

B. Clean interior and exterior glass, surfaces exposed to view; remove temporary labels, stains and foreign substances, polish transparent and glossy surfaces, vacuum carpeted and soft surfaces.

C. Remove all labels that are not permanent. Do not paint or otherwise cover fire test labels or nameplates on mechanical and electrical equipment.

D. Clean equipment and fixtures to a sanitary condition with cleaning materials appropriate to the surface and material being cleaned.

E. Clean filters of operating equipment.

F. Clean debris from roofs, gutters, downspouts, and area drains.

G. Clean site; sweep paved areas, rake clean landscaped surfaces.

H. Remove waste, surplus materials, trash/rubbish, and construction facilities from the site; dispose of in legal manner; do not burn or bury.

3.12 CLOSEOUT PROCEDURES

A. Make submittals that are required by governing or other authorities.
   1. Provide copies to Architect and Owner.

B. Accompany Project Coordinator on preliminary inspection to determine items to be listed for completion or correction in the Contractor's Correction Punch List for Contractor's Notice of Substantial Completion.

C. Notify Architect when work is considered ready for Architect's Substantial Completion inspection.

D. Submit written certification containing Contractor's Correction Punch List, that Contract Documents have been reviewed, work has been inspected, and that work is complete in accordance with Contract Documents and ready for Architect's Substantial Completion inspection.

E. Conduct Substantial Completion inspection and create Final Correction Punch List containing Architect's and Contractor's comprehensive list of items identified to be completed or corrected and submit to Architect.

F. Correct items of work listed in Final Correction Punch List and comply with requirements for access to Owner-occupied areas.

G. Notify Architect when work is considered finally complete and ready for Architect's Substantial Completion final inspection.

H. Complete items of work determined by Architect listed in executed Certificate of Substantial Completion.

END OF SECTION 01 70 00

SECTION 01 78 00
CLOSEOUT SUBMITTALS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Operation and Maintenance Data.

B. Warranties and bonds.

1.02 RELATED REQUIREMENTS

A. Section 01 30 00 - Administrative Requirements: Submittals procedures, shop drawings, product data, and samples.

B. Individual Product Sections: Specific requirements for operation and maintenance data.

C. Individual Product Sections: Warranties required for specific products or Work.

1.03 SUBMITTALS

A. Project Record Documents: Submit documents to Architect with claim for final Application for Payment.

B. Operation and Maintenance Data:
   1. Submit two copies of preliminary draft or proposed formats and outlines of contents before start of Work. Architect will review draft and return one copy with comments.
   2. For equipment, or component parts of equipment put into service during construction and operated by Owner, submit completed documents within ten days after acceptance.
   3. Submit one copy of completed documents 15 days prior to final inspection. This copy will be reviewed and returned after final inspection, with Architect comments. Revise content of all document sets as required prior to final submission.
   4. Submit two sets of revised final documents in final form within 10 days after final inspection.

C. Warranties and Bonds:
   1. For equipment or component parts of equipment put into service during construction with Owner's permission, submit documents within 10 days after acceptance.
   2. Make other submittals within 10 days after Date of Substantial Completion, prior to final Application for Payment.
   3. For items of Work for which acceptance is delayed beyond Date of Substantial Completion, submit within 10 days after acceptance, listing the date of acceptance as the beginning of the warranty period.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 PROJECT RECORD DOCUMENTS

A. Maintain on site one set of the following record documents; record actual revisions to the Work:
   1. Drawings.
   2. Specifications.
   3. Addenda.
   4. Change Orders and other modifications to the Contract.
   5. Reviewed shop drawings, product data, and samples.
   6. Manufacturer's instruction for assembly, installation, and adjusting.

B. Ensure entries are complete and accurate, enabling future reference by Owner.

C. Store record documents separate from documents used for construction.

D. Record information concurrent with construction progress.

E. Specifications: Legibly mark and record at each product section description of actual products installed, including the following:
   1. Changes made by Addenda and modifications.

F. Record Drawingsand Shop Drawings: Legibly mark each item to record actual construction including:

1. Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.
2. Measured locations of internal utilities and appurtenances concealed in construction, referenced to visible and accessible features of the Work.
3. Field changes of dimension and detail.
4. Details not on original Contract drawings.

3.02 OPERATION AND MAINTENANCE DATA

A. Source Data: For each product or system, list names, addresses and telephone numbers of Subcontractors and suppliers, including local source of supplies and replacement parts.

B. Product Data: Mark each sheet to clearly identify specific products and component parts, and data applicable to installation. Delete inapplicable information.

C. Drawings: Supplement product data to illustrate relations of component parts of equipment and systems, to show control and flow diagrams. Do not use Project Record Documents as maintenance drawings.

D. Typed Text: As required to supplement product data. Provide logical sequence of instructions for each procedure, incorporating manufacturer's instructions.

3.03 OPERATION AND MAINTENANCE DATA FOR MATERIALS AND FINISHES

A. For Each Product, Applied Material, and Finish:
   1. Product data, with catalog number, size, composition, and color and texture designations.
   2. Information for re-ordering custom manufactured products.

B. Instructions for Care and Maintenance: Manufacturer's recommendations for cleaning agents and methods, precautions against detrimental cleaning agents and methods, and recommended schedule for cleaning and maintenance.

C. Moisture protection and weather-exposed products: Include product data listing applicable reference standards, chemical composition, and details of installation. Provide recommendations for inspections, maintenance, and repair.

D. Where additional instructions are required, beyond the manufacturer's standard printed instructions, have instructions prepared by personnel experienced in the operation and maintenance of the specific products.

3.04 OPERATION AND MAINTENANCE DATA FOR EQUIPMENT AND SYSTEMS

A. For Each Item of Equipment and Each System:
   1. Description of unit or system, and component parts.
   2. Identify function, normal operating characteristics, and limiting conditions.
   3. Include performance curves, with engineering data and tests.
   4. Complete nomenclature and model number of replaceable parts.

B. Where additional instructions are required, beyond the manufacturer's standard printed instructions, have instructions prepared by personnel experienced in the operation and maintenance of the specific products.

C. Operating Procedures: Include start-up, break-in, and routine normal operating instructions and sequences. Include regulation, control, stopping, shut-down, and emergency instructions. Include summer, winter, and any special operating instructions.

D. Maintenance Requirements: Include routine procedures and guide for preventative maintenance and trouble shooting; disassembly, repair, and reassembly instructions; and alignment, adjusting, balancing, and checking instructions.

E. Provide servicing and lubrication schedule, and list of lubricants required.

F. Include manufacturer's printed operation and maintenance instructions.

G. Include sequence of operation by controls manufacturer.

H. Provide original manufacturer's parts list, illustrations, assembly drawings, and diagrams required for maintenance.

I. Provide control diagrams by controls manufacturer as installed.

J. Provide charts of valve tag numbers, with location and function of each valve, keyed to flow and control diagrams.

K. Provide list of original manufacturer's spare parts, current prices, and recommended quantities to be maintained in storage.

L. Include test and balancing reports.

M. Additional Requirements: As specified in individual product specification sections.

3.05 ASSEMBLY OF OPERATION AND MAINTENANCE MANUALS

A. Assemble operation and maintenance data into durable manuals for Owner's personnel use, with data arranged in the same sequence as, and identified by, the specification sections.

B. Where systems involve more than one specification section, provide separate tabbed divider for each system.

C. Binders: Commercial quality, 8-1/2 by 11 inch three D side ring binders with durable plastic covers; 3 inch maximum ring size. When multiple binders are used, correlate data into related consistent groupings.

D. Cover: Identify each binder with typed or printed title OPERATION AND MAINTENANCE INSTRUCTIONS; identify title of Project; identify subject matter of contents.

E. Project Directory: Title and address of Project; names, addresses, and telephone numbers of Architect, Consultants, Contractor and subcontractors, with names of responsible parties.

F. Tables of Contents: List every item separated by a divider, using the same identification as on the divider tab; where multiple volumes are required, include all volumes Tables of Contents in each volume, with the current volume clearly identified.

G. Dividers: Provide tabbed dividers for each separate product and system; identify the contents on the divider tab; immediately following the divider tab include a description of product and major component parts of equipment.

H. Text: Manufacturer's printed data, or typewritten data on 20 pound paper.

I. Drawings: Provide with reinforced punched binder tab. Bind in with text; fold larger drawings to size of text pages.

J. Provide a PDF copy, properly bookmarked as well.

3.06 WARRANTIES AND BONDS

A. Obtain warranties and bonds, executed in duplicate by responsible Subcontractors, suppliers, and manufacturers, within 10 days after completion of the applicable item of work. Except for items put into use with Owner's permission, leave date of beginning of time of warranty until Date of Substantial completion is determined.

B. Verify that documents are in proper form, contain full information, and are notarized.

C. Co-execute submittals when required.

D. Retain warranties and bonds until time specified for submittal.

E. Table of Contents: Neatly typed, in the sequence of the Table of Contents of the Project Manual, with each item identified with the number and title of the specification section in which specified, and the name of product or work item.

END OF SECTION 01 78 00

SECTION 01 91 13
GENERAL COMMISSIONING REQUIREMENTS

PART 1 GENERAL

1.01 SUMMARY

A. Commissioning is intended to achieve the following specific objectives; this section specifies the Contractor's responsibilities for commissioning:
   1. Verify that the work is installed in accordance with Contract Documents and the manufacturer’s recommendations and instructions, and that it receives adequate operational checkout prior to startup: Startup reports and Prefunctional Checklists executed by Contractor are utilized to achieve this.
   2. Verify and document that functional performance is in accordance with Contract Documents: Functional Tests executed by Contractor and witnessed by the Commissioning Authority are utilized to achieve this.
   3. Verify that operation and maintenance manuals submitted to Owner are complete: Detailed operation and maintenance (O&M) data submittals by Contractor are utilized to achieve this.
   4. Verify that the Owner’s operating personnel are adequately trained: Formal training conducted by Contractor is utilized to achieve this.

B. Commissioning, including Functional Tests, O&M documentation review, and training, is to occur after startup and initial checkout and be completed before Substantial Completion.

C. The Commissioning Authority directs and coordinates all commissioning activities; this section describes some but not all of the Commissioning Authority's responsibilities.

D. The Commissioning Authority is employed by Owner.

1.02 SCOPE OF COMMISSIONING

A. The following are to be commissioned:

B. HVAC System, including:
   1. Major and minor equipment items.
   2. Piping systems and equipment.
   3. Control system.

C. Other equipment and systems explicitly identified elsewhere in Contract Documents as requiring commissioning.

1.03 RELATED REQUIREMENTS

A. Section 22 08 00 - Commissioning of Plumbing

B. Section 23 08 00 - Commissioning of HVAC: HVAC control system testing; other requirements.

C. Section 26 08 00 - Commissioning of Electrical Systems

1.04 REFERENCE STANDARDS

A. CSI/CSC MF - Masterformat 2016.

B. PECI (Samples) - Sample Forms for Prefunctional Checklists and Functional Performance Tests Current Edition.

1.05 SUBMITTALS

A. For submittal procedures:
   1. Make all submittals specified in this section, and elsewhere where indicated for commissioning purposes, directly to the Commissioning Authority, unless they require review by Architect; in that case, submit to Architect first.
   2. Submit one copy to the Commissioning Authority, not to be returned.
   3. Make commissioning submittals on time schedule specified by Commissioning Authority.
   4. Submittals indicated as "Draft" are intended for the use of the Commissioning Authority in preparation of Prefunctional Checklists or Functional Test requirements; submit in editable electronic format, Microsoft Word 2010 preferred.
   5. As soon as possible after submittals made to Architect are approved, submit copy of approved submittal to the Commissioning Authority.

B. Product Data: If submittals to Architect do not include the following, submit copies as soon as possible:
   1. Manufacturer's product data, cut sheets, and shop drawings.
   2. Manufacturer's installation instructions.
   3. Startup, operating, and troubleshooting procedures.
   4. Fan curves.
   5. Factory test reports.
   6. Warranty information, including details of Owner's responsibilities in regard to keeping warranties in force.

C. Manufacturers' Instructions: Submit copies of all manufacturer-provided instructions that are shipped with the equipment as soon as the equipment is delivered.

D. Startup Plans and Reports.

E. Completed Prefunctional Checklists.

F. Commissioning Issues Log:
   1. Construction observations.
   2. Supporting photographs.

PART 2 PRODUCTS

2.01 TEST EQUIPMENT

A. Provide all standard testing equipment required to perform startup and initial checkout and required Functional Testing; unless otherwise noted such testing equipment will NOT become the property of Owner.

B. Calibration Tolerances: Provide testing equipment of sufficient quality and accuracy to test and/or measure system performance with the tolerances specified. If not otherwise noted, the following minimum requirements apply:
   1. Temperature Sensors and Digital Thermometers: Certified calibration within past year to accuracy of 0.5 degree F and resolution of plus/minus 0.1 degree F.
   2. Pressure Sensors: Accuracy of plus/minus 2.0 percent of the value range being measured (not full range of meter), calibrated within the last year.
   3. Calibration: According to the manufacturer’s recommended intervals and when dropped or damaged; affix calibration tags or keep certificates readily available for inspection.

C. Equipment-Specific Tools: Where special testing equipment, tools and instruments are specific to a piece of equipment, are only available from the vendor, and are required in order to accomplish startup or Functional Testing, provide such equipment, tools, and instruments as part of the work at no extra cost to Owner; such equipment, tools, and instruments are to become the property of Owner.

D. Dataloggers: Independent equipment and software for monitoring flows, currents, status, pressures, etc. of equipment.
   1. Dataloggers required to for Functional Tests will be provided by the Commissioning Authority and will not become the property of Owner.

PART 3 EXECUTION

3.01 COMMISSIONING PLAN

A. Commissioning Authority will prepare the Commissioning Plan.
   1. Attend meetings called by the Commissioning Authority for purposes of completing the commissioning plan.
   2. Require attendance and participation of relevant subcontractors, installers, suppliers, and manufacturer representatives.

B. Contractor is responsible for compliance with the Commissioning Plan.

C. Commissioning Plan: The commissioning schedule, procedures, and coordination requirements for all parties in the commissioning process.

D. Commissioning Schedule:

1. Submit anticipated dates of startup of each item of equipment and system to Commissioning Authority within 20 days after award of Contract.
2. Re-submit anticipated startup dates whenever revised, but not less than 4 weeks prior to startup.
3. Prefunctional Checklists and Functional Tests are to be performed in sequence from components, to subsystems, to systems.
4. Provide sufficient notice to Commissioning Authority for delivery of relevant Checklists and Functional Test procedures, to avoid delay.

3.02 DOCUMENTATION IDENTIFICATION SYSTEM

A. Give each submitted form or report a unique identification; use the following scheme.

B. Type of Document: Use the following prefixes:
   1. Startup Plan: SP-.
   2. Startup Report: SR-.
   3. Prefunctional Checklist: PC-.
   4. Functional Test Procedure: FTP-.
   5. Functional Test Report: FTR-.

C. System Type: Use the first 4 digits from CSI/CSC MF (Master Format), that are applicable to the system; for example:
   1. 2300: HVAC system as a whole.
   2. 2320: HVAC Piping and Pumps.
   3. 2330: HVAC Air Distribution.

D. Component Number: Assign numbers sequentially, using 1, 2, or 3 digits as required to accommodate the number of units in the system.

E. Test, Revision, or Submittal Number: Number each successive iteration sequentially, starting with 1.

F. Example: PC-2320-001.2 would be the Prefunctional Checklist for equipment item 1 in the HVAC piping system, probably a pump; this is the second, revised submittal of this checklist.

3.03 STARTUP PLANS AND REPORTS

A. Startup Plans: For each item of equipment and system for which the manufacturer provides a startup plan, submit the plan not less than 3 weeks prior to startup.

B. Submit directly to the Commissioning Authority.

3.04 PREFUNCTIONAL CHECKLISTS

A. A Prefunctional Checklist is required to be filled out for each item of equipment or other assembly specified to be commissioned.
   1. No sampling of identical or near-identical items is allowed.
   2. These checklists do not replace manufacturers' recommended startup checklists, regardless of apparent redundancy.
   3. Prefunctional Checklist forms will not be complete until after award of the contract; the following types of information will be gathered via the completed Checklist forms:
      a. Certification by installing contractor that the unit is properly installed, started up, and operating and ready for Functional Testing.
      b. Confirmation of receipt of each shop drawing and commissioning submittal specified, itemized by unit.
      c. Manufacturer, model number, and relevant capacity information; list information "as specified," "as submitted," and "as installed."
      d. Serial number of installed unit.
      e. List of inspections to be conducted to document proper installation prior to startup and Functional Testing; these will be primarily static inspections and procedures; for equipment and systems may include normal manufacturer’s start-up checklist items and minor testing.
      f. Sensor and actuator calibration information.
   4. PECI (Samples) found at http://www.peci.org/library/mcpgs.htm indicate anticipated level of detail for Prefunctional Checklists.

B. Contractor is responsible for filling out Prefunctional Checklists, after completion of installation and before startup; witnessing by the Commissioning Authority is not required unless otherwise specified.
   1. Each line item without deficiency is to be witnessed, initialed, and dated by the actual witness; checklists are not complete until all line items are initialed and dated complete without deficiencies.
   2. Checklists with incomplete items may be submitted for approval provided the Contractor attests that incomplete items do not preclude the performance of safe and reliable Functional Testing; re-submission of the Checklist is required upon completion of remaining items.
   3. Individual Checklists may contain line items that are the responsibility of more than one installer; Contractor shall assign responsibility to appropriate installers or subcontractors, with identification recorded on the form.
   4. If any Checklist line item is not relevant, record reasons on the form.
   5. Contractor may independently perform startup inspections and/or tests, at Contractor's option.
   6. Regardless of these reporting requirements, Contractor is responsible for correct startup and operation.
   7. Submit completed Checklists to Commissioning Authority within two days of completion.

C. Commissioning Authority is responsible for furnishing the Prefunctional Checklists to Contractor.
   1. Initial Drafts: Contractor is responsible for initial draft of Prefunctional Checklist where so indicated in Contract Documents.
   2. Provide all additional information requested by Commissioning Authority to aid in preparation of checklists, such as shop drawing submittals, manufacturers' startup checklists, and O&M data.
   3. Commissioning Authority may add any relevant items deemed necessary regardless of whether they are explicitly mentioned in Contract Documents or not.
   4. When asked to review the proposed Checklists, do so in a timely manner.

D. Commissioning Authority Witnessing: Required for:
   1. Each piece of primary equipment, unless sampling of multiple similar units is allowed by the commissioning plan.
   2. A sampling of non-primary equipment, as allowed by the commissioning plan.

E. Deficiencies: Correct deficiencies and re-inspect or re-test, as applicable, at no extra cost to Owner.
   1. If difficulty in correction would delay progress, report deficiency to the Commissioning Authority immediately.

3.05 FUNCTIONAL TESTS

A. A Functional Test is required for each item of equipment, system, or other assembly specified to be commissioned, unless sampling of multiple identical or near-identical units is allowed by the final test procedures.

B. Contractor is responsible for execution of required Functional Tests, after completion of Prefunctional Checklist and before closeout.

C. Commissioning Authority is responsible for witnessing and reporting results of Functional Tests, including preparation and completion of forms for that purpose.

D. Contractor is responsible for correction of deficiencies and re-testing at no extra cost to Owner; if a deficiency is not corrected and re-tested immediately, the Commissioning Authority will document the deficiency and the Contractor's stated intentions regarding correction.
   1. Deficiencies are any condition in the installation or function of a component, piece of equipment or system that is not in compliance with Contract Documents or does not perform properly.
   2. When the deficiency has been corrected, the Contractor completes the form certifying that the item is ready to be re-tested and returns the form to the Commissioning Authority; the Commissioning Authority will reschedule the test and the Contractor shall re-test.
   3. Identical or Near-Identical Items: If 10 percent, or three, whichever is greater, of identical or near-identical items fail to perform due to material or manufacturing defect, all items will be

considered defective; provide a proposal for correction within 2 weeks after notification of defect, including provision for testing sample installations prior to replacement of all items.

4. Contractor shall bear the cost of Owner and Commissioning Authority personnel time witnessing re-testing.
5. Contractor shall bear the cost of Owner and Commissioning Authority personnel time witnessing re-testing if the test failed due to failure to execute the relevant Prefunctional Checklist correctly; if the test failed for reasons that would not have been identified in the Prefunctional Checklist process, Contractor shall bear the cost of the second and subsequent re-tests.

E. Functional Test Procedures:
1. Some test procedures are included in Contract Documents; where Functional Test procedures are not included in Contract Documents, test procedures will be determined by the Commissioning Authority with input by and coordination with Contractor.
2. Examples of Functional Testing:
   a. Test the dynamic function and operation of equipment and systems (rather than just components) using manual (direct observation) or monitoring methods under full operation (e.g., the chiller pump is tested interactively with the chiller functions to see if the pump ramps up and down to maintain the differential pressure setpoint).
   b. Systems are tested under various modes, such as during low cooling or heating loads, high loads, component failures, unoccupied, varying outside air temperatures, fire alarm, power failure, etc.
   c. Systems are run through all the HVAC control system’s sequences of operation and components are verified to be responding as the sequence's state.
   d. Traditional air or water test and balancing (TAB) is not Functional Testing; spot checking of TAB by demonstration to the Commissioning Authority is Functional Testing.
3. PECI (Samples) found at http://www.peci.org/library/mcpgs.htm indicated anticipated level of detail for Functional Tests.

F. Deferred Functional Tests: Some tests may need to be performed later, after substantial completion, due to partial occupancy, equipment, seasonal requirements, design or other site conditions; performance of these tests remains the Contractor's responsibility regardless of timing.

3.06 SENSOR AND ACTUATOR CALIBRATION

A. Calibrate all field-installed temperature, relative humidity, carbon monoxide, carbon dioxide, and pressure sensors and gauges, and all actuators (dampers and valves) on this piece of equipment shall be calibrated. Sensors installed in the unit at the factory with calibration certification provided need not be field calibrated.

B. Calibrate using the methods described below; alternate methods may be used, if approved by Commissioning Authority and Owner beforehand. See PART 2 for test instrument requirements. Record methods used on the relevant Prefunctional Checklist or other suitable forms, documenting initial, intermediate and final results.

C. All Sensors:
1. Verify that sensor location is appropriate and away from potential causes of erratic operation.
2. Verify that sensors with shielded cable are grounded only at one end.
3. For sensor pairs that are used to determine a temperature or pressure difference, for temperature make sure they are reading within 0.2 degree F of each other, and for pressure, within tolerance equal to 2 percent of the reading, of each other.
4. Tolerances for critical applications may be tighter.

D. Sensors Without Transmitters - Standard Application:
1. Make a reading with a calibrated test instrument within 6 inches of the site sensor.
2. Verify that the sensor reading, via the permanent thermostat, gauge or building automation system, is within the tolerances in the table below of the instrument-measured value.
3. If not, install offset, calibrate or replace sensor.

E. Sensors With Transmitters - Standard Application.
1. Disconnect sensor.
2. Connect a signal generator in place of sensor.

3. Connect ammeter in series between transmitter and building automation system control panel.
4. Using manufacturer's resistance-temperature data, simulate minimum desired temperature.
5. Adjust transmitter potentiometer zero until 4 mA is read by the ammeter.
6. Repeat for the maximum temperature matching 20 mA to the potentiometer span or maximum and verify at the building automation system.
7. Record all values and recalibrate controller as necessary to comply with specified control ramps, reset schedules, proportional relationship, reset relationship and P/I reaction.
8. Reconnect sensor.
9. Make a reading with a calibrated test instrument within 6 inches of the site sensor.
10. Verify that the sensor reading, via the permanent thermostat, gauge or building automation system, is within the tolerances in the table below of the instrument-measured value.
11. If not, replace sensor and repeat.
12. For pressure sensors, perform a similar process with a suitable signal generator.

F. Sensor Tolerances for Standard Applications: Plus/minus the following maximums:
1. Watthour, Voltage, Amperage: 1 percent of design.
2. Pressure, Air, Water, Gas: 3 percent of design.
3. Air Temperatures (Outside Air, Space Air, Duct Air): 0.4 degrees F.
4. Relative Humidity: 4 percent of design.
5. Barometric Pressure: 0.1 inch of Hg.
6. Flow Rate, Air: 10 percent of design.
7. AHU Wet Bulb and Dew Point: 2.0 degrees F.

G. Critical Applications: For some applications more rigorous calibration techniques may be required for selected sensors. Describe any such methods used on an attached sheet.

3.07 TEST PROCEDURES - GENERAL

A. Provide skilled technicians to execute starting of equipment and to execute the Functional Tests. Ensure that they are available and present during the agreed upon schedules and for sufficient duration to complete the necessary tests, adjustments and problem-solving.

B. Provide all necessary materials and system modifications required to produce the flows, pressures, temperatures, and conditions necessary to execute the test according to the specified conditions. At completion of the test, return all affected equipment and systems to their pre-test condition.

C. Sampling: Where Functional Testing of fewer than the total number of multiple identical or near-identical items is explicitly permitted, perform sampling as follows:
1. Identical Units: Defined as units with same application and sequence of operation; only minor size or capacity difference.
2. Sampling is not allowed for:
   a. Major equipment.
   b. Life-safety-critical equipment.
   c. Prefunctional Checklist execution.
3. XX = the percent of the group of identical equipment to be included in each sample; defined for specific type of equipment.
4. YY = the percent of the sample that if failed will require another sample to be tested; defined for specific type of equipment.
5. Randomly test at least XX percent of each group of identical equipment, but not less than three units. This constitutes the "first sample."
6. If YY percent of the units in the first sample fail, test another XX percent of the remaining identical units.
7. If YY percent of the units in the second sample fail, test all remaining identical units.
8. If frequent failures occur, resulting in more troubleshooting than testing, the Commissioning Authority may stop the testing and require Contractor to perform and document a checkout of the remaining units prior to continuing testing.

D. Manual Testing: Use hand-held instruments, immediate control system readouts, or direct observation to verify performance (contrasted to analyzing monitored data taken over time to make

the “observation”).

E. Simulating Conditions: Artificially create the necessary condition for the purpose of testing the response of a system; for example apply hot air to a space sensor using a hair dryer to see the response in a VAV box.

F. Simulating Signals: Disconnect the sensor and use a signal generator to send an amperage, resistance or pressure to the transducer and control system to simulate the sensor value.

G. Over-Writing Values: Change the sensor value known to the control system in the control system to see the response of the system; for example, change the outside air temperature value from 50 degrees F to 75 degrees F to verify economizer operation.

H. Indirect Indicators: Remote indicators of a response or condition, such as a reading from a control system screen reporting a damper to be 100 percent closed, are considered indirect indicators.

I. Monitoring: Record parameters (flow, current, status, pressure, etc.) of equipment operation using dataloggers or the trending capabilities of the relevant control systems; where monitoring of specific points is called for in Functional Test Procedures:
   1. All points that are monitored by the relevant control system shall be trended by Contractor; at the Commissioning Authority’s request, Contractor shall trend up to 20 percent more points than specified at no extra charge.
   2. Other points will be monitored by the Commissioning Authority using dataloggers.
   3. At the option of the Commissioning Authority, some control system monitoring may be replaced with datalogger monitoring.
   4. Provide hard copies of monitored data in columnar format with time down left column and at least 5 columns of point values on same page.
   5. Graphical output is desirable and is required for all output if the system can produce it.
   6. Monitoring may be used to augment manual testing.

3.08 OPERATION AND MAINTENANCE MANUALS

A. Add design intent documentation furnished by Architect to manuals prior to submission to Owner.

B. Submit manuals related to items that were commissioned to Commissioning Authority for review; make changes recommended by Commissioning Authority.

C. Commissioning Authority will add commissioning records to manuals after submission to Owner.

END OF SECTION 01 91 13

SECTION 081213 - HOLLOW METAL FRAMES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes hollow-metal frames.

B. Related Requirements:

1. Section 081416 "Flush Wood Doors" for wood doors installed in hollow-metal frames.

1.2 DEFINITIONS

A. Minimum Thickness: Minimum thickness of base metal without coatings according to NAAMM-HMMA 803 or SDI A250.8.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: Include elevations, frame profiles, metal thicknesses, preparations for hardware, and other details.

C. Schedule: Prepared by or under the supervision of supplier, using same reference numbers for details and openings as those on Drawings.

1.4 INFORMATIONAL SUBMITTALS

A. Product test reports.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers acceptable to provide products for the work include:

1. Ceco Door
2. Curries
3. Steelcraft
4. SEMCO

2.2 REGULATORY REQUIREMENTS

A. Fire-Rated Assemblies: Complying with NFPA 80 and listed and labeled by a qualified testing agency acceptable to authorities having jurisdiction for fire-protection ratings and temperature-rise limits indicated, based on testing at positive pressure according to NFPA 252 or UL 10C.

1. Smoke- and Draft-Control Assemblies: Provide an assembly with gaskets listed and labeled for smoke and draft control by a qualified testing agency acceptable to authorities having jurisdiction, based on testing according to UL 1784 and installed in compliance with NFPA 105.

B. Fire-Rated, Borrowed-Lite Assemblies: Complying with NFPA 80 and listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction for fire-protection ratings indicated, based on testing according to NFPA 257 or UL 9.

2.3 INTERIOR FRAMES

A. Standard-Duty Frames: SDI A250.8, Level 1..

1. Physical Performance: Level C according to SDI A250.4.
2. Materials: Uncoated, cold-rolled steel sheet, minimum thickness of 0.042 inch (1.0 mm).
3. Construction: Face welded.
4. Exposed Finish: Prime.

2.4 FRAME ANCHORS

A. Jamb Anchors:

1. Masonry Type: Adjustable strap-and-stirrup or T-shaped anchors to suit frame size, not less than 0.042 inch (1.0 mm) thick, with corrugated or perforated straps not less than 2 inches (51 mm) wide by 10 inches (254 mm) long; or wire anchors not less than 0.177 inch (4.5 mm) thick.
2. Stud-Wall Type: Designed to engage stud, welded to back of frames; not less than 0.042 inch (1.0 mm) thick.
3. Compression Type for Drywall Slip-on Frames: Adjustable compression anchors.
4. Postinstalled Expansion Type for In-Place Concrete or Masonry: Minimum 3/8-inch- (9.5-mm-) diameter bolts with expansion shields or inserts. Provide pipe spacer from frame to wall, with throat reinforcement plate, welded to frame at each anchor location.

B. Floor Anchors: Formed from same material as frames, minimum thickness of 0.042 inch (1.0 mm), and as follows:

2.5 MATERIALS

A. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of pre-consumer recycled content no less than 25 percent.

B. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B.

C. Hot-Rolled Steel Sheet: ASTM A 1011/A 1011M, Commercial Steel (CS), Type B.

D. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B.

E. Frame Anchors: ASTM A 879/A 879M, Commercial Steel (CS), 04Z (12G) coating designation; mill phosphatized.

1. For anchors built into exterior walls, steel sheet complying with ASTM A 1008/A 1008M or ASTM A 1011/A 1011M, hot-dip galvanized according to ASTM A 153/A 153M, Class B.

F. Inserts, Bolts, and Fasteners: Hot-dip galvanized according to ASTM A 153/A 153M.

G. Power-Actuated Fasteners in Concrete: From corrosion-resistant materials.

H. Grout: ASTM C 476, except with a maximum slump of 4 inches (102 mm), as measured according to ASTM C 143/C 143M.

I. Mineral-Fiber Insulation: ASTM C 665, Type I (blankets without membrane facing).

J. Glazing: Comply with requirements in Section 088000 "Glazing."

K. Bituminous Coating: Cold-applied asphalt mastic, compounded for 15-mil (0.4-mm) dry film thickness per coat.

2.6 FABRICATION

A. Fabricate hollow-metal work to be rigid and free of defects, warp, or buckle. Accurately form metal to required sizes and profiles, with minimum radius for metal thickness. Where practical, fit and assemble units in manufacturer's plant. To ensure proper assembly at Project site, clearly identify work that cannot be permanently factory assembled before shipment.

B. Hollow-Metal Frames: Where frames are fabricated in sections due to shipping or handling limitations, provide alignment plates or angles at each joint, fabricated of same thickness metal as frames.

1. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.
2. Grout Guards: Weld guards to frame at back of hardware mortises in frames to be grouted.
3. Floor Anchors: Weld anchors to bottoms of jambs with at least four spot welds per anchor; however, for slip-on drywall frames, provide anchor clips or countersunk holes at bottoms of jambs.
4. Jamb Anchors: Provide number and spacing of anchors as follows:

    a. Masonry Type: Locate anchors not more than 16 inches (406 mm) from top and bottom of frame. Space anchors not more than 32 inches (813 mm) o.c., to match coursing.
    b. Stud-Wall Type: Locate anchors not more than 18 inches (457 mm) from top and bottom of frame. Space anchors not more than 32 inches (813 mm) o.c.
    c. Compression Type: Not less than two anchors in each frame.
    d. Postinstalled Expansion Type: Locate anchors not more than 6 inches (152 mm) from top and bottom of frame. Space anchors not more than 26 inches (660 mm) o.c.

5. Door Silencers: Except on weather-stripped frames, drill stops to receive door silencers.

C. Hardware Preparation: Factory prepare hollow-metal work to receive templated mortised hardware; include cutouts, reinforcement, mortising, drilling, and tapping according to SDI A250.6, the Door Hardware Schedule, and templates.

1. Reinforce frames to receive nontemplated, mortised, and surface-mounted hardware.
2. Comply with applicable requirements in SDI A250.6 and BHMA A156.115 for preparation of hollow-metal work for hardware.

D. Stops and Moldings: Provide stops and moldings around glazed lites and louvers where indicated. Form corners of stops and moldings with mitered hairline joints.

1. Single Glazed Lites: Provide fixed stops and moldings welded on secure side of hollow-metal work.
2. Multiple Glazed Lites: Provide fixed and removable stops and moldings so that each glazed lite is capable of being removed independently.
3. Provide fixed frame moldings on outside of exterior and on secure side of interior frames.
4. Provide loose stops and moldings on inside of hollow-metal work.
5. Coordinate rabbet width between fixed and removable stops with glazing and installation types indicated.

2.7 STEEL FINISHES

A. Prime Finish: Clean, pretreat, and apply manufacturer's standard primer.

1. Shop Primer: SDI A250.10.

2.8 ACCESSORIES

A. Mullions and Transom Bars: Join to adjacent members by welding or rigid mechanical anchors.

B. Grout Guards: Formed from same material as frames, not less than 0.016 inch (0.4 mm) thick.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Hollow-Metal Frames: Install hollow-metal frames for doors, transoms, sidelites, borrowed lites, and other openings, of size and profile indicated. Comply with SDI A250.11 or NAAMM-HMMA 840 as required by standards specified.

1. Set frames accurately in position; plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces, leaving surfaces smooth and undamaged.

a. At fire-rated openings, install frames according to NFPA 80.
b. Where frames are fabricated in sections because of shipping or handling limitations, field splice at approved locations by welding face joint continuously; grind, fill, dress, and make splice smooth, flush, and invisible on exposed faces.
c. Install frames with removable stops located on secure side of opening.
d. Install door silencers in frames before grouting.

e. Remove temporary braces necessary for installation only after frames have been properly set and secured.
f. Check plumb, square, and twist of frames as walls are constructed. Shim as necessary to comply with installation tolerances.
g. Field apply bituminous coating to backs of frames that will be filled with grout containing antifreezing agents.

2. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor, and secure with postinstalled expansion anchors.

   a. Floor anchors may be set with power-actuated fasteners instead of postinstalled expansion anchors if so indicated and approved on Shop Drawings.

3. Metal-Stud Partitions: Solidly pack mineral-fiber insulation inside frames.
4. Masonry Walls: Coordinate installation of frames to allow for solidly filling space between frames and masonry with grout.
5. Concrete Walls: Solidly fill space between frames and concrete with mineral-fiber insulation.
6. In-Place Concrete or Masonry Construction: Secure frames in place with postinstalled expansion anchors. Countersink anchors, and fill and make smooth, flush, and invisible on exposed faces.
7. In-Place Metal or Wood-Stud Partitions: Secure slip-on drywall frames in place according to manufacturer's written instructions.
8. Installation Tolerances: Adjust hollow-metal door frames for squareness, alignment, twist, and plumb to the following tolerances:

   a. Squareness: Plus or minus 1/16 inch (1.6 mm), measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
   b. Alignment: Plus or minus 1/16 inch (1.6 mm), measured at jambs on a horizontal line parallel to plane of wall.
   c. Twist: Plus or minus 1/16 inch (1.6 mm), measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
   d. Plumbness: Plus or minus 1/16 inch (1.6 mm), measured at jambs at floor.

B. Glazing: Comply with installation requirements in Section 088000 "Glazing" and with hollow-metal manufacturer's written instructions.

   1. Secure stops with countersunk flat- or oval-head machine screws spaced uniformly not more than 9 inches (230 mm) o.c. and not more than 2 inches (51 mm) o.c. from each corner.

3.2 ADJUSTING AND CLEANING

A. Final Adjustments: Remove and replace defective work, including hollow-metal work that is warped, bowed, or otherwise unacceptable.

B. Remove grout and other bonding material from hollow-metal work immediately after installation.

C. Prime-Coat Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat and apply touchup of compatible air-drying, rust-inhibitive primer.

D. Metallic-Coated Surface Touchup: Clean abraded areas and repair with galvanizing repair paint according to manufacturer's written instructions.

E. Touchup Painting: Cleaning and touchup painting of abraded areas of paint are specified in painting Sections.

END OF SECTION 081213

SECTION 081416 - FLUSH WOOD DOORS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Solid-core doors with wood-veneer faces.
2. Factory finishing flush wood doors.
3. Factory fitting flush wood doors to frames and factory machining for hardware.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of door. Include factory-finishing specifications.

B. Shop Drawings: Indicate location, size, and hand of each door; elevation of each kind of door; construction details not covered in Product Data; and the following:

1. Dimensions and locations of blocking.
2. Dimensions and locations of mortises and holes for hardware.
3. Dimensions and locations of cutouts.
4. Undercuts.
5. Requirements for veneer matching.
6. Doors to be factory finished and finish requirements.
7. Fire-protection ratings for fire-rated doors.

C. Samples: For factory-finished doors.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manuafacturers: Submect to compliance with the requirements, provide products by on of the following;

1. Algoma Hardwoods,
2. Eggers Industries
3. Graham Wood Doors
4. Mohawk Flush Doors,
5. VT Industries

2.2 FLUSH WOOD DOORS, GENERAL

A. Quality Standard: In addition to requirements specified, comply with AWI's, AWMAC's, and WI's "Architectural Woodwork Standards."

B. WDMA I.S.1-A Performance Grade:

1. Heavy Duty unless otherwise indicated.

C. Fire-Rated Wood Doors: Doors complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing at positive pressure according to NFPA 252.

1. Cores: Provide core specified or mineral core as needed to provide fire-protection rating indicated.
2. Edge Construction: Provide edge construction with intumescent seals concealed by outer stile. Comply with specified requirements for exposed edges.
3. Pairs: Provide fire-retardant stiles that are listed and labeled for applications indicated without formed-steel edges and astragals. Provide stiles with concealed intumescent seals. Comply with specified requirements for exposed edges.

D. Smoke- and Draft-Control Door Assemblies: Listed and labeled for smoke and draft control, based on testing according to UL 1784.

E. Structural-Composite-Lumber-Core Doors:

1. Structural Composite Lumber: WDMA I.S.10.

a. Screw Withdrawal, Face: 700 lbf (3100 N).
b. Screw Withdrawal, Edge: 400 lbf (1780 N).

F. Mineral-Core Doors:

1. Core: Noncombustible mineral product complying with requirements of referenced quality standard and testing and inspecting agency for fire-protection rating indicated.
2. Blocking: Provide composite blocking with improved screw-holding capability approved for use in doors of fire-protection ratings indicated as needed to eliminate through-bolting hardware.
3. Edge Construction: At hinge stiles, provide laminated-edge construction with improved screw-holding capability and split resistance. Comply with specified requirements for exposed edges.

2.3 DOORS FOR OPAQUE FINISH

A. Interior Solid-Core Doors::

1. Grade: Custom.
2. Faces: MDO.
3. Core: Either glued wood stave or structural composite lumber.
4. Construction: Five plies. Stiles and rails are bonded to core, then entire unit is abrasive planed before veneering. Faces are bonded to core using a hot press.

2.4 FABRICATION

A. Factory fit doors to suit frame-opening sizes indicated. Comply with clearance requirements of referenced quality standard for fitting unless otherwise indicated.

1. Comply with NFPA 80 requirements for fire-rated doors.

B. Factory machine doors for hardware that is not surface applied.

C. Openings: Factory cut and trim openings through doors.

1. Light Openings: Trim openings with moldings of material and profile indicated.
2. Glazing: Factory install glazing in doors indicated to be factory finished. Comply with applicable requirements in Section 088000 "Glazing."
3. Louvers: Factory install louvers in prepared openings.

2.5 SHOP PRIMING

A. Doors for Opaque Finish: Shop prime faces, all four edges, edges of cutouts, and mortises with one coat of wood primer.

2.6 FACTORY FINISHING

A. General: Comply with referenced quality standard for factory finishing. Complete fabrication, including fitting doors for openings and machining for hardware that is not surface applied, before finishing.

1. Finish faces, all four edges, edges of cutouts, and mortises. Stains and fillers may be omitted on bottom edges, edges of cutouts, and mortises.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Hardware: For installation, see Section 087100 "Door Hardware."

B. Installation Instructions: Install doors to comply with manufacturer's written instructions and referenced quality standard, and as indicated.

1. Install fire-rated doors according to NFPA 80.
2. Install smoke- and draft-control doors according to NFPA 105.

C. Job-Fitted Doors: Align and fit doors in frames with uniform clearances and bevels as indicated below; do not trim stiles and rails in excess of limits set by manufacturer or permitted for fire-rated doors. Machine doors for hardware. Seal edges of doors, edges of cutouts, and mortises after fitting and machining.

1. Clearances: Provide 1/8 inch (3.2 mm) at heads, jambs, and between pairs of doors. Provide 1/8 inch (3.2 mm) from bottom of door to top of decorative floor finish or covering unless otherwise indicated. Where threshold is shown or scheduled, provide 1/4 inch (6.4 mm) from bottom of door to top of threshold unless otherwise indicated.

a. Comply with NFPA 80 for fire-rated doors.

D. Factory-Fitted Doors: Align in frames for uniform clearance at each edge.

E. Factory-Finished Doors: Restore finish before installation if fitting or machining is required at Project site.

F. Site-Finished Doors: Provide two coats of semi-gloss paint on all door surfaces prior to installation of door locks and levers and closers.

END OF SECTION 081416

SECTION 087100 - DOOR HARDWARE

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes:

1. Mechanical door hardware for the following:

a. Swinging doors.

1.2 ACTION SUBMITTALS

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

B. Other Action Submittals:

1. Door Hardware Schedule: Prepared by or under the supervision of Installer, detailing fabrication and assembly of door hardware, as well as installation procedures and diagrams. Coordinate final door hardware schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.

a. Format: Use same scheduling sequence and format and use same door numbers as in the Contract Documents.
b. Content: Include the following information:

1) Identification number, location, hand, fire rating, size, and material of each door and frame.
2) Locations of each door hardware set, cross-referenced to Drawings on floor plans and to door and frame schedule.
3) Complete designations, including name and manufacturer, type, style, function, size, quantity, function, and finish of each door hardware product.
4) Description of electrified door hardware sequences of operation and interfaces with other building control systems.

1.3 QUALITY ASSURANCE

A. Installer Qualifications: Supplier of products and an employer of workers trained and approved by product manufacturers and an Architectural Hardware Consultant who is available during the course of the Work to consult with Contractor, Architect, and Owner about door hardware and keying.

B. Architectural Hardware Consultant Qualifications: A person who is experienced in providing consulting services for door hardware installations that are comparable in material, design, and extent to that indicated for this Project and who is currently certified by DHI as follows:

1. For door hardware, an Architectural Hardware Consultant (AHC).

C. Source Limitations: Provide electrified door hardware from same manufacturer as mechanical door hardware, unless otherwise indicated. Manufacturers that perform electrical modifications and that are listed by a testing and inspecting agency acceptable to authorities having jurisdiction are acceptable.

D. Fire-Rated Door Assemblies: Where fire-rated door assemblies are indicated, provide door hardware rated for use in assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing at positive pressure according to NFPA 252 or UL 10C, unless otherwise indicated.

E. Smoke- and Draft-Control Door Assemblies: Where smoke- and draft-control door assemblies are required, provide door hardware that meet requirements of assemblies tested according to UL 1784 and installed in compliance with NFPA 105.

1. Air Leakage Rate: Maximum air leakage of0.3 cfm/sq. ft. (3 cu. m per minute/sq. m) at the tested pressure differential of 0.3-inch wg (75 Pa) of water.

F. Electrified Door Hardware: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction.

G. Means of Egress Doors: Latches do not require more than 15 lbf (67 N) to release the latch. Locks do not require use of a key, tool, or special knowledge for operation.

H. Accessibility Requirements: Comply with applicable provisions in the DOJ's 2010 ADA Standards for Accessible Design, and ICC A117.1 for door hardware on doors in an accessible route.

1. Provide operating devices that do not require tight grasping, pinching, or twisting of the wrist and that operate with a force of not more than 5 lbf (22.2 N).
2. Comply with the following maximum opening-force requirements:

a. Interior, Non-Fire-Rated Hinged Doors: 5 lbf (22.2 N) applied perpendicular to door.
b. Fire Doors: Minimum opening force allowable by authorities having jurisdiction.

3. Bevel raised thresholds with a slope of not more than 1:2. Provide thresholds not more than 1/2 inch (13 mm) high.
4. Closers: Adjust door and gate closer sweep periods so that, from an open position of 90 degrees, the time required to move the door to a position of 12 degrees from the latch is 5 seconds minimum.
5. Spring Hinges: Adjust door and gate spring hinges so that, from an open position of 70 degrees, the time required to move the door to the closed position is 1.5 seconds minimum.

I. Keying Conference: Conduct conference at Project site to comply with requirements in Section 013100 "Project Management and Coordination."

1.4 DELIVERY, STORAGE, AND HANDLING

A. Deliver permanent cores to Owner.

1.5 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of door hardware that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Three years from date of Beneficial Occupancy or Final Acceptance, unless otherwise indicated.

a. Exit Devices: Two years from date of Beneficial Occupancy or Final Acceptance.
b. Manual Closers: 10 years from date of Beneficial Occupancy or Final Acceptance.

PART 2 - PRODUCTS

2.1

A. Manufacturer’s acceptable to provide products to be included in the work are:

1. Corbin Russwin
2. Glynn Johnson
3. Best
4. Ives
5. LCN
6. National Guard
7. Pemko
8. Rockwood
9. Von Duprin
10. Schlage
11. McKinney

2.2 SCHEDULED DOOR HARDWARE

A. Provide door hardware for each door as scheduled in Part 3 "Door Hardware Schedule" Article to comply with requirements in this Section.

1. Door Hardware Sets: Provide quantity, item, size, finish or color indicated.

2. Sequence of Operation: Provide electrified door hardware function, sequence of operation, and interface with other building control systems indicated.

B. Designations: Requirements for design, grade, function, finish, size, and other distinctive qualities of each type of door hardware are indicated in Part 3 "Door Hardware Schedule" Article. Products are identified by using door hardware designations, as follows:

1. Named Manufacturers' Products: Manufacturer and product designation are listed for each door hardware type required for the purpose of establishing minimum requirements. Manufacturers' names are abbreviated in Part 3 "Door Hardware Schedule" Article.
2. References to BHMA Designations: Provide products complying with these designations and requirements for description, quality, and function.

2.3 HINGES

A. Hinges: BHMA A156.1. Provide template-produced hinges for hinges installed on hollow-metal doors and hollow-metal frames.

2.4 SELF-CLOSING HINGES AND PIVOTS

A. Self-Closing Hinges and Pivots: BHMA A156.17.

2.5 MECHANICAL LOCKS AND LATCHES

A. Strikes: Provide manufacturer's standard strike for each lock bolt or latchbolt complying with requirements indicated for applicable lock or latch and with strike box and curved lip extended to protect frame; finished to match lock or latch.

1. Flat-Lip Strikes: For locks with three-piece antifriction latchbolts, as recommended by manufacturer.
2. Extra-Long-Lip Strikes: For locks used on frames with applied wood casing trim.
3. Aluminum-Frame Strike Box: Manufacturer's special strike box fabricated for aluminum framing.
4. Rabbet Front and Strike: Provide on locksets for rabbeted meeting stiles.

B. Bored Locks: BHMA A156.2; Grade 1; Series 4000.

C. Mortise Locks: BHMA A156.13; Operational Grade 1; stamped steel case with steel or brass parts; Series 1000.

D. Occupancy Identification: Provide mechanically operated occupancy identification on public side of door to be activated when latch is turned from unlocked to locked position. Unlocked position to read “Vacant”. Locked position to read “In use”.

2.6 AUXILIARY LOCKS

A. Bored Auxiliary Locks: BHMA A156.5: Grade 1; with strike that suits frame.

B. Mortise Auxiliary Locks: BHMA A156.5; Grade 1; with strike that suits frame.

C. Push-Button Combination Locks: BHMA A156.5; mortise; Grade 1; lock opens by entering a one- to five-digit code by pushing correct buttons in correct sequence; automatically relocks when door is closed; with strike that suits frame.

2.7 EXIT LOCKS AND EXIT ALARMS

A. Exit Locks and Alarms: BHMA A156.29, Grade 1.

2.8 MANUAL FLUSH BOLTS

A. Manual Flush Bolts: BHMA A156.16; minimum 3/4-inch (19-mm) throw; designed for mortising into door edge.

2.9 LOCK CYLINDERS

A. Lock Cylinders: Tumbler type, constructed from brass or bronze, stainless steel, or nickel silver.

1. Cylinders to be small format interchangeable core Best / Schlage per owner's existing locking system.

2.10 KEYING

A. Keying System: Owner will provide keyway system required for cylinders. Keying to be provided by owner. Keys by Best

2.11 OPERATING TRIM

A. Operating Trim: BHMA A156.6; match existing, unless otherwise indicated.

2.12 ACCESSORIES FOR PAIRS OF DOORS

A. Coordinators: BHMA A156.3; consisting of active-leaf, hold-open lever and inactive-leaf release trigger; fabricated from steel with nylon-coated strike plates; with built-in, adjustable safety release; and with internal override.

B. Carry-Open Bars: BHMA A156.3; prevent the inactive leaf from opening before the active leaf; provide polished brass or bronze carry-open bars with strike plate for inactive leaves of pairs of doors unless automatic or self-latching bolts are used.

C. Astragals: BHMA A156.22.

2.13 SURFACE CLOSERS

A. Surface Closers: BHMA A156.4; rack-and-pinion hydraulic type with adjustable sweep and latch speeds controlled by key-operated valves and forged-steel main arm. Comply with manufacturer's written recommendations for size of door closers depending on size of door, exposure to weather, and anticipated frequency of use. Provide factory-sized closers, adjustable to meet field conditions and requirements for opening force.

2.14 CONCEALED CLOSERS

A. Concealed Closers: BHMA A156.4; rack-and-pinion hydraulic type with adjustable sweep and latch speeds controlled by key-operated valves. Comply with manufacturer's written recommendations for size of door closers depending on size of door, exposure to weather, and anticipated frequency of use. Provide factory-sized closers, adjustable to meet field conditions and requirements for opening force.

2.15 MECHANICAL STOPS AND HOLDERS

A. Wall- and Floor-Mounted Stops: BHMA A156.16; polished cast brass, bronze, or aluminum base metal.

2.16 OVERHEAD STOPS AND HOLDERS

A. Overhead Stops and Holders: BHMA A156.8.

2.17 DOOR GASKETING

A. Door Gasketing: BHMA A156.22; air leakage not to exceed 0.50 cfm per foot (0.000774 cu. m/s per m) of crack length for gasketing other than for smoke control, as tested according to ASTM E 283; with resilient or flexible seal strips that are easily replaceable and readily available from stocks maintained by manufacturer.

2.18 THRESHOLDS

A. Thresholds: BHMA A156.21; fabricated to full width of opening indicated.

2.19 METAL PROTECTIVE TRIM UNITS

A. Metal Protective Trim Units: BHMA A156.6; fabricated from 0.050-inch- (1.3-mm-) thick aluminum; with manufacturer's standard machine or self-tapping screw fasteners.

2.20 AUXILIARY DOOR HARDWARE

A. Auxiliary Hardware: BHMA A156.16.

2.21 FABRICATION

A. Fasteners: Provide door hardware manufactured to comply with published templates prepared for machine, wood, and sheet metal screws. Provide screws that comply with commercially recognized industry standards for application intended, except aluminum fasteners are not permitted. Provide Phillips flat-head screws with finished heads to match surface of door hardware, unless otherwise indicated.

1. Concealed Fasteners: For door hardware units that are exposed when door is closed, except for units already specified with concealed fasteners. Do not use through bolts for installation where bolt head or nut on opposite face is exposed unless it is the only means of securely attaching the door hardware. Where through bolts are used on hollow door and frame construction, provide sleeves for each through bolt.
2. Fire-Rated Applications:

    a. Wood or Machine Screws: For the following:

        1) Hinges mortised to doors or frames; use threaded-to-the-head wood screws for wood doors and frames.
        2) Strike plates to frames.
        3) Closers to doors and frames.

    b. Steel Through Bolts: For the following unless door blocking is provided:

        1) Surface hinges to doors.

2) Closers to doors and frames.
3) Surface-mounted exit devices.

3. Spacers or Sex Bolts: For through bolting of hollow-metal doors.
4. Fasteners for Wood Doors: Comply with requirements in DHI WDHS.2, "Recommended Fasteners for Wood Doors."
5. Gasketing Fasteners: Provide noncorrosive fasteners for exterior applications and elsewhere as indicated.

2.22 FINISHES

A. Provide finishes complying with BHMA A156.18 as indicated in door hardware schedule.

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Steel Doors and Frames: For surface applied door hardware, drill and tap doors and frames according to ANSI/SDI A250.6.

B. Mounting Heights: Mount door hardware units at heights to comply with the following unless otherwise indicated or required to comply with governing regulations.

1. Standard Steel Doors and Frames: ANSI/SDI A250.8.
2. Custom Steel Doors and Frames: HMMA 831.
3. Wood Doors: DHI WDHS.3, "Recommended Locations for Architectural Hardware for Wood Flush Doors."

C. Install each door hardware item to comply with manufacturer's written instructions. Where cutting and fitting are required to install door hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation of surface protective trim units with finishing work. Do not install surface-mounted items until finishes have been completed on substrates involved.

1. Set units level, plumb, and true to line and location. Adjust and reinforce attachment substrates as necessary for proper installation and operation.
2. Drill and countersink units that are not factory prepared for anchorage fasteners. Space fasteners and anchors according to industry standards.

D. Hinges: Install types and in quantities indicated in door hardware schedule but not fewer than the number recommended by manufacturer for application indicated or one hinge for every 30 inches (750 mm) of door height, whichever is more stringent, unless other equivalent means of support for door, such as spring hinges or pivots, are provided.

E. Intermediate Offset Pivots: Where offset pivots are indicated, provide intermediate offset pivots in quantities indicated in door hardware schedule but not fewer than one intermediate offset pivot per door and one additional intermediate offset pivot for every 30 inches (750 mm) of door height greater than 90 inches (2286 mm).

F. Lock Cylinders: Install construction cores to secure building and areas during construction period.
   1. Furnish permanent cores to Owner for installation.

G. Thresholds: Set thresholds for exterior doors and other doors indicated in full bed of sealant complying with requirements specified in Section 079200 "Joint Sealants."

H. Stops: Provide floor stops for doors unless wall or other type stops are indicated in door hardware schedule. Do not mount floor stops where they will impede traffic.

I. Perimeter Gasketing: Apply to head and jamb, forming seal between door and frame.

J. Meeting Stile Gasketing: Fasten to meeting stiles, forming seal when doors are closed.

K. Door Bottoms: Apply to bottom of door, forming seal with threshold when door is closed.

L. Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.

3.2 FIELD QUALITY CONTROL

A. Independent Architectural Hardware Consultant: Owner will engage a qualified independent Architectural Hardware Consultant to perform inspections and to prepare inspection reports.

3.3 DOOR HARDWARE SCHEDULE

A. Basis of Design Manufacturer's provided in Schedule. Code name followed by manufacturer's name.
   1. BE: Best
   2. IV: Ives
   3. LC: LCN
   4. PE: Pemko / Assa Abloy
   5. VO: VonDuprin
   6. AB: Architectural Builders Hardware
   7. VA: Curries / Assa Abloy
   8. MC: McKinney
   9. SH: Schlage

Group 1: Doors to mechanical rooms in Observation Room, Storeroom and Waiting Room

3	Hinges	5BB1HW 4 1/2 x 4 1/2	652	IV
3	Door Silencers	608	Gray	RO
1	Wall Bumper	409	US32D	RO
1	Lever Lockset	AXL 80 (Storage Function) RHO	626	SH
1	Cylinder*	Match owner's existing Primus interchangeable 6-pin cores		SH

*Coordinate lock/keying with ENCSD facilities personnel.

Group 2: Doors to mechanical rooms in Conference Room

3	Hinges	5BB1HW 4 1/2 x 4 1/2	652	IV
3	Door Silencers	608	Gray	RO
1	Overhead Stop	4144	US32D	AB
1	Lever Lockset	AXL 80 (Storage Function) RHO	626	SH
1	Cylinder*	Match owner's existing Primus interchangeable 6-pin cores		SH

*Coordinate lock/keying with ENCSD facilities personnel.

Final Cores to be provided by contractor to ENDSD. Locks to be shipped with temporary construction cores. ENCSD will remove construction cores upon keying.

END OF SECTION 087100

SECTION 09 51 23
ACOUSTICAL TILE CEILINGS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. This Section includes acoustical tiles for ceilings and the following:
   1. 2'x2' Acoustical Tile Lay-in Ceiling
   2. Suspended ceiling grid

B. Products furnished, but not installed under this Section, include anchors, clips, and other ceiling attachment devices to be cast in concrete at ceilings.

1.03 DEFINITIONS

A. AC: Articulation Class.

B. CAC: Ceiling Attenuation Class.

C. LR: Light-Reflectance coefficient.

D. NRC: Noise Reduction Coefficient.

1.04 SUBMITTALS

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

B. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which the following items are shown and coordinated with each other, based on input from installers of the items involved:
   1. Ceiling suspension system members.
   2. Method of attaching hangers to building structure.

C. Samples for Initial Selection: For components with factory-applied color finishes.

D. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for each acoustical tile ceiling.

E. Maintenance Data: For finishes to include in maintenance manuals.

F. Certificates: Submit certificates from manufacturers of acoustical ceiling units and suspension systems attesting that their products comply with specification requirements.

1.05 QUALITY ASSURANCE

A. Source Limitations:
   1. Acoustical Ceiling Tile: Obtain each type through one source from a single manufacturer.
   2. Suspension System: Obtain each type through one source from a single manufacturer.

B. Fire-Test-Response Characteristics: Provide acoustical tile ceilings that comply with the following requirements:
   1. Surface-Burning Characteristics: Provide acoustical tiles with the following surface-burning characteristics complying with ASTM E 1264 for Class A materials as determined by testing identical products per ASTM E 84:
      a. Smoke-Developed Index: 450 or less.

C. Seismic Standard: Provide acoustical tile ceilings designed and installed to withstand the effects of earthquake motions according to the following:
      a. CISCA's Recommendations for Acoustical Ceilings: Comply with CISCA's "Recommendations for Direct-Hung Acoustical Tile and Lay-in Panel Ceilings--Seismic Zones 0-2."

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver acoustical tiles, suspension system components, and accessories to Project site in original, unopened packages and store them in a fully enclosed, conditioned space where they will be protected against damage from moisture, humidity, temperature extremes, direct sunlight, surface

contamination, and other causes.

B. Before installing acoustical tiles, permit them to reach room temperature and a stabilized moisture content.

C. Handle acoustical tiles carefully to avoid chipping edges or damaging units in any way.

1.07 PROJECT CONDITIONS

A. Environmental Limitations: Do not install acoustical tile ceilings until spaces are enclosed and weatherproof, wet work in spaces is complete and dry, work above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.
   1. Pressurized Plenums: Operate ventilation system for not less than 48 hours before beginning acoustical tile ceiling installation.

1.08 COORDINATION

A. Coordinate layout and installation of acoustical tiles and suspension system with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, fire-suppression system, and partition assemblies.

1.09 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Acoustical Ceiling Units: Full-size tiles equal to 2.0 percent of quantity installed.
   2. Suspension System Components: Quantity of each concealed grid and exposed component equal to 2.0 percent of quantity installed.

PART 2 PRODUCTS

2.01 ACOUSTICAL TILES, GENERAL

A. Acoustical Tile Standard: Provide manufacturer's standard tiles of configuration indicated that comply with ASTM E 1264 classifications as designated by types, patterns, acoustical ratings, and light reflectances, unless otherwise indicated.

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

C. Sound Attenuation Performance: Provide acoustical ceiling units with ratings for ceiling sound transmission class (STC) of range indicated as determined according to AMA 1-II "Ceiling Sound Transmission Test by Two-Room Method" with ceilings continuous at partitions and supported by a metal suspension system of type appropriate for ceiling unit of configuration indicated (concealed for tile, exposed for panels).

D. Broad Spectrum Antimicrobial Fungicide and Bactericide Treatment: Provide acoustical tiles treated with manufacturer's standard antimicrobial formulation that inhibits fungus, mold, mildew, and gram-positive and gram-negative bacteria and showing no mold, mildew, or bacterial growth when tested according to ASTM D 3273 and evaluated according to ASTM D 3274 or ASTM G 21.

2.02 ACOUSTICAL TILES FOR ACOUSTICAL TILE CEILING

A. Refer to drawings for locations of ceiling finish.

B. Basis-of-Design Product (as listed below): Subject to compliance with requirements, provide Armstrong product as specified or a comparable product by one of the following:
   1. CertainTeed
   2. USG Interiors, Inc
   3. Armstrong World Industries, Inc.

C. Lay-in Ceiling “A” Armstrong 1713 School Zone Fine Fissured, USG 22421 Radar Education or equal by CertainTeed HHF-454-HNR. Use in Finished Areas.

1. Color: White.
2. LR: Not less than 0.83.
3. NRC: Not less than 0.70.
4. CAC: Not less than 35.
5. Edge/Joint Detail: Square Edge
6. Thickness: min. 3/4 inch.
7. Modular Size: 24 by 24 inches.
8. Antimicrobial Treatment: Broad spectrum fungicide and bactericide based.
9. 15 Year No-Sag Resistance: Provide 15 year no-sag warranty.

D. Lay-in Ceiling “B” Armstrong Kitchen Zone 673 or vinyl covered gypsum by USG 3260, CertainTeed Performa Vinylrock 1142-CRF-1. Use in Mechanical Rooms.
1. Color: White.
2. LR: Not less than 0.77.
3. NRC: N/A.
4. CAC: min. 33.
5. Edge/Joint Detail: Square.
6. Thickness: min. 1/2 inch.
7. Modular Size: 24 by 24 inches.
8. Humidity tolerant: Humiguard Plus, ClimaPlus Performance, or Sag Resistant
9. 15 Year No-Sag Resistance: Provide 15 year no-sag warranty.
10. Tile shall be approved for use in food processing areas

2.03 METAL SUSPENSION SYSTEMS, GENERAL

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

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

C. Wire Hangers, Braces, and Ties: Provide wires complying with the following requirements:
1. Galvanized, Carbon-Steel Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper.
2. Size: Select wire diameter so its stress at 3 times hanger design load (ASTM C 635, Table 1, "Direct Hung") will be less than yield stress of wire, but provide not less than 12 gauge diameter wire.

D. Hanger Rods: Mild steel, zinc coated or protected with rust-inhibitive paint.

E. Angle Hangers: Angles with legs not less than 7/8 inch wide; formed with 0.04-inch- thick, galvanized steel sheet complying with ASTM A 653/A 653M, G90 coating designation; with bolted connections and 5/16-inch- diameter bolts.

F. Seismic Struts: Manufacturer's standard compression struts designed to accommodate lateral forces.

G. Seismic Clips: Manufacturer's standard seismic clips designed and spaced to secure acoustical tiles in-place.

2.04 METAL SUSPENSION SYSTEM FOR ACOUSTICAL TILE CEILING

A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:

B. Products: Subject to compliance with requirements, provide one of the following:
1. Armstrong World Industries, Inc.
2. USG Interiors, Inc.
3. Chicago Metalic
4. CertainTeed

C. Intermediate Duty, Direct-Hung, Double-Web, Suspension System: Main and cross runners roll formed from and capped with cold-rolled steel sheet, prepainted, electrolytically zinc coated, or hot-dip galvanized according to ASTM A 653/A 653M, G30 coating designation.

1. Structural Classification: Intermediate-duty system.
2. Access: Upward and end or side pivoted, with initial access openings of size indicated below and located throughout ceiling within each module formed by main and cross runners, with additional access available by progressively removing remaining acoustical tiles.

D. Indirect-Hung, Fire-Rated Suspension System: Main and cross runners roll formed from cold-rolled steel sheet with 15/16” wide exposed faces on structural members, prepainted, electrolytically zinc coated, or hot-dip galvanized according to ASTM A 653/A 653M, G30 coating designation.
   1. Structural Classification: Intermediate-duty system.
   2. Carrying Channels: Cold-rolled steel, 0.059850-inch- minimum base (uncoated) metal thickness, not less than 3/16-inch- wide flanges by 1-1/2-inch- deep steel channels, 475 lb/1000 feet, with rust-inhibitive paint finish.
   3. Access: Where access is indicated, provide special cross runners or split splines to allow for removal of acoustical units in indicated access areas. Identify access tile with manufacturer's standard unobtrusive markers for each access unit.

2.05 METAL EDGE MOLDINGS AND TRIM

A. Products: Subject to compliance with requirements, provide one of the following:
   1. Armstrong World Industries, Inc.
   2. Chicago Metallic Corporation
   3. USG Interiors, Inc.

B. Roll-Formed, Sheet-Metal Edge Moldings and Trim: Type and profile indicated or, if not indicated, manufacturer's standard moldings for edges and penetrations that comply with seismic design requirements; formed from sheet metal of same material, finish, and color as that used for exposed flanges of suspension system runners.
   1. Provide manufacturer's standard edge moldings that fit acoustical tile edge details and suspension systems indicated and that match width and configuration of exposed runners, unless otherwise indicated.
   2. For circular penetrations of ceiling, provide edge moldings fabricated to diameter required to fit penetration exactly.

2.06 ACOUSTICAL SEALANT

A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:

B. Products: Subject to compliance with requirements, provide one of the following:
   1. Acoustical Sealant for Exposed and Concealed Joints:
      a. Pecora Corporation; AC-20 FTR Acoustical and Insulation Sealant.
      b. USG Corporation; SHEETROCK Acoustical Sealant.
   2. Acoustical Sealant for Concealed Joints:
      a. OSI Sealants, Inc.; Pro-Series SC-175 Rubber Base Sound Sealant.
      b. Pecora Corporation; BA-98.
      c. Tremco, Inc.; Tremco Acoustical Sealant.

C. Acoustical Sealant for Exposed and Concealed Joints: Manufacturer's standard nonsag, paintable, nonstaining latex sealant, with a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24), complying with ASTM C 834 and effective in reducing airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.

D. Acoustical Sealant for Concealed Joints: Manufacturer's standard nondrying, nonhardening, nonskinning, nonstaining, gunnable, synthetic-rubber sealant, with a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24), recommended for sealing interior concealed joints to reduce airborne sound transmission.

2.07 MISCELLANEOUS MATERIALS

A. Hold-Down Clips for Non-Fire-Rated Ceilings: For interior ceilings composed of lay-in panels weighting less than 1 lb per sq.ft., provide hold-down clips spaced 2'-0" o.c. on all cross tees.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine substrates, areas, and conditions, including structural framing and substrates to which acoustical tile ceilings attach or abut, with Installer present, for compliance with requirements specified in this and other Sections that affect ceiling installation and anchorage and with requirements for installation tolerances and other conditions affecting performance of acoustical tile ceilings.
   1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Testing Substrates: Before installing adhesively applied tiles on wet-placed substrates such as cast-in-place concrete or plaster, test and verify that moisture level is below tile manufacturer's recommended limits.

B. Measure each ceiling area and establish layout of acoustical tiles to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width tiles at borders, and comply with layout shown on reflected ceiling plans.

3.03 INSTALLATION, SUSPENDED ACOUSTICAL TILE CEILINGS

A. General: Install acoustical tile ceilings to comply with ASTM C 636 and seismic design requirements indicated, per manufacturer's written instructions and CISCA's "Ceiling Systems Handbook."

B. Suspend ceiling hangers from building's structural members and as follows:
   1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structure or of ceiling suspension system.
   2. Splay hangers only where required to miss obstructions; offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
   3. Splay hangers only where required and, if permitted with fire-resistance-rated ceilings, to miss obstructions; offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
   4. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with location of hangers at spacings required to support standard suspension system members, install supplemental suspension members and hangers in form of trapezes or equivalent devices.
   5. Secure wire hangers to ceiling suspension members and to supports above with a minimum of three tight turns. Connect hangers directly either to structures or to inserts, eye screws, or other devices that are secure and appropriate for substrate and that will not deteriorate or otherwise fail due to age, corrosion, or elevated temperatures.
   6. Do not support ceilings directly from permanent metal forms or floor deck. Fasten hangers to cast-in-place hanger inserts, postinstalled mechanical or adhesive anchors, or power-actuated fasteners that extend through forms into concrete.
   7. When steel framing does not permit installation of hanger wires at spacing required, install carrying channels or other supplemental support for attachment of hanger wires.
   8. Do not attach hangers to steel deck tabs.
   9. Do not attach hangers to steel roof deck. Attach hangers to structural members.
   10. Space hangers not more than 48 inches o.c. along each member supported directly from hangers, unless otherwise indicated; provide hangers not more than 8 inches from ends of each member.
   11. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards and publications.

C. Secure bracing wires to ceiling suspension members and to supports with a minimum of four tight turns. Suspend bracing from building's structural members as required for hangers, without attaching to permanent metal forms, steel deck, or steel deck tabs. Fasten bracing wires into concrete with cast-in-place or postinstalled anchors.

D. Install edge moldings and trim of type indicated at perimeter of acoustical tile ceiling area and where necessary to conceal edges of acoustical tiles.
   1. Apply acoustical sealant in a continuous ribbon concealed on back of vertical legs of moldings before they are installed.

2. Screw attach moldings to substrate at intervals not more than 16 inches o.c. and not more than 3 inches from ends, leveling with ceiling suspension system to a tolerance of 1/8 inch in 12 feet. Miter corners accurately and connect securely.
3. Do not use exposed fasteners, including pop rivets, on moldings and trim.

E. Install suspension system runners so they are square and securely interlocked with one another. Remove and replace dented, bent, or kinked members.

F. Arrange directionally patterned acoustical tiles as follows:
1. Install tiles with pattern running in one direction parallel to long axis of space.

3.04 CLEANING

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

END OF SECTION 09 51 23

SECTION 23 01 01
HVAC GENERAL PROVISIONS

PART 1 GENERAL

1.01 SCOPE OF WORK

A. The Contractor shall provide all materials, equipment and labor necessary to install and set into operation the heating and air conditioning equipment as shown on the Engineering Drawings and as contained herein.

B. Intent of the drawings and specifications is to obtain complete systems, tested, adjusted, and ready for operation.

C. Include incidental details not usually indicated or specified, but necessary for proper installation and operation.

1.02 QUALITY ASSURANCE

A. Refer to the General and Supplementary General Conditions.

B. All work shall conform to applicable Underwriters' Laboratories, or third party agency credited by the NCBCC, State Building Code requirements and regulations, as amplified herein, and in accordance with the requirements of and subject to the acceptance of the North Carolina Fire Insurance Rating Bureau. All fabricated assemblies of electrically-operated equipment furnished under this contract shall have Underwriters' Laboratories approval, third party agency accredited by the NCBCC, or UL Re- examination listing for the particular type of materials or devices in question.
   1. American Society of Mechanical Engineers Code: Unfired Pressure Vessels shall be adhered to.
   2. National Board of Fire Underwriters' Pamphlets: No. 90A - Air Conditioning Systems (1995)
   3. National Board of Fire Underwriters' Standard.

C. Wherever the words "Approved", "Approval", or "Approved Equal" appear, it is intended that items other than the model number specified shall be subject to the approval of the Engineer.

D. Where a product has electrical requirements that differ from the Basis of Design specified product, it is the Mechanical Contractor's responsibility to coordinate the electrical requirements of the submitted equipment with the Electrical Engineer and Electrical Contractor and implement them at no additional cost to the project.

E. "Provide" as used herein shall mean that the Contractor responsible shall furnish and install said item or equipment. "Furnish" as used herein shall mean that the Contractor responsible shall acquire and make available said item or equipment and that installation shall be by others. Install" as used herein shall mean that the Contractor responsible shall make installation of items or equipment furnished by others.

F. All material and equipment that the Contractor proposes to substitute in lieu of those specified, shall be submitted to the Engineer within twenty (20) days after the bid date for evaluation. The submittal shall include a full description of the material or equipment and all pertinent engineering data required to substantiate the equality of the proposed item to that specified. Article 8 of the General Conditions will be followed for substitutions after award of Contract.

G. Boiler Inspection Certificate - It shall be the responsibility of the Contractor to complete the installation of fired or unfired pressure vessels and their safety devices in accordance with the requirements of the latest edition of the North Carolina Department of Labor, "Boiler Inspection Law, Rules and Regulations". The Contractor shall be responsible for notifying the Bureau of Boiler Inspection in writing at least two weeks prior to the date of completion of all equipment requiring inspection. Certificates furnished by the Bureau of Boiler Inspection shall be in a frame having a removable glass cover and posted near the pressure vessel. Certificates shall be installed before requesting final inspection of the completed project. The pressure vessel is NOT to be operated before it is inspected and approved.

1.03 SUBSTITUTIONS

A. Products are specified for use on this project by one of the following:

1. Reference Standards and Description: Any products meeting the Reference Standards and Description will be acceptable (i.e., piping).
2. Naming of a product as an example to denote the quality standard of the product is desired, in which case three or more brands will be denoted (where applicable) to establish equivalent designs. Naming of a product does not restrict Bidders to a specific brand (i.e., fixtures, valves, etc.).
3. Requests for approval of manufacturer's or substitutions which have not been pre-approved shall be made by using the forms at the end of this section.

B. During bidding period: Submitted written requests from bidders only using the forms
1. Herein, will be considered if received at least ten (10) calendar days prior to the date of receipt of bids to allow for proper evaluation. Requests from suppliers or subcontractors will not be considered.
2. Substitutions will be considered when a product becomes unavailable through no fault of the Contractor. A request constitutes a representation that the Bidder/Contractor:
3. Has investigated proposed product and determined that it meets or exceeds the quality level of the specified product and is suitable for use in the Work.
   a. Will provide the same warranty for the substitution as for the specified product.
   b. Will coordinate installation and make changes to other work which may be required for the work to be complete with no additional cost to the Owner.
   c. Waives claims for additional cost or time extension which may subsequently become apparent.
   d. Has included a list of similar projects on which this product has been used with names and telephone numbers for verification.
   e. Has written verification from the product manufacturer that this product has been in use a minimum of two (2) years on a project similar to this work.
4. Substitutions will not be considered when they are indicated or implied on shop drawings or product data submittals, without separate written request, or when acceptance will require revision to the Contract Documents.

C. Architect/Engineer Review
1. Review and approval will rely on manufacturer's literature and other data as outlined herein.
2. Inadequacies in such submittals that fail to identify unsuitability are the responsibility of the parties making submittal.

D. Substitution Procedure
1. Submit three copies of request for substitution for consideration. Limit each request to one proposed substitution.
2. Submit shop drawings, product data, and certified test results attesting to the proposed product equivalence.
3. Submit listing of similar projects.
4. Submit manufacturer's written verification that product has been in use a minimum of two (2) years at similar projects.
5. The Architect/Engineer will notify Contractor, in writing, of decision to accept or reject request.
6. Products bid or incorporated in the work that are not specified and without written approval of the Architect/Engineer may not be acceptable, and if not, the Contractor will be required to furnish and install the products specified.
7. The Architect/Engineer will issue written approvals of product substitutions to all Bidders. Substitutions are not approved without written approval.
8. FORMS: Copy forms incorporated in this project manual for use for all product substitutions.

1.04 SUBMITTALS

A. See General and Supplementary General Conditions.

B. After notification of the award of the contract and written notice to begin work, the Contractor shall submit to the Architect/Engineer, within the time frame specified by the Architect, for approval a detailed list of equipment and material which he proposes to use. Items requiring submittal data for approval will be noted at this time.

C. Contractor shall clearly indicate deviations (if any) from the project specifications on each submittal. Shop drawings accepted by the Engineer shall not relieve the Contractor of their responsibility to construct the work in accordance with the Contract Documents.

D. Include proper identification of equipment or item by name and/or number, as indicated on the Drawings.

E. Submittals shall list the equipment sorted by mark number as indicated on the Contract Document schedules.

F. Where equipment or items specified include accessories, parts, and additional items under one designation, submittals shall be complete and include all required components.

G. Equipment requiring electrical connections shall include composite wiring diagrams, motor efficiency, and power factor data. Wiring diagrams submitted shall be specific to project conditions.

H. Where submittals cover products containing non-metallic materials, include MSDS sheets from the manufacturer stating physical and chemical properties of components and precautionary steps to be taken.

I. Mark general catalog sheets and drawings to indicate specific items submitted and their correlation to specific tagged equipment on the drawings. Cross out all nonapplicable or extraneous information that does not apply to the submitted equipment. Circle or otherwise clearly indicate applicable options.

J. The Contractor shall provide an electronic PDF copy of the submittal data. The PDF submittal shall contain complete submittal data on all products, methods, etc. proposed for use on the project.

K. Each submittal shall bear the approval of the Contractor indicating that he has reviewed the data and found it to meet the requirements of the specifications as well as space limitations and other project conditions. The submittals shall be clearly identified showing project name, manufacturer's catalog number, and all necessary performance and fabrication data. Detailed submittal data shall be provided when items are to be considered as substitutions for specified items. Acceptance for approval shall be in writing from the Engineer.

L. The Contractor shall submit to the Engineer a set of accurately marked-up plans indicating all changes encountered during the construction. Final payment will be contingent on receipt of these as-built plans.

M. The Contractor shall furnish an electronic PDF copy of maintenance and operating instructions, as outlined in Paragraph C, Item #6.

N. The Contractor shall submit to the Owner all certificates required for operating system in compliance with the plans and specifications.

1.05 PRODUCT DELIVERY, STORAGE AND HANDLING

A. All material and equipment shall be delivered and unloaded by the Contractor within the project site as noted herein or as directed by the Owner.

B. The Contractor shall protect all material and equipment from breakage, theft, or weather damage. No material or equipment shall be stored on the ground.

C. The material and equipment shall remain the property of the Contractor until the project has been completed and turned over to the Owner. No partial acceptance of the work will be permitted.

1.06 WORK CONDITIONS AND COORDINATION

A. The Contractor shall review the electrical plans to establish points of connection and the extent of electrical work to be provided in his contract. All electrical work shall be performed by a licensed electrician.

B. All individual motor starters, disconnects and junction boxes for mechanical equipment (fans, pumps, etc) shall be furnished and installed under Division 23 unless indicated as a part of a motor control center. Refer to Division 26 specifications for information. Motor starters for mechanical equipment provided in motor control centers shall be furnished under Division 26. Under Division 26, power wiring shall be provided up to a termination point consisting of a junction box, trough, starter, variable frequency drive, or disconnect switch. Under Division 26, line side terminations

shall be provided. Wiring from termination point to the mechanical equipment, including final connections, shall be provided under Division 23. The Mechanical Contractor shall be responsible for the proper direction of rotation for all three phase equipment. The Mechanical Contractor shall furnish and install all control circuitry.

C. This Contractor shall be responsible for the final electrical connections to all equipment installed as part of his Contract. Unless otherwise noted, this Contractor shall wire from his equipment to disconnect switches, junction boxes, or panelboard circuit breakers as provided by the Electrical Contractor.

D. Where Architectural features and elements govern location of work, refer to Architectural drawings prior to fabrication of materials or system components.

E. Refer to the Structural Drawings to become familiar with structural member sizes, framing type and configuration, opening sizes, and other details that could impact the work. Failure to coordinate with the Work of other trades, resulting in relocation of installed work to coordinate with architectural and/or structural elements, shall NOT be allowed as a basis for extra compensation by the contractor.

F. Where piping, ductwork, or other items are indiacted to be routed in the webbing of joists or trusses, the mechanical contractor shall confirm with the General Contractor/Construction Manager and steel supplier the final joist/truss profile prior to fabricating or order materials. The actual final joist/truss profile shall be used in the BIM coordination effort.

G. Openings for insulated piping shall be based on the outside diameter of the insulation with continuous insulation through the opening.

H. Seal non-fire rated floor penetrations with non-shrink grout or urethane caulk, as appropriate.

I. Seal non-rated wall openeings with mineral wool and urethane caulk.

J. Duct/pipe/conduit penetrations through floor slabs of mechanical platforms or slabs above the bottom floor shall have water stopped curb surrounding the pipe/duct/conduit opening. Coordinate with Construction Manager/General Contractor to confirm openings based on Coordination Drawings.

K. Pipe, conduit and duct chases required for installation of work shall be provided by the General Contractor unless otherwise noted. This Contractor shall be responsible for coordinating the location of all required chases.

L. Electrical work shall be in accordance with all State codes.

M. Pipe, conduit and duct chases required for installation of work shall be provided by the General Contractor unless otherwise noted. This Contractor shall be responsible for coordinating the location of all required chases.

N. All work shall be coordinated with other trades. Cutting of new work and subsequent patching shall be at the Contractor's expense at no extra cost to the Owner.

O. Contractor shall review the complete construction document package and determine, prior to the bid, which portions of the above grade structural slabs are hard rock concrete and/or light weight insulating concrete. Contractor shall review the Structural Engineer's requirements for attachment of loads to slabs, joists, trusses, and other structural members. DO NOT exceed point loads on Structural Engineer's drawings and details. Unistrut and/or other support appartus required to span multiple joists or beams shall be included in the Contractor's bid. No additional monies will be given for support steel or other components required to support Mechanical piping, duct, equipment, or other items.

1.07 GUARANTEE

A. Refer to the General and Supplementary General Conditions.

B. Where extended warranties or guarantees are available from the manufacturer, the Contractor shall prepare the necessary contract documents to validate these warranties as required by the manufacturer and present them to the Architect/Engineer.

C. The Contractor shall include in his bid a full warranty and guarantee for a five (5) year period on the compressor for the refrigeration equipment, including all chillers. This warranty does not include labor following the first year's Labor and Material Warranty.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

A. Materials and equipment shall be new, unless noted otherwise, of the highest grade and quality and free from defects or other imperfections.

B. The Contractor shall provide name plates for identification of all equipment, switches, panels, etc.

C. The name plates shall be laminated phenolic plastic, black front and back with white core, white engraved letters (1/4" minimum) etched into the white core. name plates shall be fastened with sheet metal screws.

PART 3 EXECUTION

3.01 INSPECTION

A. This Contractor shall examine the areas of completed work and shall insure that no defects or errors are present which would result in the poor application or installation of subsequent work.

3.02 INSTALLATION

A. All work shall be performed in a manner indicating proficiency in the trade.

B. Contractor may install additional piping, fittings, valves, etc., not indicated on the drawings, for testing purposes or for convenience to faciliate installation of the work. Where such materials are installed, they shall comply with the specifications and shall be sizes to be compatible with system design. Remove such materials when they interfere with design conditions or as directed by the Engineer.

C. This Contractor shall be responsible for completely cleaning the spray fireproofing from ALL materials or equipment installed as part of this Contract. This includes, but is not limited to, ductwork, piping, conduit, equipment, faceplates, boxes, disconnects, control panels, and cabling.

D. Use of access panels in inaccessible ceilings for access to equipment, valves, dampers, etc., is not permitted, unless access panels are indicated on the Architectural reflected ceiling plans. Review any locations where additional access panels may be required with the Architect prior to incorporating into Work.

E. All conduit, pipes, ducts, etc., shall be either parallel to building walls or plumb where installed in a vertical position and shall be concealed when located in architecturally finished areas.

F. Any cutting or patching required for installation of this Contractor's work shall be kept to a minimum. Written approval shall be required by the Architect/Engineer if cutting of primary structure is involved.

G. All patching shall be done in such a manner as to restore the areas or surfaces to match existing finishes.

H. The annular space around ALL wall and floor penetrations shall be properly sealed. For rated assemblies, a UL listed method shall be used. For non-rated wall and floors, the annular space shall be packed with mineral wool, or another suitable non-combustible material, and caulked air tight.

I. The Contractor shall lay out and install his work in advance of pouring concrete floors or walls. He shall furnish all sleeves to the General Contractor for openings through poured masonry floors or walls above grade required for passage of all conduits, pipes, or ducts installed by him. The Contractor shall provide all inserts and hangers required to support his equipment.

J. Installation of piping and ductwork shall not interfere with walkways or service access.

K. All trapeze hanger rods shall be cut to within 1" of the bottom nut.

L. Provide minimum 1/2" thick closed cell elastomeric foam insulation, applied with adhesive, on lower edges of equipment and mechanical duct and pipe supporting elements suspended less than 7 ft above finished floors, platforms, or roofs.

3.03 PERFORMANCE

A. The Contractor shall perform all excavation and backfill operations necessary for installation of his work.

3.04 ERECTION

A. All support steel, angles, channels, pipes or structural steel stands and anchoring devices that may be required to rigidly support or anchor material and equipment shall be provided by this Contractor.

3.05 ADJUST AND CLEAN

A. All equipment and installed materials shall be thoroughly clean and free of all dirt, oil, grit, grease, etc.

B. Clean piping and ductwork both internally and externally to remove dirt, dust, debris, and other foreign matter. When external surfaces of piping are rusted, clean and restore surface to original condition.

C. Clean all equipment as recommended by the manufacturer.

D. Factory painted equipment shall not be repainted unless damaged areas exist. These areas shall be touched up with a material suitable for intended service. In no event shall name plates be painted.

E. Dirt, dust, and other foreign matter shall be blown and/or cleaned from coils, terminal devices, diffusers, registers, and grilles. Inspect all coils and comb coil fins where damaged to as-new condition prior to test and balance work.

F. At a scheduled meeting, the Contractor shall instruct the Owner or the Owner's representative in the operation and maintenance of all equipment installed under his Contract.

G. Equipment with filter media shall be run for a period of two (2) weeks after completion of work at which time a new filter media shall be installed with one change of filter media provided the Owner for future replacement.

3.06 TESTING, ADJUSTING, AND BALANCING

A. Tests for equipment, ductwork, piping, and other systems shall be performed as specified in their respective sections in accordance with technical requirements indicated.

B. Provide equipment and devices required for testing, including fittings for additional openings as required for the test apparatus.

C. All ductwork and piping inspections and testing shall be successfully completed with test reports reviewed and approved by the Engineer before concealment or application of covering materials.

D. Testing shall be witnessed by the Engineer, unless otherwise indicated. Notify Engineer, Owner, Commission Authority, and other parties at least 72 hours in advance of testing date. Engineer, at his discretion, may opt not to witness a given test. In this case, The Construction Manager/General Contractor and/or CxA shall witness the test and forward results to Engineer for review.

E. Contractor shall be responsible for certifying in writing all equipment and system test results. Certification shall include identification of portion of system tested, date, time, weather conditions, test criteria, testing medium, and pressure used, duration of test, and name and title of person signing test certification document. Results shall be submitted to Engineer within three (3) days of test completion.

3.07 MAINTENANCE AND OPERATING MANUAL

A. The Contractor shall prepare a PDF version of the manual describing the proper maintenance and system operation. This manual shall not consist of standard factory printed data intended for dimension or design purposes (although these may be included), but shall be prepared to describe this particular job. This manual shall include the following:
   1. A check list for periodic maintenance of all equipment.
   2. Suggested setting of all controls and switches for normal operation, with description of control and its location.
   3. A check list for seasonal shutdown.
   4. Maintenance and spare parts data for each major piece of equipment.
   5. As-built wiring, interlock and control diagrams for equipment with color coding shown on wiring and interlock diagrams.
   6. Air and Water Balance Report.

B. The PDF shall be indexed, bookmarked, dated and signed by the Contractor when completed.

C. The Contractor shall prepare in (4) copies a manual describing the proper maintenance and system operation. This manual shall not consist of standard factory printed data intended for dimension or design purposes (although these may be included), but shall be prepared to describe this particular job. This manual shall include the following:
   1. A checklist for periodic maintenance of all equipment.
   2. Suggested setting of all controls and switches for normal operation, with description of control and its location.
   3. A checklist for seasonal shutdown.
   4. Maintenance and spare parts data for each major piece of equipment.
   5. As-built wiring, interlock and control diagrams for equipment with color coding shown on wiring and interlock diagrams.
   6. Air and Water Balance Reports.

D. The operating and maintenance manuals shall be submitted to the Engineer for approval. When the manuals are considered complete by the Engineer, they will be turned over to the Owner for their permanent use.

END OF SECTION 23 01 01 23 01 01

SECTION 23 05 11
ELECTRICAL WORK

PART 1 GENERAL

1.01 DIVISION OF WORK

A. This Contractor shall be responsible for the final electrical and the entire control connections and wiring to all equipment installed as part of his contract.

B. Contractor shall review the electrical plans, where applicable, to establish points of connection and the extent of his electrical work to be provided in his contract.

C. Unless otherwise noted, this Contractor shall wire from his equipment to disconnect switches, junction boxes, or panelboard circuit breakers as provided by the Mechanical Contractor or as required by the existing conditions.

D. All power and control wiring shall be in conduits. Refer to electrical specifications for conduit and conduit fittings.

E. All electrical work shall be performed by a licensed electrician.

F. All electrical work shall be in accordance with the State Building Code and all its supplements, the latest edition of the National Electrical Code and the electrical specifications.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

A. All motor starters, disconnects, switches, relays, conduits, conductors, etc. that are required for a complete electrical power and/or control system shall conform to the requirements set forth by NEC.

B. Refer to the plans for the type, size and electrical characteristics of the starters, disconnects, switches, relays, conductor and conduits.

C. All conductors and conduits shall be sized as noted on the plans or as required per NEC.

D. All individual motor starters for mechanical equipment (i.e., fans, pumps, etc.) shall be furnished and installed under Division 23.

E. All relays, actuators, timers, seven-day clocks, alternators, pressure, vacuum, float, flow, pneumatic-electric, and electric-pneumatic switches, aquastats, freezestats, line and low voltage thermostats, thermals, remote selector switches, remote push-button stations, emergency break-glass stations, interlocking, disconnect switches beyond termination point, and other appurtenances associated with equipment under Division 23 shall be furnished, installed and wired under Division 23.

PART 3 EXECUTION

3.01 GENERAL REQUIREMENTS

A. All motor starters, disconnects, and switches shall be installed on or as close to the equipment they are serving as possible, or where shown on the plans.

B. Electrical connection to equipment subject to vibration which develops objectionable noises shall be made from the conduit system with short lengths of flexible metal conduit type FMC per 2020 SCO Electrical Guidelines and Policies Section 260533. Connection to other equipment shall be made with rigid conduit.

C. Conduits shall be run in a concealed space such as wall cavities, ceiling cavities, etc. except in the mechanical rooms where conduit may be run exposed.

END OF SECTION 23 05 11 23 05 11

SECTION 23 05 48
VIBRATION AND SEISMIC CONTROLS FOR HVAC

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Vibration isolation requirements.

B. Vibration isolators.

1.02 REFERENCE STANDARDS

A. ASHRAE (HVACA) - ASHRAE Handbook - HVAC Applications Most Recent Edition Cited by Referring Code or Reference Standard.

1.03 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate selection and arrangement of vibration isolation and/or seismic control components with the actual equipment to be installed.
   2. Coordinate the work with other trades to provide additional framing and materials required for installation.
   3. Coordinate compatibility of support and attachment components with mounting surfaces at the installed locations.

1.04 SUBMITTALS

A. Product Data: Provide manufacturer's standard catalog pages and data sheets for products, including materials, fabrication details, dimensions, and finishes.
   1. Vibration Isolators: Include rated load capacities and deflections; include information on color coding or other identification methods for spring element load capacities.

B. Shop Drawings - Vibration Isolation Systems:
   1. Include dimensioned plan views and sections indicating proposed arrangement of vibration isolators; indicate equipment weights and static deflections.

1.05 QUALITY ASSURANCE

A. Comply with applicable building code.

B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.01 VIBRATION ISOLATION REQUIREMENTS

A. Design and provide vibration isolation systems to reduce vibration transmission to supporting structure from vibration-producing HVAC equipment and/or HVAC connections to vibration-isolated equipment.

B. Comply with applicable general recommendations of ASHRAE (HVACA), where not in conflict with other specified requirements:

C. General Requirements:
   1. Select vibration isolators to provide required static deflection.
   2. Select vibration isolators for uniform deflection based on distributed operating weight of actual installed equipment.
   3. Select vibration isolators for outdoor equipment to comply with wind design requirements.

D. Equipment Isolation: As indicated on drawings.

2.02 VIBRATION ISOLATORS

A. Manufacturers:
   1. Vibration Isolators:
      a. Kinetics Noise Control, Inc

b. Mason Industries
c. Vibration Eliminator Company, Inc
d. The VMC Group/Amber Booth
e. Or Approved Equal

2. Source Limitations: Furnish vibration-isolators and associated accessories produced by a single manufacturer and obtained from a single supplier.

B. General Requirements:
1. Resilient Materials for Vibration Isolators: Oil, ozone, and oxidant resistant.

C. Vibration Isolators for Nonseismic Applications:
1. Resilient Material Isolator Pads:
a. Description: Single or multiple layer pads utilizing elastomeric (e.g. neoprene, rubber) isolator material.
b. Pad Thickness: As required for specified minimum static deflection; minimum 0.25 inch thickness.
c. Multiple Layer Pads: Provide bonded, galvanized sheet metal separation plate between each layer.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as shown on the drawings.

B. Verify that mounting surfaces are ready to receive vibration isolation and/or seismic control components and associated attachments.

C. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Install anchors and fasteners in accordance with ICC Evaluation Services, LLC (ICC-ES) evaluation report conditions of use where applicable.

C. Secure fasteners according to manufacturer's recommended torque settings.

D. Install flexible piping connections to provide sufficient slack for vibration isolation and/or seismic relative displacements as indicated or as required.

E. Vibration Isolation Systems:
1. Clean debris from beneath vibration-isolated equipment that could cause short-circuiting of isolation.
2. Use elastomeric grommets for attachments where required to prevent short-circuiting of isolation.
3. Adjust isolators to be free of isolation short circuits during normal operation.
4. Do not overtighten fasteners such that resilient material isolator pads are compressed beyond manufacturer's maximum recommended deflection.

END OF SECTION 23 05 48

SECTION 23 05 53
IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Nameplates.

B. Tags.

C. Stencils.

D. Pipe markers.

1.02 REFERENCE STANDARDS

A. ASTM D709 - Standard Specification for Laminated Thermosetting Materials 2017.

1.03 SUBMITTALS

A. List: Submit list of wording, symbols, letter size, and color coding for mechanical identification.

B. Chart and Schedule: Submit valve chart and schedule, including valve tag number, location, function, and valve manufacturer's name and model number.

C. Product Data: Provide manufacturers catalog literature for each product required.

D. Manufacturer's Installation Instructions: Indicate special procedures, and installation.

PART 2 PRODUCTS

2.01 IDENTIFICATION APPLICATIONS

A. Air Handling Units: Nameplates.

B. Automatic Controls: Tags. Key to control schematic.

C. Control Panels: Nameplates.

D. Dampers: Ceiling tacks, where located above lay-in ceiling.

E. Ductwork: Stencilled painting.

F. Instrumentation: Tags.

G. Major Control Components: Nameplates.

H. Piping: Stencilled painting.

I. Relays: Tags.

J. Small-sized Equipment: Tags.

K. Thermostats: Nameplates.

2.02 NAMEPLATES

A. Manufacturers:
   1. Advanced Graphic Engraving, LLC
   2. Brimar Industries, Inc
   3. Craftmark Pipe Markers
   4. Kolbi Pipe Marker Co
   5. Seton Identification Products, a Tricor Direct Company
   6. Or Approved Equal

B. Letter Color: Black.

C. Letter Height: 1/4 inch.

D. Background Color: White.

E. Phenolic: Conform to ASTM D709.

2.03 TAGS

A. Manufacturers:
   1. Advanced Graphic Engraving

2. Brady Corporation
3. Brimar Industries, Inc
4. Craftmark Pipe Markers
5. Kolbi Pipe Marker Co
6. Seton Identification Products, a Tricor Company
7. Or Approved Equal

B. Metal Tags: Aluminum with stamped letters; tag size minimum 1-1/2 inch diameter with smooth edges. Use metal tags in return air plenums.

C. Valve Tag Chart: Typewritten letter size list in anodized aluminum frame.

2.04 STENCILS

A. Manufacturers:
1. Brady Corporation
2. Craftmark Pipe Markers
3. Kolbi Pipe Marker Co
4. Seton Identification Products, a Tricor Company
5. Or Approved Equal

B. 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. Ductwork and Equipment: 2-1/2 inch high letters.
5. Stencil Paint: Semi-gloss enamel, colors conforming to ASME A13.1.

2.05 CEILING GRID LABELS

A. Label each device or valve above the ceiling and label the ceiling grid below each. Indicate the type of device or valve and its associated service (e.g. “Shutoff Valve – HW”, “VAV-21”).

B. Provide custom printed labels for each device, either vinyl or polypropylene, suitable for indoor / outdoor applications. Use portable printer equal to Brady HandiMark Portable Industrial Labeling System.

C. Labels shall be no more than 1-inch in height. Lettering shall be minimum 18-point font. Lettering shall be black on white tape.

D. Provide a list of devices and valves labeled with the identical information in the O&M Manuals.

E. Submit samples of markings on three different devices for approval of the Owner and Engineer.

F. Ceiling grid markers shall be the color listed below:
1. Electrical - Pull Box/Disconnects/Future - Neon Red
2. Mechanical Equipment/Fan/Dampers, etc. - Neon Yellow
3. Fire Alarm/Sprinklers/Life Safety - Red

PART 3 EXECUTION

3.01 PREPARATION

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

3.02 INSTALLATION

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

B. Install tags with corrosion resistant chain.

C. All piping and duct shall be labeled at least once in EVERY room. Piping and ductwork shall be labeled every 15 ft and at every change of direction.

D. All exposed mechanical piping in mechanical rooms, boiler rooms, on and above mezzanine levels, both insulated and uninsulated, shall be color coded with 30 mil PVC jacketing per the following schedule:
   1. Fuel Gas — Paint piping Yellow
   2. Refrigerant — Gray

E. Install ductwork with stencilled painting. Identify with air handling unit identification number and area served. Identify service (supply, return, exhaust, outside air, etc.) Locate identification at air handling unit, at each side of penetration of structure or enclosure, and at each obstruction.

F. Provide ceiling grid labels to locate valves or dampers above lay-in panel ceilings. Locate in corner of panel closest to equipment.

G. Identify control panels, manual motor starters, combination motor starters, disconnects, variable frequency drives, and major control components outside panels with plastic nameplates.

H. Identify thermostats or temperature sensors relating to air handling units or valves with labels.

I. Identify valves in main and branch piping with valve labels.

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

K. Identify air handling units with plastic nameplates indicating unit number, area served, OEM and external static pressure, based on actual equipment submittal data, number and size of filters, and number and size of belts (where applicable).

L. Provide ceiling track markers to locate valves or dampers above T-bar type panel ceilings. Locate in corner of panel closest to equipment. Markers shall be installed prior to request for above ceiling inspection.

3.03 SCHEDULE

A. Standard Color Identification for Mechanical Piping (all labels shall be provided with flow arrows):

1.	Fuel Gas Piping	GAS	Black Lettering/Yellow Background
2.	Condensate Drain	COND	Black Lettering/White Background
3.	Refrigerant	REF	Black Lettering/Yellow Background

B. Standard Color Identification for Ductwork (all labels shall be provided with flow arrows):

1.	Supply Air	SUPPLY	Black Lettering
2.	Return	RETURN	Black Lettering
3.	Outside Air	OUTSIDE AIR	Black Lettering
4.	General Exhaust	EXHAUST	Black Lettering

END OF SECTION 23 05 53

SECTION 23 05 93
TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 GENERAL

1.01 SECTION INCLUDES

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

B. Measurement of final operating condition of HVAC systems.

1.02 REFERENCE STANDARDS

A. AABC (NSTSB) - AABC National Standards for Total System Balance, 7th Edition 2016.

B. ASHRAE Std 111 - Measurement, Testing, Adjusting, and Balancing of Building HVAC Systems 2008, with Errata (2019).

C. NEBB (TAB) - Procedural Standard for Testing Adjusting and Balancing of Environmental Systems 2019.

1.03 SUBMITTALS

A. TAB Plan: Submit a written plan indicating the testing, adjusting, and balancing standard to be followed and the specific approach for each system and component.
   1. Submit to Architect.
   2. Submit to the Commissioning Authority.

B. Include at least the following in the plan:
   1. Indicate standard to be followed (AABC or NEBB)
   2. List of all airflow and system capacity and efficiency measurements to be performed and a description of specific test procedures, parameters, formulas to be used.
   3. Copy of field checkout sheets and logs to be used, listing each piece of equipment to be tested, adjusted and balanced with the data cells to be gathered for each.
   4. Identification and types of measurement instruments to be used and their most recent calibration date.
   5. Discussion of what notations and markings will be made on the duct and piping drawings during the process.
   6. Final test report forms to be used.
   7. Detailed step-by-step procedures for TAB work for each system and issue, including:
      a. Terminal flow calibration (for each terminal type).
      b. Diffuser proportioning.
      c. Branch/submain proportioning.
      d. Total flow calculations.
      e. Rechecking.
      f. Diversity issues.
   8. Details of how TOTAL flow will be determined; for example:
      a. Air: Sum of terminal flows via control system calibrated readings or via hood readings of all terminals, supply (SA) and return air (RA) pitot traverse, SA or RA flow stations.
   9. Specific procedures that will ensure that systems are operating at the lowest possible pressures and methods to verify this.
   10. Confirmation of understanding of the outside air ventilation criteria under all conditions.
   11. Method of verifying and setting minimum outside air flow rate will be verified and set and for what level (total building, zone, etc.).
   12. Methods for making coil or other system plant capacity measurements, if specified.
   13. Description of TAB work for areas to be built out later, if any.
   14. Time schedule for deferred or seasonal TAB work, if specified.
   15. False loading of systems to complete TAB work, if specified.
   16. Procedures for formal deficiency reports, including scope, frequency and distribution.

C. Control System Coordination Reports: Communicate in writing to the controls installer all setpoint and parameter changes made or problems and discrepancies identified during TAB that affect, or could affect, the control system setup and operation.

D. Final Report: Indicate deficiencies in systems that would prevent proper testing, adjusting, and balancing of systems and equipment to achieve specified performance.
   1. Revise TAB plan to reflect actual procedures and submit as part of final report.
   2. Submit draft copies of report for review prior to final acceptance of Project. Provide final copies for Architect and for inclusion in operating and maintenance manuals.
   3. Provide final reports in soft cover, letter size, 3-ring binder manuals, complete with index page and indexing tabs, with cover identification at front and side. Include set of reduced drawings with air outlets and equipment identified to correspond with data sheets, and indicating thermostat locations. The Final Report shall be placed in and become a part of the Maintenance and Operations Manuals (4 copies).
   4. Include actual instrument list, with manufacturer name, serial number, and date of calibration.
   5. Form of Test Reports: Where the TAB standard being followed recommends a report format use that; otherwise, follow ASHRAE Std 111.
   6. Units of Measure: Report data in I-P (inch-pound) units only.
   7. Include the following on the title page of each report:
      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. Also include a certification sheet containing the seal and name, address, telephone number, and signature of the Certified Test and Balance Engineer. Include in this division a listing of the instruments used for the procedures along with proof of calibration.

E. Project Record Documents: Record actual locations of flow measuring stations and balancing valves and rough setting.

1.04 QUALITY ASSURANCE

A. The TAB agency shall be a subcontractor of the General Contractor (or Construction Manager) and shall report directly to and be paid by the General Contractor.

B. The TAB agency shall be either a certified member of AABC or NEBB to perform TAB service for HVAC, water balancing and vibrations and sound testing of equipment. The certification shall be maintained for the entire duration of duties specified herein.

C. Any agency that has been the subject of disciplinary action by either the AABC or NEBB within the five years preceding Contract Award shall not be eligible to perform any work related to the TAB. All work performed in this Section and in other related Sections by the TAB agency shall be considered invalid if the TAB agency loses its certification prior to Contract completion, and the successor agency's review shows unsatisfactory work performed by the predecessor agency.

D. TAB Specialist: The TAB specialist shall be either a member of AABC or an experienced technician of the Agency certified by NEBB. The certification shall be maintained for the entire duration of duties specified herein. If, for any reason, the Specialist loses subject certification during this period, the General Contractor shall immediately notify the Engineer and submit another TAB Specialist for approval. Any individual that has been the subject of disciplinary action by either the AABC or NEBB within the five years preceding Contract Award shall not be eligible to perform any duties related to the HVAC systems, including TAB. All work specified in this Section and in other related Sections performed by the TAB specialist shall be considered invalid if the TAB Specialist loses its certification prior to Contract completion and must be performed by an approved successor.

E. TAB Specialist shall be identified by the General Contractor within 60 days after the notice to proceed. The TAB specialist will be coordinating, scheduling and reporting all TAB work and related activities and will provide necessary information as required by the Resident Engineer. The responsibilities would specifically include:
   1. Shall directly supervise all TAB work.
   2. Shall sign the TAB reports that bear the seal of the TAB standard. The reports shall be accompanied by report forms and schematic drawings required by the TAB standard, AABC, TABB or NEBB.
   3. Would follow all TAB work through its satisfactory completion.

4. Shall provide final markings of settings of all HVAC adjustment devices.
5. Permanently mark location of duct test ports.
6. Shall document critical paths from the fan or pump. These critical paths are ones in which are 100% open from the fan or pump to the terminal device. This will show the least amount of restriction is being imposed on the system by the TAB firm.

F. All TAB technicians performing actual TAB work shall be experienced and must have done satisfactory work on a minimum of 3 projects comparable in size and complexity to this project. Qualifications must be certified by the TAB agency in writing. The lead technician shall be certified by AABC or NEBB

1.05 WARRANTY

A. National Project Performance Guarantee: Provide a guarantee AABC or NEBB will assist in completing requirements of the Contract Documents if TAB firm fails to comply with the Contract Documents. Guarantee includes the following provisions:
   1. The certified TAB firm has tested and balanced systems according to the Contract Documents.
   2. Systems are balanced to optimum performance capabilities within design and installation limits.
   3. Warranty Period: Five (5) years.

PART 2 PRODUCTS

2.01 PLUGS

A. Provide plastic plugs to seal holes drilled in ductwork for test purposes.

2.02 INSULATION REPAIR MATERIAL

A. Refer to individual insulation sections for repair of insulation removed or damaged during TAB work.

PART 3 EXECUTION

3.01 GENERAL REQUIREMENTS

A. Perform total system balance in accordance with one of the following:
   1. AABC (NSTSB), AABC National Standards for Total System Balance.

B. Begin work after completion of systems to be tested, adjusted, or balanced and complete work prior to Substantial Completion of the project.

C. Where HVAC systems and/or components interface with life safety systems, including fire and smoke detection, alarm, and control, coordinate scheduling and testing and inspection procedures with the authorities having jurisdiction.

D. TAB Agency Qualifications:
   1. Company specializing in the testing, adjusting, and balancing of systems specified in this section.
   2. Having minimum of three years documented experience.
   3. Certified by one of the following:
      a. AABC, Associated Air Balance Council: www.aabc.com/#sle; upon completion submit AABC National Performance Guaranty.
      b. NEBB, National Environmental Balancing Bureau: www.nebb.org/#sle.

E. TAB Supervisor and Technician Qualifications: Certified by same organization as TAB agency.

F. For each air handling system, provide a graphical static pressure profile indicating the pressure drop across each component of the air handling unit (filter, coils, dampers, wheel, etc).

3.02 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.

B. Submit field reports. Report defects and deficiencies that will or could prevent proper system balance.

C. Beginning of work means acceptance of existing conditions.

3.03 PREPARATION

A. Hold a pre-balancing meeting at least one week prior to starting TAB work.
1. Require attendance by all installers whose work will be tested, adjusted, or balanced.

B. Obtain design drawings and specifications and become thoroughly acquainted with the design intent.

C. Obtain copies of approved shop drawings of all air handling equipment, outlets (supply, return, and exhaust) and temperature control diagrams.

D. Compare design to installed equipment and field installations.

E. Walk the system to determine variations of installation from design.

F. Check filters for cleanliness.

G. Lubricate all motors and bearings.

3.04 ADJUSTMENT TOLERANCES

A. Air Systems Tolerances

Systems - Air	Tolerances of Drawing Design	Remarks
Air Handling Units, Fans (Supply, Return, Exhaust)	-5% to + 10%	Systems with Filters must be tested at dirty conditions
Outdoor Air	100% to 110%	To obtain this accuracy requires ductwork be traversed
Terminal Units	+/- 5%	Calibrate all boxes at minimum of two points. Single point calibration is not acceptable.
Diffusers and Grilles	+/-10%	If design is less than 100 CFM, tolerance can be +/- 10 CFM
Pressurized Rooms - Positive	Supply +100-105% Exhaust or Return 100-95%	Room offset tolerance to design 100% to +110%
Pressurized rooms - Negative	Supply 95% to 100% Exhaust or Return 100% to 105%	Room offset tolerance to design 100% to 105%

3.05 RECORDING AND ADJUSTING

A. Field Logs: Maintain written logs including:
1. Running log of events and issues.
2. Discrepancies, deficient or uncompleted work by others.
3. Contract interpretation requests.
4. Lists of completed tests.

B. Ensure recorded data represents actual measured or observed conditions.

C. Use only those instruments which have the maximum field measuring accuracy and are best suited to the function being measured.

D. Apply instrument as recommended by the manufacturer.

E. When averaging values, take a sufficient quantity of readings that will result in a repeatability error of less than 5 percent. When measuring a single point, repeat readings until 2 consecutive identical values are obtained.

F. Permanently mark settings of valves, dampers, and other adjustment devices allowing settings to be restored. Set and lock memory stops.

G. Mark on drawings the locations where traverse and other critical measurements were taken and cross reference the location in the final report.

H. After adjustment, take measurements to verify balance has not been disrupted or that such disruption has been rectified.

I. Leave systems in proper working order, replacing belt guards, closing access doors, closing doors to electrical switch boxes, and restoring thermostats to specified settings.

J. Seal ducts and piping, and test for and repair leaks.

K. Seal insulation to re-establish integrity of vapor barrier.

L. Retest, adjust, and balance systems subsequent to significant system modifications and resubmit test results.

3.06 AIR SYSTEM PROCEDURE

A. Adjust air handling and distribution systems to provide required or design supply, return, and exhaust air quantities at site altitude.

B. Test, adjust, and balance the air systems before the hydronic systems.

C. Make air quantity measurements in ducts by Pitot tube traverse of entire cross sectional area of duct.

D. Measure air quantities at air inlets and outlets.

E. Adjust distribution system to obtain uniform space temperatures free from objectionable drafts and noise. This includes adjusting the deflection of all diffuser and grilles.

F. Use volume control devices to regulate air quantities only to extent that adjustments do not create objectionable air motion or sound levels. Effect volume control by duct internal devices such as dampers and splitters.

G. Vary total system air quantities by adjustment of fan speeds. Provide drive changes required. Vary branch air quantities by damper regulation.

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.
   1. Artificially load filters by partially blanking to produce static pressure air drop of filter manufacturer's recommeneded "dirty" pressure drop.

I. Coordinate with Controls Contractor on adjusting static pressure setpoints of VAV systems and differential pressure setpoints of VFD controlled pumps.

J. Adjust outside air automatic dampers, outside air, return air, and exhaust dampers for design conditions.

K. Measure temperature conditions across outside air, return air, and exhaust dampers to check leakage.

L. Where modulating dampers are provided, take measurements and balance at extreme conditions.

3.07 CRITICAL FLOW PATH

A. Provide a documented critical path for all fluid flows. There shall be at least one terminal device that can be traced back to the fan or pump where there is no damper or valves that are less than 100% open.

3.08 DEMONSTRATION

A. Training
   1. Train the Owner's maintenance personnel on troubleshooting procedures and testing, adjusting, and balancing procedures. Provide four (4) hours on site training. Review with the Owner's personnel the information contained in the Operating and Maintenance Data specified in Division 1 and Section 23 01 00.
   2. Schedule training with the Owner through the Engineer with at least 7 days prior notice.

3.09 SCOPE

A. Test, adjust, and balance the following:
   1. Air Cooled Refrigerant Condensers.
   2. Air Coils.
   3. Air Handling Units.
   4. Fans.
   5. Air Filters.
   6. Air Terminal Units.
   7. Air Inlets and Outlets.

B. This Section does NOT include:
   1. Testing boilers and pressure vessels for compliance with safety codes.
   2. Specifications for materials for patching mechanical systems.
   3. Specifications for materials and installation of adjusting and balancing; refer to the respective system sections for materials and installation requirements.
   4. Requirements and procedures for piping and ductwork systems leakage tests.

3.10 MINIMUM DATA TO BE REPORTED

A. Electric Motors:
   1. Manufacturer.
   2. Model/Frame.
   3. HP/BHP.
   4. Phase, voltage, amperage; nameplate, actual, no load.
   5. RPM.
   6. Service factor.
   7. Starter size, rating, heater elements.
   8. Sheave Make/Size/Bore.

B. V-Belt Drives:
   1. Identification/location.
   2. Required driven RPM.
   3. Driven sheave, diameter and RPM.
   4. Belt, size and quantity.
   5. Motor sheave diameter and RPM.
   6. Center to center distance, maximum, minimum, and actual.

C. Air Cooled Condensers:
   1. Identification/number.
   2. Location.
   3. Manufacturer.
   4. Model number.
   5. Entering DB air temperature, design and actual.
   6. Leaving DB air temperature, design and actual.

D. Cooling Coils:
   1. Identification/number.
   2. Location.
   3. Manufacturer.
   4. Air flow, design and actual.
   5. Entering air DB temperature, design and actual.
   6. Entering air WB temperature, design and actual.

7. Leaving air DB temperature, design and actual.
8. Leaving air WB temperature, design and actual.
9. Water flow, design and actual.
10. Water pressure drop, design and actual.
11. Entering water temperature, design and actual.
12. Leaving water temperature, design and actual.
13. Air pressure drop, design and actual.

E. Heating Coils:
1. Identification/number.
2. Location.
3. Manufacturer.
4. Air flow, design and actual.
5. Water flow, design and actual.
6. Water pressure drop, design and actual.
7. Entering water temperature, design and actual.
8. Leaving water temperature, design and actual.
9. Entering air temperature, design and actual.
10. Leaving air temperature, design and actual.
11. Air pressure drop, design and actual.

F. Air Moving Equipment:
1. Location.
2. Manufacturer.
3. Model number.
4. Air flow, specified and actual.
5. Return air flow, specified and actual.
6. Outside air flow, specified and actual.
7. Total static pressure (total external), specified and actual.
8. Inlet pressure.
9. Discharge pressure.
10. Fan RPM.

G. Exhaust Fans:
1. Location.
2. Manufacturer.
3. Model number.
4. Air flow, specified and actual.
5. Total static pressure (total external), specified and actual.
6. Inlet pressure.
7. Discharge pressure.
8. Fan RPM.

H. Duct Traverses:
1. System zone/branch.
2. Duct size.
3. Design air flow.
4. Test velocity.
5. Test air flow.
6. Duct static pressure.
7. Air temperature.

I. Air Distribution Tests:
1. Air terminal number.
2. Room number/location.
3. Terminal type.
4. Terminal size.
5. Design air flow.

6. Test (final) air flow.
7. Percent of design air flow.

END OF SECTION 23 05 93

SECTION 23 07 13
DUCT INSULATION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Duct insulation.

B. Jacketing and accessories.

1.02 REFERENCE STANDARDS

A. ASTM C518 - Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus 2021.

B. ASTM C553 - Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications 2013 (Reapproved 2019).

C. ASTM C612 - Standard Specification for Mineral Fiber Block and Board Thermal Insulation 2014 (Reapproved 2019).

D. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2023.

E. ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials 2022a, with Editorial Revision (2023).

F. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials Current Edition, Including All Revisions.

1.03 SUBMITTALS

A. Product Data: Provide product description, thermal characteristics, list of materials and thickness for each service, and locations. Include the following information:
   1. Schedule indicating insulation type, thickness, and location for each service
   2. Density
   3. Compressive Strength
   4. "k" value at 75 deg F
   5. Nominal "R" value
   6. Flame spread rating

B. Manufacturer's Instructions: Indicate installation procedures necessary to ensure acceptable workmanship and that installation standards will be achieved.

1.04 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products of the type specified in this section with not less than three years of documented experience.

B. Applicator Qualifications: Company specializing in performing the type of work specified in this section, documented experience and approved by manufacturer.

C. Before installing insulation, build mockups for each type of insulation and finish listed below to demonstrate quality of insulation application and finishes. Build mockups in the location indicated or, if not indicated, as directed by Owner. Use materials indicated for the completed Work. Mockups shall include piping insulation, ductwork insulation and equipment insulation.

D. All the ductwork and piping in pump rooms, mechanical rooms and equipment rooms including areas without ceilings is to be considered as exposed piping or ductwork. This also includes penthouses, interstitial spaces, and crawl spaces, where applicable.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Accept materials on site in original factory packaging, labelled with manufacturer's identification, including product density and thickness.

B. Protect insulation from weather and construction traffic, dirt, water, chemical, and mechanical damage, by storing in original wrapping.

1.06 FIELD CONDITIONS

A. Maintain ambient temperatures and conditions required by manufacturers of adhesives, mastics, and insulation cements.

B. Maintain temperature during and after installation for minimum period of 24 hours.

C. Insulation shall not be installed until all testing and inspection of pipe, duct, vessel, etc. has been completed and approved by Engineer/Owner's representative.

PART 2 PRODUCTS

2.01 REGULATORY REQUIREMENTS

A. Surface Burning Characteristics: Flame spread index/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E84, UL 723, UL 723, or ASTM E84. These ratings must be as tested on composite of insulation, jacket or facing, and adhesive. Components such as adhesives, mastics, and cements must meet the same individual ratings as minimum requirements.

2.02 GLASS FIBER, FLEXIBLE

A. Manufacturer:
   1. CertainTeed Corporation
   2. Johns Manville
   3. Knauf Insulation
   4. Owens Corning Corporation
   5. Or Approved Equal

B. Insulation: ASTM C553; flexible, noncombustible blanket.
   1. K value: 0.36 at 75 degrees F, when tested in accordance with ASTM C518.
   2. Maximum Service Temperature: 1,200 degrees F.
   3. Maximum Water Vapor Absorption: 5.0 percent by weight.

C. Vapor Barrier Jacket:
   1. Kraft paper with glass fiber yarn and bonded to aluminized film.
   2. Moisture Vapor Permeability: 0.02 perm inch, when tested in accordance with ASTM E96/E96M.
   3. Secure with pressure-sensitive tape.

D. Vapor Barrier Tape:
   1. Kraft paper reinforced with glass fiber yarn and bonded to aluminized film with pressure-sensitive rubber-based adhesive.

E. Indoor Vapor Barrier Mastic:
   1. Manufacturers:
      a. Childers CP-35
      b. Hardcast Seal-Tack AF

F. Tie Wire: Annealed steel, 16 gauge, 0.0508 inch diameter.

2.03 GLASS FIBER, RIGID

A. Manufacturer:
   1. CertainTeed Corporation
   2. Johns Manville
   3. Knauf Insulation
   4. Owens Corning Corporation
   5. Or Approved Equal

B. Insulation: ASTM C612; rigid, noncombustible blanket.
   1. K Value: 0.24 at 75 degrees F, when tested in accordance with ASTM C518.
   2. Maximum Service Temperature: 450 degrees F.
   3. Maximum Water Vapor Absorption: 5.0 percent.
   4. Maximum Density: 8.0 pcf.

C. Vapor Barrier Jacket:
   1. Kraft paper with glass fiber yarn and bonded to aluminized film.
   2. Moisture Vapor Permeability: 0.02 perm inch, when tested in accordance with ASTM E96/E96M.
   3. Secure with pressure-sensitive tape.

D. Vapor Barrier Tape:
   1. Manufacturers:
      a. 3M
      b. Polyguard
      c. Shurtape
   2. Kraft paper reinforced with glass fiber yarn and bonded to aluminized film with pressure-sensitive rubber-based adhesive.

E. Protective Coating:
   1. Manufacturers:
      a. Design Polymerics; DP 2510 Water Based, Low VOC, Duct Liner Protective Coating:

F. Indoor Vapor Barrier Finish:
   1. Cloth: Untreated; 9 oz/sq yd weight, glass fabric.
   2. Vinyl emulsion type acrylic, compatible with insulation, white color.

2.04 JACKETING AND ACCESSORIES

A. Canvas Jacket: UL listed 6 oz/sq yd plain weave cotton fabric treated with dilute fire-retardant lagging adhesive.
   1. Lagging Adhesive:
      a. Manufacturers:
         1) Design Polymerics; DP 3050 Water Based, Zero VOC, Premium Quality, Lagging Adhesive, and Vapor Retarder
         2) Childers CP-35
      b. Compatible with insulation.

PART 3 EXECUTION

3.01 EXAMINATION

A. Test ductwork for design pressure prior to applying insulation materials.

B. Verify that surfaces are clean, foreign material removed, and dry.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Insulate all supply diffusers and ducted return grilles with 2" R6 Duct Wrap. Cut diffusers so there is a folder 2" lap on all four sides. Take with FSK tape where insulated flex meets duct insulation so there are no raw edges of fiberglass.

C. Install multiple layers of insulation with longitudinal and end seams staggered.

D. Install insulation with least number of joints practical.

E. Insulated Ducts Conveying Air Below Ambient Temperature:
   1. Insulation on all pipes or ducts conveying air or liquids below the ambient temperature is required to have a continuous vapor barrier. On all insulation with a vapor barrier, seal the joints, duct wrap seams, vapor retarder (ASJ) film seams and penetrations in insulation at hangers, supports, anchors, and other projections with a vapor-barrier coating/mastic as specified in the individual insulation sections.
   2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier coating/mastic.
   3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
   4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.
   5. Continue insulation through walls, sleeves, hangers, and other duct penetrations.

F. Ducts Exposed in Mechanical Equipment Rooms or Finished Spaces: Provide rigid fiberglass board insulation and finish with canvas jacket sized for finish painting.

G. External Duct Wrap Insulation Application:

1. Secure insulation with vapor barrier with wires and seal jacket joints with vapor barrier adhesive or tape to match jacket.
2. Install without sag on underside of duct. Use adhesive or mechanical fasteners where necessary to prevent sagging. Lift duct off trapeze hangers and insert spacers. Spacers shall be heavy density insulation material. Refer to MICA 8th edition Plate 3-640.
3. Seal vapor barrier penetrations by mechanical fasteners with vapor barrier adhesive.
4. Stop and point insulation around access doors and damper operators to allow operation without disturbing wrapping.

3.03 SCHEDULES

A. All supply, outside air, and return air ductwork shall be completely insulated, unless otherwise noted on the plans. Insulation shall completely cover flexible connections. Insulation shall be minimum 2.5 inch thick or the thickness required to meet the R-values below.

B. All insulation within the building envelope, except in the attic (where applicable), shall have a minimum R-value of 6.0 based on installed thickness. Any insulation wrap or board installed outside the building envelope or in an attic, shall have a minimum R-value of 8.0 based on installed thickness.

C. Exhaust and Relief Ducts Within 10 ft of Exterior Openings or Building Envelope Penetrations: minimum R-value of 6.0 based on installed thickness.

END OF SECTION 23 07 13

SECTION 23 07 19
HVAC PIPING INSULATION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Piping insulation.

B. Flexible removable and reusable blanket insulation.

C. Jacketing and accessories.

1.02 RELATED REQUIREMENTS

A. Section 07 84 00 - Firestopping.

1.03 REFERENCE STANDARDS

A. ASTM B209/B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate 2021a.

B. ASTM C177 - Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus 2019, with Editorial Revision (2023).

C. ASTM C195 - Standard Specification for Mineral Fiber Thermal Insulating Cement 2007 (Reapproved 2019).

D. ASTM C449 - Standard Specification for Mineral Fiber Hydraulic-Setting Thermal Insulating and Finishing Cement 2007 (Reapproved 2019).

E. ASTM C534/C534M - Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form 2023.

F. ASTM C547 - Standard Specification for Mineral Fiber Pipe Insulation 2022a.

G. ASTM C795 - Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel 2008 (Reapproved 2018).

H. ASTM C1423 - Standard Guide for Selecting Jacketing Materials for Thermal Insulation 2021.

I. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2023.

J. ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials 2022a, with Editorial Revision (2023).

K. ASTM G153 - Standard Practice for Operating Enclosed Carbon Arc Light Apparatus for Exposure of Nonmetallic Materials 2013 (Reapproved 2021).

L. SAE AMS3779 - Tape, Adhesive, Pressure-Sensitive Thermal Radiation Resistant, Aluminum Coated Glass Cloth 2016b.

M. MICA - Midwest Insulation Contractors Association National Commercial & Industrial Insulation Standards; 8th Edition.

N. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials Current Edition, Including All Revisions.

1.04 SUBMITTALS

A. Product Data: Provide product description, thermal characteristics, list of materials and thickness for each service, and locations. Provide the following information:
   1. Schedule indicating insulation type, thickness, and location for each service (equipment, duct, and pipe with size).
   2. Density
   3. Compressive Strength
   4. "k" value at 75 deg F
   5. Nominal "R" value
   6. Mean temperature range
   7. Flame spread rating

B. Shop Drawings: Show details for the following:

1. Application of protective shields, saddles, and inserts at hangers for each type of insulation and hanger.
2. Attachment and covering of heat tracing inside insulation.
3. Insulation application at pipe expansion joints for each type of insulation.
4. Insulation application at elbows, fittings, flanges, valves, and specialties for each type of insulation.
5. Application of field-applied jackets.

C. Manufacturer's Instructions: Indicate installation procedures that ensure acceptable workmanship and installation standards will be achieved.

D. Provide plates from MICA 8th edition manual for each insulation system on the project as part of the submittals. The plates for each system shall be filled out by the insulating contractor for each product being used.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with not less than three years of documented experience.

B. Applicator Qualifications: Company specializing in performing the type of work specified in this section with minimum five years of experience.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Accept materials on site, labeled with manufacturer's identification, product density, and thickness.

B. Store insulation in original wrapping and protect from weather and construction traffic. Protect insulation against dirt, water, chemical, and mechanical damage.

1.07 FIELD CONDITIONS

A. Maintain ambient conditions required by manufacturers of each product.

B. Maintain temperature before, during, and after installation for minimum of 24 hours.

C. Insulation shall not be installed until all testing and inspection of pipe, duct, vessel, etc. has been completed and approved by Engineer/Owner’s representative.

D. Replace insulation damaged by either moisture or other means. Insulation which has been wet, whether dried or not, is considered damaged. Make repairs where condensation is caused by improper installation of insulation. Also replace any materials damaged by the condensation.

PART 2 PRODUCTS

2.01 REGULATORY REQUIREMENTS

A. Surface Burning Characteristics: Flame spread index/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E84, UL 723, ASTM E84, or UL 723.

2.02 GLASS FIBER, RIGID

A. Manufacturers:
1. CertainTeed Corporation
2. Johns Manville Corporation
3. Knauf Insulation
4. Owens Corning Corporation
5. Manson Insulation
6. Or Approved Equal

B. Insulation: ASTM C547and ASTM C795; rigid molded, noncombustible.
1. K Value: ASTM C177, 0.24 at 75 degrees F.
2. Maximum Service Temperature: 850 degrees F.
3. Maximum Moisture Absorption: 0.2 percent by volume.

C. Vapor Barrier Jacket: White kraft paper with glass fiber yarn, bonded to aluminized film; moisture vapor transmission when tested in accordance with ASTM E96/E96M of 0.02 perm-inches.

D. Tie Wire: 0.048 inch stainless steel with twisted ends on maximum 12 inch centers.

E. Vapor Barrier Lap Adhesive: Compatible with insulation.

F. Insulating Cement/Mastic: ASTM C195; hydraulic setting on mineral wool.

G. Fibrous Glass Fabric:
   1. Cloth: Untreated; 9 oz/sq yd weight.
   2. Blanket: 1.0 pcf density.
   3. Weave: 5 by 5.

H. Indoor Vapor Barrier Finish:
   1. Cloth: Untreated; 9 oz/sq yd weight.
   2. Vinyl emulsion type acrylic, compatible with insulation, white color.

I. Outdoor Vapor Barrier Mastic: Vinyl emulsion type acrylic or mastic, compatible with insulation, black color.

J. Insulating Cement: ASTM C449.

2.03 FLEXIBLE ELASTOMERIC CELLULAR INSULATION

A. Manufacturers:
   1. Aeroflex USA, Inc
   2. Armacell LLC
   3. K-Flex USA LLC
   4. Or Approved Equal

B. Insulation: Preformed flexible elastomeric cellular rubber insulation complying with ASTM C534/C534M Grade 1; use molded tubular material wherever possible.
   1. Minimum Service Temperature: Minus 40 degrees F.
   2. Maximum Service Temperature: 180 degrees F.
   3. Connection: Waterproof vapor barrier adhesive.

C. Elastomeric Foam Adhesive: Air dried, contact adhesive, compatible with insulation.

2.04 JACKETING AND ACCESSORIES

A. Canvas Jacket: UL listed 6 oz/sq yd plain weave cotton fabric treated with dilute fire-retardant lagging adhesive.
   1. Lagging Adhesive: Compatible with insulation.
      a. Manufacturers:
         1) Vimasco Corporation:
         2) GLT Products

B. Aluminum Jacket:
   1. Manufacturers:
      a. Ideal Tape Co., Inc
      b. Alumaguard.
      c. ITW.
   2. Comply with ASTM B209/B209M, Temper H14, minimum thickness of 0.016 inch with factory-applied polyethylene and kraft paper moisture barrier on the inside surface.
   3. Thickness: 0.016 inch sheet.
   4. Finish: Embossed.
   5. Joining: Longitudinal slip joints and 2 inch laps.
   6. Fittings: 0.016 inch thick die-shaped fitting covers with factory-attached protective liner.
   7. Metal Jacket Bands: 3/8 inch wide; 0.015 inch thick aluminum.

C. Reinforced Tape:
   1. Metallized polypropylene tape suitable for continuous spiral wrapping of insulated pipe bends and fittings resulting in a tight, smooth surface without wrinkles.
   2. Comply with UL 723, SAE AMS3779, and ASTM C1423.
   3. Finish: Match insulation.

D. Foil Mastic Tape:
   1. Kraft paper bonded to aluminized film with pressure-sensitive rubber-based adhesive.

PART 3 EXECUTION

3.01 EXAMINATION

A. Test piping for design pressure, liquid tightness, and continuity prior to applying insulation materials.

B. Verify that surfaces are clean and dry, with foreign material removed.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions and the MICA manual 8th edition. In cases of conflict, the more stringent instructions shall apply.

B. Where existing piping insulation is either removed or damaged during construction, it shall be reinsulated per these specifications.

C. Where insulation thickness exceeds 3 inches, the insulation shall be two layers. Secure first layer before installing the next layer and stagger the joints.

D. Install multiple layers of insulation with longitudinal and end seams staggered.

E. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.

F. Install insulation with least number of joints practical.

G. Exposed Piping: Locate insulation and cover seams in least visible locations.

H. Insulated Pipes Conveying Fluids Below Ambient Temperature:
   1. Insulate entire system, including fittings, valves, unions, flanges, strainers, flexible connections, pump bodies, and expansion joints.
   2. Insulation on all pipes or ducts conveying air or liquids below the ambient temperature is required to have a continuous vapor barrier. On all insulation with a vapor barrier, seal the joints, duct wrap seams, vapor retarder (ASJ) film seams and penetrations in insulation at hangers, supports, anchors, and other projections with a vapor-barrier coating/mastic as specified in the individual insulation sections.
   3. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier coating/mastic.
   4. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
   5. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.

I. For hot piping conveying fluids over 120 degrees F, insulate flanges and unions at equipment.

J. Glass Fiber Insulated Pipes Conveying Fluids Above Ambient Temperature:
   1. Provide standard jackets, with vapor barrier, factory-applied or field-applied. Secure with self-sealing longitudinal laps and butt strips with pressure sensitive adhesive. Secure with outward clinch expanding staples.
   2. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe. Finish with glass cloth and adhesive or PVC fitting covers.

K. Inserts and Shields:
   1. Shields: Galvanized steel, 20 gauge, one half the circumference of the insulation, and a minimum of 12 inches long, between pipe hangers or pipe hanger rolls and inserts.
   2. Insert location: Between support shield and piping and under the finish jacket.
   3. Insert Configuration: Minimum 6 inches long, of same thickness and contour as adjoining insulation; may be factory fabricated.
   4. Insert Material: Hydrous calcium silicate insulation or other heavy density insulating material suitable for the planned temperature range.

L. Continue insulation through walls, sleeves, pipe hangers, and other pipe penetrations. Finish at supports, protrusions, and interruptions. At fire separations, see Section 07 84 00.

M. Pipe Exposed in Mechanical Rooms and Finished Spaces: Finish with canvas jacket sized for finish painting. Canvas shall be coated twice with Foster fireproof lagging to ensure specified flame and smoke spread ratings.

N. Exterior Applications: Provide vapor barrier jacket. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe, and finish with glass mesh reinforced vapor barrier cement. Provide with 0.016 inch aluminum rolled jacket. Cover with aluminum jacket with aluminum bands 12 inches on center and at each butt joint located on bottom side of horizontal piping. Fittings shall be covered with two piece factory fabricated "ELL-JACS."

O. All exposed piping surfaces, insulation, supports, etc., shall be painted with two coats of oil base paint. Color shall be selected by the Owner.

P. Insulation systems shall be installed per the applicable plate from the MICA manual 8th edition:
1. Pre-formed Pipe Insulation Single Layer Construction: Plate 1-100
2. Flexible Foam Insulation: Plate 1-200
3. Field applied Metal Jacketing: Plate 1-400
4. Non-metallic sealed jacketing systems: PVC, etc: Plate 1-510
5. Split Ring Hangers: Plate 1-600
6. Clevis Hanger with High Density Inserts: Plate 1-610
7. Pre-Insulated Pipe Support, Standoff Clamp: Plate 1-640
8. Vapor Stop (Dam) - Pipe: Plate 1-660
9. Refrigerant and Low Temperature: Plate 1-801
10. Traced Piping: Plate 1-900
11. Pre-formed Elbow Insulation: Plate 2-100
12. Mechanical Fitting Field Fabricated: Plate 2-116
13. Pre-formed or Fabricated Tee Insulation: Plate 2-120
14. Field or Factory-Fabricated Valve Insulation: Plate 2-130
15. In-line Flange Insulation Built-up and Beveled: Plate 2-135
16. Flexible Foam Fittings: 90s and 45s: Plate 2-200
17. Flexible Foam Fittings, Ts: 2-220
18. Flexible Foam Ts: Plate 2-225
19. PVC/Insert Valve Insulation: Plate 2-530
20. PVC/Insert Mechanical Coupling on In-line Flange: Plate 2-535
21. Non-metallic Jackets: Fitting and Valve Insulation Sealed Jacketing Systems: Plate 2-536
22. PVC End Cap Over Insulation: 2-540
23. Vapor Stop (Dam) - Fittings: Plate 2-660
24. Large Diameter Vessels Block and Blanket Insulation: Plate 4-100
25. Small Diameter Vessels: Plate 4-120
26. Large Diameter Horizontal Vessels: Plate 4-140
27. Vessels, Flexible Foam Sheets: 4-200
28. Flexible Foam for Low Temperature Equipment: 4-210
29. Vapor Stop (Dam) - Equipment: 4-660

3.03 SCHEDULE

A. Condensate
1. Condensate lines shall be insulated with 1.0 inch thick closed cell insulation. The insulation shall extend from the connection on the unit until it either terminates at a floor drain or other indirect waste receptor, or turns underground.

B. Refrigerant
1. Refrigerant lines shall be insulated with 1.5 inch thick closed cell elastomeric foam insulation. Both gas and liquid lines should be insulated.

END OF SECTION 23 07 19

SECTION 23 08 00
COMMISSIONING OF HVAC

PART 1 GENERAL

1.01 SUMMARY

A. This section covers the Contractor's responsibilities for commissioning; each subcontractor or installer responsible for the installation of a particular system or equipment item to be commissioned is responsible for the commissioning activities relating to that system or equipment item.

B. The Commissioning Authority (CA) directs and coordinates all commissioning activities and provides Prefunctional Checklists and Functional Test Procedures for Contractor's use.

C. The entire HVAC system is to be commissioned, including commissioning activities for the following specific items:
   1. Control system.
   2. Major and minor equipment items.
   3. Piping systems and equipment.
   4. Ductwork and accessories.
   5. Other equipment and systems explicitly identified elsewhere in Contract Documents as requiring commissioning.

D. The Prefunctional Checklist and Functional Test requirements specified in this section are in addition to, not a substitute for, inspection or testing specified in other sections.

1.02 REFERENCE STANDARDS

A. ASHRAE Guideline 1.1 - HVAC&R Technical Requirements for the Commissioning Process 2007, with Errata (2012).

1.03 SUBMITTALS

A. Updated Submittals: Keep the Commissioning Authority informed of all changes to control system documentation made during programming and setup; revise and resubmit when substantial changes are made.

B. Draft Prefunctional Checklists and Functional Test Procedures for Control System: Detailed written plan indicating the procedures to be followed to test, checkout and adjust the control system prior to full system Functional Testing; include at least the following for each type of equipment controlled:
   1. System name.
   2. List of devices.
   3. Step-by-step procedures for testing each controller after installation, including:
      a. Process of verifying proper hardware and wiring installation.
      b. Process of downloading programs to local controllers and verifying that they are addressed correctly.
      c. Process of performing operational checks of each controlled component.
      d. Plan and process for calibrating valve and damper actuators and all sensors.
      e. Description of the expected field adjustments for transmitters, controllers and control actuators should control responses fall outside of expected values.
   4. Copy of proposed log and field checkout sheets to be used to document the process; include space for initial and final read values during calibration of each point and space to specifically indicate when a sensor or controller has “passed” and is operating within the contract parameters.
   5. Description of the instrumentation required for testing.
   6. Indicate what tests on what systems should be completed prior to TAB using the control system for TAB work. Coordinate with the Commissioning Authority and TAB contractor for this determination.

C. Startup Reports, Prefunctional Checklists, and Trend Logs: Submit for approval of Commissioning Authority.

D. HVAC Control System O&M Manual Requirements. In addition to documentation specified elsewhere, compile and organize at minimum the following data on the control system:
   1. Specific step-by-step instructions on how to perform and apply all functions, features, modes, etc. mentioned in the controls training sections of this specification and other features of this system. Provide an index and clear table of contents. Include the detailed technical manual for programming and customizing control loops and algorithms.
   2. Full as-built set of control drawings.
   3. Full as-built sequence of operations for each piece of equipment.
   4. Full points list; in addition to the information on the original points list submittal, include a listing of all rooms with the following information for each room:
      a. Floor.
      b. Room number.
      c. Room name.
      d. Air handler unit ID.
      e. Reference drawing number.
      f. Air terminal unit tag ID.
      g. Heating and/or cooling valve tag ID.
      h. Minimum air flow rate.
      i. Maximum air flow rate.
   5. Full print out of all schedules and set points after testing and acceptance of the system.
   6. Full as-built print out of software program.
   7. Electronic copy on disk of the entire program for this facility.
   8. Marking of all system sensors and thermostats on the as-built floor plan and HVAC drawings with their control system designations.
   9. Maintenance instructions, including sensor calibration requirements and methods by sensor type, etc.
   10. Control equipment component submittals, parts lists, etc.
   11. Warranty requirements.
   12. Copies of all checkout tests and calibrations performed by the Contractor (not commissioning tests).
   13. Organize and subdivide the manual with permanently labeled tabs for each of the following data in the given order:
      a. Sequences of operation.
      b. Control drawings.
      c. Points lists.
      d. Controller and/or module data.
      e. Thermostats and timers.
      f. Sensors and DP switches.
      g. Valves and valve actuators.
      h. Dampers and damper actuators.
      i. Program setups (software program printouts).

E. Project Record Documents:
   1. Submit updated version of control system documentation, for inclusion with operation and maintenance data.
   2. Show actual locations of all static and differential pressure sensors (air, water and building pressure) and air-flow stations on project record drawings.

F. Draft Training Plan:
   1. Follow the recommendations of ASHRAE Guideline 1.1.
   2. Control system manufacturer's recommended training.
   3. Demonstration and instruction on function and overrides of any local packaged controls not controlled by the HVAC control system.

G. Training Manuals:
   1. Provide three extra copies of the controls training manuals in a separate manual from the O&M manuals.

PART 2 PRODUCTS

2.01 TEST EQUIPMENT

A. Provide all standard testing equipment required to perform startup and initial checkout and required functional performance testing; unless otherwise noted such testing equipment will NOT become the property of Owner.

B. Equipment-Specific Tools: Where special testing equipment, tools and instruments are specific to a piece of equipment, are only available from the vendor, and are required in order to accomplish startup or Functional Testing, provide such equipment, tools, and instruments as part of the work at no extra cost to Owner; such equipment, tools, and instruments are to become the property of Owner.

PART 3 EXECUTION

3.01 PREPARATION

A. Cooperate with the Commissioning Authority in development of the Prefunctional Checklists and Functional Test Procedures.

B. Furnish additional information requested by the Commissioning Authority.

C. Prepare a preliminary schedule for HVAC pipe and duct system testing, flushing and cleaning, equipment start-up and testing, adjusting, and balancing start and completion for use by the Commissioning Authority; update the schedule as appropriate.

D. Notify the Commissioning Authority when pipe and duct system testing, flushing, cleaning, startup of each piece of equipment and testing, adjusting, and balancing will occur; when commissioning activities not yet performed or not yet scheduled will delay construction notify ahead of time and be proactive in seeing that the Commissioning Authority has the scheduling information needed to efficiently execute the commissioning process.

E. Put all HVAC equipment and systems into operation and continue operation during each working day of testing, adjusting, and balancing and commissioning, as required.
   1. Include cost of sheaves and belts that may be required for testing, adjusting, and balancing.

F. Provide test holes in ducts and plenums where directed to allow air measurements and air balancing; close with an approved plug.

G. Provide temperature and pressure taps in accordance with Contract Documents.

3.02 INSPECTING AND TESTING - GENERAL

A. Submit startup plans, startup reports, and Prefunctional Checklists for each item of equipment or other assembly to be commissioned.

B. Perform the Functional Tests directed by the Commissioning Authority for each item of equipment or other assembly to be commissioned.

C. Provide two-way radios for use during the testing.

D. Damper Stroke Setup and Check:
   1. For all damper actuator positions checked, verify the actual position against the control system readout.
   2. Set fan to normal operating mode.
   3. Command damper closed; visually verify that damper is closed and adjust output zero signal as required.
   4. Command damper open; verify position is full open and adjust output signal as required.
   5. Command damper to a few intermediate positions.
   6. If actual damper position does not reasonably correspond, replace actuator.

E. Deficiencies: Correct deficiencies and re-inspect or re-test, as applicable, at no extra cost to Owner.

3.03 TAB COORDINATION

A. TAB: Testing, adjusting, and balancing of HVAC.

B. Coordinate commissioning schedule with TAB schedule.

C. Review the TAB plan to determine the capabilities of the control system toward completing TAB.

D. Provide all necessary unique instruments and instruct the TAB technicians in their use; such as handheld control system interface for setting terminal unit boxes, etc.

E. Have all required Prefunctional Checklists, calibrations, startup and component Functional Tests of the system completed and approved by the Commissioning Authority prior to starting TAB.

F. Provide a qualified control system technician to operate the controls to assist the TAB technicians or provide sufficient training for the TAB technicians to operate the system without assistance.

3.04 CONTROL SYSTEM FUNCTIONAL TESTING

A. Prefunctional Checklists for control system components will require a signed and dated certification that all system programming is complete as required to accomplish the requirements of Contract Documents and the detailed Sequences of Operation documentation submittal.

B. Do not start Functional Testing until all controlled components have themselves been successfully Functionally Tested in accordance with Contract Documents.

C. Using a skilled technician who is familiar with this building, execute the Functional Testing of the control system as required by the Commissioning Authority.

D. Functional Testing of the control system constitutes demonstration .

E. Functionally Test integral or stand-alone controls in conjunction with the Functional Tests of the equipment they are attached to, including any interlocks with other equipment or systems; further testing during control system Functional Test is not required unless specifically indicated below.

F. Demonstrate the following to the Commissioning Authority during testing of controlled equipment; coordinate with commissioning of equipment.
   1. Setpoint changing features and functions.
   2. Sensor calibrations.

G. If the control system, integral control components, or related equipment do not respond to changing conditions and parameters appropriately as expected, as specified and according to acceptable operating practice, under any of the conditions, sequences, or modes tested, correct all systems, equipment, components, and software required at no additional cost to Owner.

3.05 OPERATION AND MAINTENANCE MANUALS

A. Add design intent documentation furnished by Architect to manuals prior to submission to Owner.

B. Submit manuals related to items that were commissioned to Commissioning Authority for review; make changes recommended by Commissioning Authority.

C. Commissioning Authority will add commissioning records to manuals after submission to Owner.

3.06 DEMONSTRATION AND TRAINING

A. Demonstrate operation and maintenance of HVAC system to Owner' personnel; if during any demonstration, the system fails to perform in accordance with the information included in the O&M manual, stop demonstration, repair or adjust, and repeat demonstration. Demonstrations may be combined with training sessions if appropriate.

B. These demonstrations are in addition to, and not a substitute for, Prefunctional Checklists and demonstrations to the Commissioning Authority during Functional Testing.

C. TAB Review: Instruct Owner's personnel for minimum 4 hours, after completion of TAB, on the following:
   1. Review final TAB report, explaining the layout and meanings of each data type.
   2. Discuss any outstanding deficient items in control, ducting or design that may affect the proper delivery of air or water.
   3. Identify and discuss any terminal units, duct runs, diffusers, coils, fans and pumps that are close to or are not meeting their design capacity.
   4. Discuss any temporary settings and steps to finalize them for any areas that are not finished.
   5. Other salient information that may be useful for facility operations, relative to TAB.

D. Provide the services of manufacturer representatives to assist instructors where necessary.

E. Provide the services of the HVAC controls instructor at other training sessions, when requested, to discuss the interaction of the controls system as it relates to the equipment being discussed.

END OF SECTION 23 08 00

SECTION 23 23 00
REFRIGERANT PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Piping.

B. Moisture and liquid indicators.

C. Valves.

D. Strainers.

E. Check valves.

F. Filter-driers.

G. Flexible connections.

1.02 REFERENCE STANDARDS

A. ASME BPVC-IX - Boiler and Pressure Vessel Code, Section IX - Qualification Standard for Welding, Brazing, and Fusing Procedures; Welders; Brazers; and Welding, Brazing, and Fusing Operators 2023.

B. ASME B16.22 - Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings 2021.

C. ASME B31.5 - Refrigeration Piping and Heat Transfer Components 2022.

D. ASME B31.9 - Building Services Piping 2020.

E. AWS A5.8M/A5.8 - Specification for Filler Metals for Brazing and Braze Welding 2019.

F. MSS SP-58 - Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation 2018, with Amendment (2019).

1.03 SYSTEM DESCRIPTION

A. Provide pipe hangers and supports in accordance with ASME B31.5 unless indicated otherwise.

B. Filter-Driers:

1. Use a filter-drier immediately ahead of liquid-line controls, such as thermostatic expansion valves, solenoid valves, and moisture indicators.

1.04 SUBMITTALS

A. Product Data: Provide general assembly of specialties, including manufacturers catalogue information. Provide manufacturers catalog data including load capacity.

B. Shop Drawings: Indicate schematic layout of system, including equipment, critical dimensions, and sizes.

C. Design Data: Submit design data indicating pipe sizing. Indicate load carrying capacity of trapeze, multiple pipe, and riser support hangers.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store piping and specialties in shipping containers with labeling in place.

B. Protect piping and specialties from entry of contaminating material by leaving end caps and plugs in place until installation.

C. Dehydrate and charge components such as piping and receivers, seal prior to shipment, until connected into system.

PART 2 PRODUCTS

2.01 REGULATORY REQUIREMENTS

A. Comply with ASME B31.9 for installation of piping system.

B. Welding Materials and Procedures: Comply with ASME BPVC-IX and applicable state labor regulations.

C. Products Requiring Electrical Connection: Listed and classified by UL, as suitable for the purpose indicated.

2.02 PIPING

A. Copper Tube: ASTM B280, H58 hard drawn. Soft annealed copper tube will not be accepted.
   1. Fittings: ASME B16.22 wrought copper.
   2. Joints: Braze, AWS A5.8M/A5.8 BCuP silver/phosphorus/copper alloy.

B. Pipe Supports and Anchors:
   1. Provide hangers and supports that comply with MSS SP-58.
   2. Pipe Hangers for pipe 6" and smaller: Cooper B3100, Anvil Fig. 260, or equivalent.
   3. Riser Clamps: Cooper B3373, Anvil Fig. 40, or equivalent.
   4. Beam Clamps: Cooper B3050, Anvil Fig. 134, or equivalent.
   5. Offset Clamps: Cooper B3148, Anvil Fig. 103, or equivalent
   6. Ceiling Plate: Cooper B3199, Anvil Fig. 610, or equivalent
   7. Wall Brackets: Cooper B3067, Anvil Fig. 199, or equivalent.
   8. Rod Ceiling Plate: Cooper, Anvil Fig. 610, or equivalent.
   9. Concrete Inserts: Cooper B2500, Anvil Fig. 95 or equivalent.
   10. Copper Pipe Support: Carbon steel ring, adjustable, copper plated.
   11. Hanger Rods: Mild steel threaded both ends, threaded one end, or continuous threaded.

2.03 MOISTURE AND LIQUID INDICATORS

A. Manufacturers:
   1. Henry Technologies
   2. Parker Hannifin/Refrigeration and Air Conditioning
   3. Sporlan, a Division of Parker Hannifin
   4. Or Approved Equal

B. Indicators: Single port type, UL listed, with copper or brass body, flared or solder ends, sight glass, color coded paper moisture indicator with removable element cartridge and plastic cap; for maximum temperature of 200 degrees F and maximum working pressure of 500 psi.

2.04 VALVES

A. Manufacturers:
   1. Hansen Technologies Corporation
   2. Henry Technologies
   3. Flomatic Valves
   4. Or Approved Equal

B. Diaphragm Packless Valves:
   1. UL listed, globe or angle pattern, forged brass body and bonnet, phosphor bronze and stainless steel diaphragms, rising stem and handwheel, stainless steel spring, nylon seat disc, solder or flared ends, with positive backseating; for maximum working pressure of 500 psi and maximum temperature of 275 degrees F.

C. Packed Angle Valves:
   1. Forged brass or nickel plated forged steel, forged brass seal caps with copper gasket, rising stem and seat with backseating, molded stem packing, solder or flared ends; for maximum working pressure of 500 psi and maximum temperature of 275 degrees F.

D. Ball Valves:
   1. Two piece bolted forged brass body with teflon ball seals and copper tube extensions, brass bonnet and seal cap, chrome plated ball, stem with neoprene ring stem seals; for maximum working pressure of 500 psi and maximum temperature of 300 degrees F.

E. Service Valves:
   1. Forged brass body with copper stubs, brass caps, removable valve core, integral ball check valve, flared or solder ends, for maximum pressure of 500 psi.

2.05 STRAINERS

A. Manufacturers:
   1. Hansen Technologies Corporation
   2. Parker Hannifin/Refrigeration and Air Conditioning

3. Sporlan, a Division of Parker Hannifin

B. Straight Line or Angle Line Type:
1. Brass or steel shell, steel cap and flange, and replaceable cartridge, with screen of stainless steel wire or monel reinforced with brass; for maximum working pressure of 430 psi.

2.06 CHECK VALVES

A. Manufacturers:
1. Hansen Technologies Corporation
2. Parker Hannifin/Refrigeration and Air Conditioning
3. Sporlan, a Division of Parker Hannifin
4. Or Approved Equal
5. Substitutions: See Section 01 60 00 - Product Requirements.

B. Globe Type:
1. Cast bronze or forged brass body, forged brass cap with neoprene seal, brass guide and disc holder, phosphor-bronze or stainless steel spring, teflon seat disc; for maximum temperature of 300 degrees F and maximum working pressure of 425 psi.

2.07 FILTER-DRIERS

A. Manufacturers:
1. Alco
2. Cash
3. Flow Controls Division of Emerson Electric
4. Henry
5. Parker Hannifin/Refrigeration and Air Conditioning
6. Sporlan, a Division of Parker Hannifin
7. Or Approved Equal

B. Cores: Molded or loose-fill molecular sieve desiccant compatible with refrigerant, activated alumina, activated charcoal, and filtration to 40 microns, with secondary filtration to 20 microns; of construction that will not pass into refrigerant lines.

C. Construction: UL listed.
1. Sealed Type: Copper shell.
2. Connections: Soldered.

2.08 FLEXIBLE CONNECTORS

A. Manufacturers:
1. Circuit Hydraulics, Ltd
2. Flexicraft Industries
3. Penflex
4. Or Approved Equal

B. Corrugated stainless steel hose with single layer of stainless steel exterior braiding, minimum 9 inches long with copper tube ends; for maximum working pressure of 640 psi.

2.09 EXPANSION LOOPS

A. Flexible hose expansion loops shall be manufactured complete with two parallel sections of corrugated metal house, compatible braid, 180º return bend, with inlet and outlet connections. Field fabricated loops shall not be acceptable.

B. Flexible hose expansion loops shall impart no thrust loads to system support, anchors or building structure.

C. Flexible hose expansion loops to be "VRF Metraloop” as manufactured by The Metraflex Company

D. Corrugated Hose shall be Type 321 stainless Steel

E. Braid shall be double layer of type 304 Stainless Steel

F. Fittings shall be Sch 40 S Type 304 Stainless in accordance with ASTM A240

G. Copper pipe systems, the VRF Metraloop shall be equipped with a stainless-steel to copper conversion fitting with XHP copper stub ends.

H. Flexible hose expansion loops shall have a factory supplied; hanger / support lug located at the bottom of the 180º return.

I. Rated for 700 PSI @ 300°F

PART 3 EXECUTION

3.01 PREPARATION

A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.

B. Remove scale and dirt on inside and outside before assembly.

C. Prepare piping connections to equipment with flanges or unions.

3.02 INSTALLATION

A. Install refrigeration specialties in accordance with manufacturer's instructions.

B. Space refrigerant piping far enough apart to allow for field installed insulation of thickness specified.

C. The installation of piping and related items shall be made neatly and in such a manner as not to interfere with access to valves or equipment. Expansion, drainage and maintenance of installed piping shall be possible.

D. Route piping in orderly manner, with plumbing parallel to building structure, and maintain gradient.

E. Install piping to conserve building space and avoid interference with use of space.

F. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.

G. Sleeves shall be provided wherever pipes pass through walls, floors and ceilings. Sleeves shall be Schedule 40, black steel, one-half inch in diameter larger than the pipe or insulation on the pipe. Sleeves through walls and ceilings shall be flush. Sleeves through floors shall extend one inch above finished floor. Sleeves through exterior walls shall be caulked and made watertight.

H. Pipe Hangers and Supports:
   1. Install in accordance with ASME B31.5.
   2. Support horizontal piping as indicated.
   3. Place hangers within 12 inches of each horizontal elbow.
   4. Provide copper plated hangers and supports for copper piping.

I. Arrange piping to return oil to compressor. Provide traps and loops in piping, and provide double risers as required. Slope horizontal piping 0.40 percent in direction of flow.

J. Provide clearance for installation of insulation and access to valves and fittings.

K. Flood piping system with nitrogen when brazing.

L. Fully charge completed system with refrigerant after testing.

3.03 FIELD QUALITY CONTROL

A. Test refrigeration system in accordance with ASME B31.5.

B. All refrigerant equipment not tested at the factory shall be shut off from the rest of the system and tested under a vacuum with no evidence of leakage. Piping systems shall be tested after installation, and before any insulation is applied. All controls and other apparatus that may be damaged by the test pressure shall be removed before tests are made.

C. Refrigerant piping leak testing shall be as follows, unless equipment manufacturer mandates or recommends or more stringent procedure:
   1. Connect the refrigerant manifold gauge hoses to the liquid side and gas side service ports on the equipment and connect the center hose to a nitrogen tank fitted with a pressure regulator.
   2. Fill the lines with nitrogen to 590 psi but no more than 595 psi.
   3. Monitor the pressure periodically for a minimum of 24 hours. If the pressure drops, use soapy water to check for leaks. Bubbles will occur if joints are not tight.
   4. Repair leaks. Repeat the previous steps until the pressure remains constant for 24 hours.
   5. Maintain 145 psi of pressure for 15 minutes and check for further leakage. If the pressure drops, check for leaks and repair. Repeat this step until 145 psi of pressure is maintained for

15 minutes.

6. Remove hoses from service ports.

D. Evacuation Procedure. After performing leak test, use a vacuum pump to triple evacuate the system as described below:
   1. Use a vacuum pump with a check valve to prevent pump oil from flowing backward while the vacuum pump is closed. Completely close the liquid-vapor line service valves of the outdoor unit.
   2. Using vacuum-rated hoses, connect the manifold gauges to the liquid and suction (and high pressure, if applicable) gas pipes.
   3. Evacuate the system to 750 microns, hold for 5 minutes, and check for leaks. Repair and repeat as necessary until vacuum holds.
   4. Break the vacuum by applying 10 psi of nitrogen.
   5. Evacuate the system to 500 microns, hold for 5 minutes, and check for leaks. Repair and repeat as necessary until vacuum holds.
   6. Break the vacuum by applying 10 psi of nitrogen.
   7. Evacuate the system to 200 microns. Wait for 15 minutes. A rise of no more than 200 microns is acceptable. If over 400 microns, check for leaks, repair, and repeat.
   8. If under 400 microns, continue holding vacuum for 2.5 hours. If vacuum exceeds 400 microns at end of period, check for leaks, repair, and repeat.
   9. If system holds under 400 microns for 2.5 hours, system is ready for charging.

3.04 SCHEDULES

A. Hanger Spacing for Copper Tubing.
   1. 1/2 inch, 5/8 inch, and 7/8 inch OD: Maximum span, 5 feet; minimum rod size, 1/4 inch.
   2. 1-1/8 inch OD: Maximum span, 6 feet; minimum rod size, 1/4 inch.
   3. 1-3/8 inch OD: Maximum span, 7 feet; minimum rod size, 3/8 inch.
   4. 1-5/8 inch OD: Maximum span, 8 feet; minimum rod size, 3/8 inch.
   5. 2-1/8 inch OD: Maximum span, 8 feet; minimum rod size, 3/8 inch.

END OF SECTION 23 23 00

SECTION 23 31 00
HVAC DUCTS AND CASINGS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Metal ductwork.

1.02 REFERENCE STANDARDS

A. ASHRAE (FUND) - ASHRAE Handbook - Fundamentals Most Recent Edition Cited by Referring Code or Reference Standard.

B. ASTM A36/A36M - Standard Specification for Carbon Structural Steel 2019.

C. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process 2023.

D. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar 2023.

E. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2023.

F. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems 2021.

G. SMACNA (DCS) - HVAC Duct Construction Standards Metal and Flexible 2021.

H. SMACNA (LEAK) - HVAC Air Duct Leakage Test Manual 2012.

I. UL 181 - Standard for Factory-Made Air Ducts and Air Connectors Current Edition, Including All Revisions.

1.03 SUBMITTALS

A. Product Data: Provide data for duct materials and duct connections.

B. Shop Drawings: Indicate duct fittings, particulars such as gages, sizes, welds, and configuration prior to start of work for 1/2" pressure class and higher systems.
   1. Clearly indicate which fittings shall be used on the project: elbows, wyes, takeoffs, transitions, offsets, etc.

C. Test Reports: Indicate pressure tests performed. Include date, section tested, test pressure, and leakage rate, following SMACNA (LEAK).

1.04 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience, and approved by manufacturer.

B. Galvanizing thickness and country of origin must be clearly stenciled on each duct section. At the discretion of the Engineer, sheet metal gauges and reinforcing may be randomly checked to verify all duct construction is in compliance.

C. Ductwork and fittings must have a computer generated label affixed to each section detailing the duct dimensions, sheet metal gauge, intermediate and joint reinforcement size, and the transverse connector brand and classification.

1.05 FIELD CONDITIONS

A. Do not install duct sealants when temperatures are less than those recommended by sealant manufacturers.

B. Maintain temperatures within acceptable range during and after installation of duct sealants.

C. If ductwork is stored on site, elevate duct above floors and maintain protection on ends.

PART 2 PRODUCTS

2.01 DUCT ASSEMBLIES

A. Regulatory Requirements: Construct ductwork to comply with NFPA 90A standards.

B. Duct transverse joints and reinforcement materials, including angle ring flanges and stiffeners, shall be of the same material as the duct.

C. Ducts: Galvanized steel, unless otherwise indicated.

D. Low Pressure Supply (Heating Systems): 2 inch w.g. pressure class, galvanized steel.

E. Low Pressure Supply (System with Cooling Coils): 2 inch w.g. pressure class, galvanized steel.

F. Return and Relief: -2 inch w.g. pressure class, galvanized steel.

G. General Exhaust: -2 inch w.g. pressure class, galvanized steel.

H. Outside Air Intake: -2 inch w.g. pressure class, galvanized steel.

2.02 MATERIALS

A. Galvanized Steel for Ducts: Hot-dipped galvanized steel sheet, ASTM A653/A653M FS Type B, with G90/Z275 coating.

B. Stainless Steel for Ducts: ASTM A666, Type 304.

C. Joint Sealers and Sealants: Non-hardening, water resistant, mildew and mold resistant.
   1. Manufacturers:
      a. Childers
      b. Ductmate
      c. Durodyne
      d. Foster
      e. Hardcast
      f. McGill Airseal
      g. Sheet Metal Connectors, Inc.
      h. Or Approved Equal
   2. Flexible, water-based, adhesive sealant designed for use in all pressure duct systems. After curing, it shall be resistant to ultraviolet light and shall prevent the entry of water, air, and moisture into the duct system. Sealer shall be UL 723 and UL 181B-M listed and meet NFPA requirements for Class 1 ductwork. VOC shall be <75 g/l.
   3. Neoprene gasket must be closed cell rubber based sealing tape and must pass UL 94 HF-1.
   4. Butyl rubber gasket which complies with UL 723, Mil-C 18969B and TTS-S-001657. This material, in addition to the above, shall not contain vegetable oils, fish oils, or any other type vehicle that will support fungal and/or bacterial growth.
   5. Surface Burning Characteristics: Flame spread index of zero and smoke developed index of zero, when tested in accordance with ASTM E84.

D. Hanger Rod: ASTM A36/A36M; steel, galvanized; threaded both ends, threaded one end, or continuously threaded.

E. Cable Suspension System:
   1. Suspension system shall be Gripple Hang-Fast as manufactured and supplied by Gripple, Inc., or Ductmate "Clutcher" cable hanging system.
   2. Suspension system shall be load rated and verified by SMACNA Testing and Research Institute to be in compliance with SMACNA Standards.
   3. All suspension systems shall used galvanized hardware.

2.03 DUCTWORK FABRICATION

A. Fabricate and support in accordance with SMACNA (DCS) and as indicated.
   1. Internal tie rods or bracing are not allowed for ductwork 36" and below. Tie rods shall be 1/2", 3/4", 1", 1-1/4" or 1-1/2" galvanized rods with bolt assembly consisting of rubber washer and friction anchored threaded insert similar to Ductmate Easyrod or PPI Condu-Lock.
   2. Internal tie rods are not allowed for ductwork in chase and other non-accessible locations.

B. Where the size for a duct segment is not indicated, the duct segment size shall be equal to the largest duct segment to which it is connected. Transition to smaller size shall occur on the side of the fitting where smaller size is indicated.

C. No variation of duct configuration or size permitted except by written permission. Size round duct installed in place of rectangular ducts in accordance with ASHRAE (FUND) Handbook - Fundamentals.

D. Construct T's, bends, and elbows with radius of not less than 1-1/2 times width of duct on centerline. Where not possible and where rectangular elbows must be used, provide air foil turning vanes of perforated metal with glass fiber insulation.

E. Increase duct sizes gradually, not exceeding 15 degrees divergence wherever possible; maximum 30 degrees divergence upstream of equipment and 45 degrees convergence downstream.

F. Fabricate continuously welded round and oval duct fittings in accordance with SMACNA (DCS).

G. Where ducts are connected to exterior wall louvers and duct outlet is smaller than louver frame, provide blank-out panels sealing louver area around duct. Use same material as duct, painted black on exterior side; seal to louver frame and duct.

2.04 HANGERS AND SUPPORTS

A. Refer to the Structural Drawngs and Details for the limitations and applications of each type of hanger and weight when attaching to bar joists, trusses, or other building Structural elements. The Contractor shall be responsible for providing additional miscellaenous steel, unistrut, and other components to span multiple joists as required by the Structural Drawings to distribute concentrated loads.

B. Unless otherwise indicated, use straps or Z bar hangers with 3/8” rods to support rectangular ducts 48” wide and smaller and trapeze hangers with rods or angles to support rectangular ducts over 48” wide.
   1. Use trapeze hangers to support externally insulated ductwork with weight bearing inserts.

C. For round ducts 24" diameter or smaller, use single hanger.
   1. Cable Suspension System may be used up to 16" diameter
   2. Round Duct Strap Bracket by Ductmate Industries may be used up to 24"diameter.

D. For round ducts over 24" diameter, use 2 hangers with half round trapeze.

E. For round ducts over 25” diameter or larger, use 2 minimum 3/8” rods with trapeze.

F. The following upper attachments, upper attachment devices, lower hanger attachments, hanger devices, and/or hanger attachments are not allowed except where specifically indicated:
   1. Hook or loop.
   2. Nailed pin fasteners.
   3. Expansion nails without washers.
   4. Powder charged or mechanically driven fasteners (forced entry anchors).
   5. Beam or "C" clamps without retaining clips or friction clamps (provide retaining clips
   6. for "C" clamps).
   7. Friction clamps for ductwork over 12".
   8. Non-factory manufactured upper attachments for metal pan deck including wire coil and double circle (Items 16 and 17 of Fig 4-3 of SMACNA HVAC Duct Construction Standards 95).
   9. Wire hanger.
   10. Trapeze hangers supported by wires or straps.
   11. Rods, straps or welded studs directly attached to metal deck.
   12. Drilled hole with attachment to structural steel.
   13. Lag screw expansion anchor.
   14. Rivets.

G. Supporting devices shall be standard products of manufacturers having published load ratings.

H. Unless drawings indicate the required framing, provide angle iron framing around roof opening where duct penetrates through roof decking, to maintain roof decking structural integrity in accordance with roof decking manufacturer's recommendations. This is not required for concrete decking. For concrete decking, consult with Structural Engineer for location and size of opening prior to execution of Work.

I. For welded ducts, soldered ducts or ducts with water tight joints, do not use supports utilizing screws or other penetrations into ductwork.

J. All hangers and supports shall be fully galvanized.

2.05 MANUFACTURED DUCTWORK AND FITTINGS

A. Double Wall Insulated Round Ducts: Round spiral lockseam duct with galvanized steel outer wall, perforated galvanized steel inner wall; fitting with solid inner wall.
   1. Manufacture in accordance with SMACNA (DCS).
   2. Insulation:
      a. Thickness: 1 inch.
      b. Material: Fiberglass or elastomeric foam.
      c. Finish: "Paint grip" galvanneal or mill phosphatized
   3. Manufacturers:
      a. MKT Metal Manufacturing
      b. Hamlin
      c. SMC
      d. McGill Airflow
      e. Or Approved Equal

B. Double Wall Insulated Rectangular Ducts: Rectangular spiral lockseam duct with galvanized steel outer wall, perforated galvanized steel inner wall; fitting with solid inner wall.
   1. Manufacture in accordance with SMACNA (DCS).
   2. Insulation:
      a. Thickness: 1 inch.
      b. Material: Fiberglass or elastomeric foam.
      c. Finish: "Paint grip" galvanneal or mill phosphatized

C. Flexible Ducts: UL 181, Class 0, interlocking spiral of aluminum foil.
   1. Insulation: Fiberglass insulation with polyethylene vapor barrier film.
   2. Pressure Rating: 8 inches wg positive or negative.
   3. Maximum Velocity: 5000 fpm.
   4. Temperature Range: Minus 20 degrees F to 250 degrees F.
   5. Insulation: R6.0
      a. Insulation material shall not be exposed to airstream.
   6. Manufacturers:
      a. Lindab
      b. Flexmaster
      c. Clevaflex
      d. Thermaflex
      e. Or Approved Equal

2.06 LONGITUDINAL SEAM:

A. Rectangular Duct:
   1. Unless otherwise indicated, use Pittsburgh lock seam construction.
   2. Seal longitudinal seams with approved sealant or provide pre-sealed from factory with encapsulated mastic.
   3. Button punch snap lock construction (SMACNA L-2) is not allowed except for ductwork that is both low pressure (2” WG or lower pressure class) and 18” and smaller duct width.
   4. Button punch snap lock construction is not allowed for ductwork in chases and areas above inaccessible ceilings.
   5. Button punch snaplock construction is not allowed on exhaust ductwork or aluminum ductwork

B. Round and Oval Duct
   1. Unless otherwise indicated, longitudinal seams shall be in accordance with SMACNA HVAC Duct Construction Standards with the following exceptions:
      a. Snaplock seams are not allowed.
      b. SMACNA seam types RL-3, 6A, 6B, 7, and 8 shown in Figure 3-2 are not allowed, except for 2" w.g. class round ducts 16" or less in diameter.

2.07 RECTANGULAR TRANSVERSE JOINT CONNECTORS:

A. Slide-on Transverse Joint Connectors:

1. Duct constructed using engineered slide-on connector systems must be submitted and conform to manufacturer's published duct construction standards and guidelines for joint classification, sheet metal gauge, intermediate and joint reinforcement size and spacing, unless otherwise specified.
2. Manufacturer of engineered connector system must have certified independent performance testing for leakage, deflection and seismic stability.
3. All components of the engineered system must be clearly embossed with the manufacturer's name, model number or identifying marking.
4. Butyl rubber gasket must be applied per the manufacturer's instructions on all connections except for breakaway connections. Closed Cell Neoprene gasket must be applied per the manufacturer's instructions on all breakaway connections. No substitution of connector system components or gaskets is permitted.
5. All duct installed using engineered connectors must adhere to the manufacturer's published assembly and installation guidelines for all standard, breakaway, roof-top or specialty connections unless otherwise specified.

B. Formed-on Flanges:
1. Lockformers TDC or Engles TDF may be used in accordance with T-25 flanges of SMACNA HVAC Duct Construction Standards, provided that corner pieces with bolts are used. If TDF/TDC flanges are damaged, replace the damaged joint(s) by straightening and reinforcing with minimum 1-1/2 x 1-1/2 x 1/4 angle at each side of transverse joint

PART 3 EXECUTION

3.01 INSTALLATION

A. Install, support, and seal ducts in accordance with SMACNA (DCS).

B. During construction provide temporary closures of metal or taped polyethylene on open ductwork to prevent construction dust from entering ductwork system.

C. Install ductwork parallel to building walls and ceilings and at such heights not to obstruct any portion of window, doorway, stairway, or passageway. Install ductwork to allow adequate access and service space for equipment and access clearances for cable tray/j-hooks. Refer to drawings and/or manufacturer's recommendations Install vertical ductwork plumb. Make allowances for beams, pipes or other obstructions in building construction and for work of other contractors. Check plans showing work of other trades and consult with Engineer in event of any interference.

D. Where interferences develop in the field, offset or reroute ductwork as required to clear such interferences. Do not divide duct and do not route any other utilities such as piping or conduit through duct. In all cases, consult drawings for exact location of space allocated for duct, ceiling heights, door and window openings, or other architectural details before fabricating or installing duct. Consult Designer where conflicts arise between ductwork and other utilities which cannot be resolved by relocating duct.

E. Where offsets in ductwork are required, contractor to use standard 30, 45 or 90-degree elbows. Where space constraints do not allow for the use of standard elbows for offsets, use of angled offsets as depicted by SMACNA Figure 2-7 (Angled Offset Type 1) may be used with maximum angle of offset not to exceed 15 degrees maximum. Offsets Type 2 and 3 in SMACNA Figure 2-7 shall not be allowed.

F. Rectangular Duct Elbows:
1. Rectangular Duct: Unless specific type is indicated, provide radius elbows with splitter vanes with minimum centerline radius to width or diameter ratio of 1.5
   a. 1.5 radius elbows with full spliter vanes as follows:
      1) One vane for duct width 2-12"
      2) Two vanes for duct width 13-20"
      3) Three vanes for duct width 21"-36"
      4) Four vanes for duct width 38" and larger
      5) Fabricate vanes in accordance with SMACNA.
   b. Rectangular throad elbows with turning vanes where 1.5 radius elbows do not fit.
   c. Rectangular throat/radius heel elbows or rectangular elbows without turning vanes shall not be used.

G. Round and Oval Duct Elbows:
   1. Unless specific type is indicated, use radius elbows with centerline radius to diameter ratio of 1.5. ONLY where1.5 radius elbows do not fit, 1.0 radius elbows may be used if approved by the Engineer.

H. Construct ductwork so that interior surfaces are smooth. Internal duct hangers and internal bracing are not allowed. Refer to above for internal tie rods.

I. Support coils, filters, air terminals, dampers, sound attenuating devices, or other devices installed in duct systems with angles or channels and make all connections to such equipment including equipment furnished by others. Secure frames with gaskets, nuts, bolts and washers.

J. Flexible ducts shall not exceed 5 feet in length. Bends, kinks, and sagging of flexible duct will not be accepted. The maximum permitted sag is 1/2" per foot of support spacing.

K. Install outside air intake duct to pitch down at minimum 1” per 20 ft toward intake louver or plenum and to drain to outside of building. Solder or seal seams to form watertight joints.

L. Install exhaust air duct to pitch down at minimum 1” per 20 ft toward exhaust louver.

M. Where 2 different metal ducts meet, install joint in such a manner that metal ducts do not contact each other by using proper gasket seal or compound.

N. Flexible Ducts: Connect to metal ducts with adhesive plus sheet metal screws.
   1. Flexible ducts are not allowed for special exhaust systems, such as laboratory exhaust, vehicle exhaust, etc.
   2. Splicing of flexible duct will not be allowed.
   3. Flexible ducts shall not pass through any partition, wall, floor, or ceiling.

O. Duct sizes indicated are inside clear dimensions. For lined ducts, maintain sizes inside lining.

P. 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.

Q. Locate ducts with sufficient space around equipment to allow normal operating and maintenance activities.

R. Use double nuts and lock washers on threaded rod supports.

S. At exterior wall louvers, seal duct to louver frame and install blank-out panels.

T. All trapeze hanger rods shall be cut to within 1" of the bottom nut.

END OF SECTION 23 31 00

SECTION 23 33 00
AIR DUCT ACCESSORIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Backdraft dampers - metal.

B. Duct access doors.

C. Duct test holes.

D. Fire dampers.

E. Flexible duct connectors.

F. Volume control dampers.

G. Miscellaneous products:
   1. Internal strut end plugs.
   2. Duct opening closure film.

1.02 REFERENCE STANDARDS

A. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems 2021.

B. NFPA 92 - Standard for Smoke Control Systems 2021, with Amendment.

C. SMACNA (DCS) - HVAC Duct Construction Standards Metal and Flexible 2021.

D. UL 33 - Safety Heat Responsive Links for Fire-Protection Service Current Edition, Including All Revisions.

E. UL 555 - Standard for Fire Dampers Current Edition, Including All Revisions.

1.03 SUBMITTALS

A. Product Data: Provide for shop fabricated assemblies including volume control dampers. Include electrical characteristics and connection requirements.

B. Manufacturer's Installation Instructions: Provide instructions for fire dampers and combination fire and smoke dampers.

C. Project Record Drawings: Record actual locations of access doors and test holes.

D. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. Extra Fusible Links: One of each type and size.

1.04 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum five years of documented experience.

B. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

C. All dampers shall be certified to bear the AMCA Certified Ratings Program seal for Air Performance, Efficiency, and Air Leakage.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Protect dampers from damage to operating linkages and blades.

B. Storage: Store materials in a dry area indoor, protected from physical damage and in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.01 AIR TURNING DEVICES/EXTRACTORS

A. Manufacturers:
   1. Carlisle HVAC Products
   2. Elgen Manufacturing, Inc
   3. Ruskin Company
   4. Titus HVAC, a brand of Johnson Controls

5. Ward Industries, a brand of Hart and Cooley, Inc
6. Or Approved Equal

B. Multi-blade device with blades aligned in short dimension; steel construction; with individually adjustable blades, mounting straps.

2.02 BACKDRAFT DAMPERS - METAL

A. Manufacturers:
1. Nailor Industries, Inc
2. Ruskin Company, a brand of Johnson Controls
3. United Enertech
4. Greenheck
5. Arrow
6. Or Approved Equal

B. Frames shall be flanged, a minimum of 3 inches wide, and a minimum of 20 gauge roll formed galvanized steel or 0.125 inch extruded aluminum with pre-punched mounting holes and welded corner clips for maximum rigidity.

C. Blades shall be single piece, with a maximum width of 6 inches, counter balanced, and shall be constructed of minimum 26 gauge rool formed galvanized steel or 0.070 inch extruded aluminum. Blade ends shall overlap for maximum weather protection.

D. Blade seals shall be extruded vinyl and mechanically attached to blade edge.

E. Bearings shall be corrosion resistant synthetic.

F. Linkages shall use a galvanized tie bar with stainless steel pivot pins.

G. Axles shall be stainless steel.

H. Mounting shall be suitable for the required orientation.

2.03 DUCT AIR TURNING VANES

A. Provide factory manufactured turning vanes in each elbow where inside radius is less than the width of the duct, and in all square or rectangular elbows.

B. Turning vane assemblies shall be adequately supported and affixed to prevent rattling, breakaway, and shall not deform. Assemblies longer than 12 inches shall be double wall.

C. Turning vanes in negative pressure ductwork with pressure rating above 2 inches shall be installed in accordance with SMACNA Industrial Duct Construction Standard.

D. Turning vanes shall match the duct material construction.

E. Rectangular Throat Elbow Truning Vanes (Vane Runner Length up to 18" and Vane Length up to 36")
1. Provide single blade type vanes having 2" radius and 1-1/2" spacing, 24 gauge minimum. Construct vanes in accordance with SMACNA HVAC Duct Construction Standards.
2. If duct size changes in mitered elbow, use single blade type vanes with trailing edge extension.

F. Rectangular Throat Elbow Truning Vanes (Vane Runner Length up to 18" and Vane Length up to 36"):
1. Use double wall airfoil type with smoothly-rounded entry nose and extended trailing edge on 2.4" center spacing.
2. Vanes shall be equal to HEP (High Efficiency Profile) vanes as manufactured by Aero/Dyne Co.

G. Radius Elbow Splitter Vanes:
1. Splitter vanes for radius elbows shall be extended entire length of fitting and constructed in accordance with SMACNA HVAC Duct Construction Standards.

H. Manufacturers:
1. Aero Dyne
2. Ductmate, Inc.
3. Sheet Metal Connectors, Inc.

4. Duro-Dyne
5. DynAir Inc.
6. Or Approved Equal

2.04 WIRE MESH SCREENS

A. Screen assemblies shall be removable.

B. Mesh: 1/2 inch square pattern, 1/16 inch galvanized wire, interwoven, welded at wire intersections and to the frame to prevent rattles.

C. Frames: Minimum of 1 inch by 1 inch by 1/8 inch galvanized steel angles for duct sizes through 24 inches, 1-1/2 inch by 1-1/2 inch by 3/16 inch for duct sizes between 25 inches and 48 inches, and 2 inches by 2 inches for ducts larger than 48 inches continuous around perimeter of screen. Provide intermediate supports to limit screen deflection to 1/16 inch at maximum design airflow.

2.05 FLEXIBLE DUCT 90° ELBOW SUPPORT

A. Manufacturers:
1. Build Right Products
2. Hart and Cooley
3. Thermaflex
4. Or Approved Equal

B. Pre-manufactured support to form any brand flexible duct into a smooth 90 degree elbow.
1. One size shall fit 4" to 16" flexible ducts
2. No additional tools shall be required for installation
3. UL listed for use in Return Air Plenums

2.06 DUCT ACCESS DOORS

A. Manufacturers:
1. Acudor Products Inc, a Division of Nelson Industrial Inc
2. Ductmate Industries, Inc, a DMI Company
3. Durodyne
4. Elgen Manufacturing
5. MKT Metal Manufacturing
6. Nailor Industries Inc
7. Ruskin Company
8. SEMCO LLC
9. Or Approved Equal

B. Fabrication: Rigid and close-fitting of galvanized steel with sealing gaskets and quick fastening locking devices. For insulated ducts, install minimum 1 inch thick insulation with sheet metal cover.
1. Up to 18 inches Square: Provide two hinges and two sash locks.
2. Up to 24 by 48 inches: Three hinges and two compression latches with outside and inside handles.

C. Access doors with sheet metal screw fasteners are not acceptable.

D. Provide access doors of adequate size to allow easy access to the equipment that will require maintenance. Provide insulated or acoustically lined doors to prevent condensation where applicable.

E. Manufacturer shall provide a neoprene gasket around perimeter of access door for airtight seal.

F. Systems 2" w.g. or less shall use a hinged, cam, or hinged & cam square framed access door.

G. Systems 3" w.g. and above shall use a sandwich type access door. Construct doors in accordance with Figure 7-3 of the 2005 SMACNA Manual, "HVAC Duct Construction Standards, Metal & Flexible," Third Edition. Doors shall be rated for +/- 10" w.g.

2.07 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, air tight flanged fittings with screw cap. Provide extended neck fittings to clear insulation.

2.08 FIRE DAMPERS

A. Manufacturers:
   1. Nailor Industries Inc
   2. NCA, a brand of Metal Industries Inc
   3. Pottorff
   4. Ruskin Company
   5. United Enertech
   6. Air Balance/ABI
   7. Greenheck
   8. Metal Industries
   9. Prefco
   10. ATI Industries
   11. Or Approved Equal

B. Fabricate in accordance with NFPA 90A and UL 555, and as indicated.

C. Fire Resistance: 1-1/2 hours or 3 hours as required by assembly rating.

D. Dynamic Closure Rating: Dampers shall be classified for dynamic closure to 4000 fpm and 4 inches w.g. static pressure.

E. Construction:
   1. Integral Sleeve Frame: Minimum 20 gauge roll formed galvanized steel. Sleeve length to be determined by Contractor for each condition.
   2. Blades:
      a. Curtain type
      b. Action: Spring or gravity closure upon fusible link release.
      c. Orientation: Horizontal.
      d. Material: Minimum 24 gage roll formed, galvanized steel.
   3. Closure Springs: Type 301 stainless steel, constant force type, if required.
   4. Mounting: Vertical and/or Horizontal.
   5. Duct Transition Connection, Damper Style:
      a. B style – rectangular connection, blades out of air stream, high free area.
      b. G style – A style connection, grille mounting tabs at end of sleeve for grille.
      c. CR style – round connection, sealed.
   6. Finish: Mill galvanized.

F. Fusible Links: UL 33, separate at 165 degrees F with adjustable link straps for combination fire/balancing dampers.

G. Breakaway Connection:
   1. Ductmate or Drivemate.

2.09 FLEXIBLE DUCT CONNECTORS

A. Manufacturers:
   1. Carlisle HVAC Products
   2. Ductmate Industries, Inc, a DMI Company
   3. Elgen Manufacturing, Inc
   4. Durodyne
   5. Or Approved Equal

B. Flexible duct connector shall be used where ductwork connects to fan apparatus or fan casings to isolate vibration transfer. Connectors shall be attached in such a manner as to provide an airtight and waterproof seal.

C. Connectors will comply with NFPA 90A, “Installation of Air Conditioning & Ventilation Systems” and NFPA 90B, “Installation of Warm Air Heating & Air Conditioning Systems”.

D. Connector fabrics shall meet NFPA 701 (formerly UL 214.)

E. Connector fabrics shall be mildew resistant per ASTM G21.

F. Indoor installations shall be NFPA 701 listed, fire retardant Vinyl coated woven nylon or Neoprene coated woven fiberglass fabric. Minimum density of Vinyl is 20 oz. /sq. yd. and rated to 200F. Minimum density of Neoprene 30 oz. / sq. yard and rated to 200F.

G. Outdoor installations shall be NFPA 701 listed UV-resistant Hypalon coated woven fiberglass fabric. Minimum density 24 oz. /sq. yd. and rated to 250F.

H. High temperature applications shall be NFPA 701 listed, Silicone coated satin weave fiberglass fabric. Minimum density 17.5 oz. /sq. yd. and rated to 500 F.

I. Chemical resistant applications shall be of Teflon coated woven fiberglass fabric. Minimum density 18 oz. /sq. yd. and rated to 500 F.

J. Fabricate in accordance with SMACNA (DCS) and as indicated.

K. Flexible Duct Connections: Fabric crimped into metal edging strip.

2.10 VOLUME CONTROL DAMPERS

A. Manufacturers:
1. MKT Metal Manufacturing
2. Nailor Industries Inc
3. NCA, a brand of Metal Industries Inc
4. Ruskin Company:
5. United Enertech
6. Greenheck
7. Pottorff
8. Johnson Controls
9. Air Balance, Inc.
10. Or Approved Equal

B. Fabricate in accordance with SMACNA (DCS) and as indicated.

C. Round Control Damper - 1 in w.g. and below:
1. Velocity: Up to 2,000 fpm
2. Temperature: 180°F
3. Construction:
   a. Frame Material - Galvanized Steel
   b. Frame Thickness: 20 gauge
   c. Blade Material: Galvanized Steel
   d. Axle Bearings: Bronze
   e. Axle Material: Plated Steel
   f. Operaror: 3/8 inch sq. locking manual quandrant.
      1) On insulated ducts, provide 2 inch standoff bracket
   g. Manufacturers:
      1) Greenheck MBDR-50
      2) Ruskin
      3) Nailor

D. Round Control Damper - 4 in w.g. and below:
1. Velocity: Up to 3,000 fpm
2. Temperature: 180°F
3. Leakage: 4 cfm/ft2 @ 1 in. wg
4. Construction:
   a. Frame Material - Galvanized Steel
   b. Frame Thickness: 20 gauge
   c. Blade Material: Galvanized Steel
   d. Blade seal: Silicone
   e. Axle Bearings: Bronze
   f. Axle Material: Plated Steel
   g. Operaror: 3/8 inch sq. locking manual quandrant.

1) On insulated ducts, provide 2 inch standoff bracket

5. Manufacturers:
   a. Greenheck VCDR-53
   b. Ruskin
   c. Nailor

E. Rectangular Single Blade Dampers: 1 in w.g. and below, up to 10 x 30 inch duct
1. Velocity: Up to 2,000 fpm
2. Temperature: 180°F
3. Construction:
   a. Frame Material - Galvanized Steel
   b. Frame Thickness: 20 gauge
   c. Blade Material: Galvanized Steel
   d. Axle Bearings: Synthetic sleeve type
   e. Axle Material: Plated Steel
   f. Operaror: 3/8 inch sq. locking manual quandrant, 2-1/2 inch long extension
      1) On insulated ducts, provide 2 inch standoff bracket
4. Manufacturers:
   a. Greenheck MBD-10M
   b. Ruskin
   c. Nailor

F. Rectangular Multi-Blade Balancing Dampers: 2 in w.g. and below
1. Pressure: Up to 4 in w.g.
2. Velocity: 2,000 fpm
3. Temperature: 180°F
4. Construction:
   a. Frame Material - Galvanized Steel
   b. Frame Thickness: 16 gauge
   c. Blade Material: Galvanized Steel
   d. Blade Thickness: 16 gauge
   e. Blade Type: 3V
   f. Blade Operation: Opposed
   g. Axle Bearings: Synthetic sleeve type
   h. Axle Material: Plated Steel
   i. Operaror: 1/2 inch locking manual quandrant, 1-1/2 inch long standoff bracket
   j. Extension Pin: 1/2 inch diagonal glass reinforced polymer extends 3-1/2 inch beyond frame
5. Manufacturers:
   a. Greenheck MBD-15
   b. Ruskin
   c. Nailor

G. Quadrants:
1. Provide locking, indicating quadrant regulators on single and multi-blade dampers.
2. On insulated ducts mount quadrant regulators on stand-off mounting brackets, bases, or adapters.
3. Where rod lengths exceed 30 inches provide regulator at both ends.

2.11 MISCELLANEOUS PRODUCTS

A. Internal Strut End Plugs: Combination end-mounting and sealing plugs for metal conduit used as internal reinforcement struts for metal ducts; plug crimped inside conduit with outside gasketed washer seal.

B. Duct Opening Closure Film: Mold-resistant, self-adhesive film to keep debris out of ducts during construction.
1. Thickness: 2 mils.
2. High tack water based adhesive.

3. UV stable light blue color.
4. Elongation Before Break: 325 percent, minimum.
5. Manufacturers:
   a. Carlisle HVAC Products; Dynair Duct Protection Film
   b. Surface Shields
   c. Trimaco
   d. Ductmate ProGuard
   e. Or Approved Equal

PART 3 EXECUTION

3.01 INSTALLATION

A. Install accessories in accordance with manufacturer's instructions, NFPA 90A, and follow SMACNA (DCS). Refer to Section 23 31 00 for duct construction and pressure class.

B. Provide backdraft dampers on exhaust fans or exhaust ducts nearest to outside and where indicated.

C. Provide a pre-manufactured support at each diffuser to turn the flex duct into a 90° elbow.

D. Contractor shall identify balancing dampers above the ceiling by either spray painting them bright orange or hanging an orange flag from the damper handle. If hanging a flag in a return air plenum, material shall comply with fire and smoke spread ratings for plenum use.

E. All fire dampers, smoke dampers, and combination fire/smoke dampers shall be installed with bottom edge 24" maximum above lay-in ceiling.

F. All balancing dampers shall be installed maximum 30" above the lay-in ceiling.

G. Provide duct access doors for inspection and cleaning before and after filters, coils, fans, automatic dampers, at fire dampers, combination fire and smoke dampers, and elsewhere as indicated. Provide minimum 12 by 12 inch size for hand access, size for shoulder access, and as indicated. Provide 8 by 8 inch for balancing dampers only. Review locations prior to fabrication.

H. Provide duct test holes where indicated and required for testing and balancing purposes.

I. Provide fire dampers and smoke dampers at locations indicated, where ducts and outlets pass through fire rated components. Install with required perimeter mounting angles, sleeves, breakaway duct connections, corrosion resistant springs, bearings, bushings and hinges.

J. Install smoke dampers and combination smoke and fire dampers in accordance with NFPA 92.

K. The Contractor shall inspect and test all fire dampers, smoke dampers, and combination fire/smoke dampers in accordance with NFPA 80 in the presence of the Authority Having Jurisdiction.

L. Demonstrate re-setting of fire dampers to Owner's representative.

M. At fans and motorized equipment associated with ducts, provide flexible duct connections immediately adjacent to the equipment.

N. At equipment supported by vibration isolators, provide flexible duct connections immediately adjacent to the equipment.
   1. Refer to Section 23 05 48.

O. 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.

P. 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 23 33 00

SECTION 23 81 26.13
SMALL-CAPACITY SPLIT-SYSTEM AIR CONDITIONERS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Air-source heat pumps.

B. Indoor air handling (fan and coil) units for ducted systems.

C. Controls.

1.02 REFERENCE STANDARDS

A. AHRI 210/240 - Performance Rating of Unitary Air-Conditioning and Air-Source Heat Pump Equipment 2023.

B. AHRI 520 - Performance Rating of Positive Displacement Condensing Units 2004.

C. ASHRAE Std 15 - Safety Standard for Refrigeration Systems 2019, with All Amendments and Errata.

D. ASHRAE Std 23.1 - Methods for Performance Testing Positive Displacement Refrigerant Compressors and Condensing Units that Operate at Subcritical Pressures of the Refrigerant 2019.

E. NEMA MG 1 - Motors and Generators 2021.

F. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems 2021.

G. NFPA 90B - Standard for the Installation of Warm Air Heating and Air-Conditioning Systems 2021.

H. UL 207 - Standard for Refrigerant-Containing Components and Accessories, Nonelectrical Current Edition, Including All Revisions.

1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide rated capacities, weights, accessories, electrical nameplate data, and wiring diagrams.

C. Shop Drawings: Indicate assembly, required clearances, and location and size of field connections.

D. Design Data: Indicate refrigerant pipe sizing.

E. Warranty: Submit manufacturers warranty and ensure forms have been filled out in Owner's name and registered with manufacturer.

1.04 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.

1.05 WARRANTY

A. Provide five year manufacturers warranty for compressors.

PART 2 PRODUCTS

2.01 SYSTEM DESIGN

A. Split-System Heating and Cooling Units: Self-contained, packaged, matched factory-engineered and assembled, pre-wired indoor and outdoor units; UL listed.
   1. Heating and Cooling: Air-source electric heat pump located in outdoor unit with evaporator; auxiliary electric heat.
   2. Provide refrigerant lines internal to units and between indoor and outdoor units, factory cleaned, dried, pressurized and sealed, with insulated suction line.

B. Performance Requirements: See Drawings for additional requirements.

2.02 INDOOR AIR HANDLING UNITS FOR DUCTED SYSTEMS

A. Manufacturer:
   1. Trane

2. York
3. Carrier
4. Or Approved Equal

B. Indoor Units: Self-contained, packaged, factory assembled, pre-wired unit consisting of cabinet, supply fan, heating and cooling element(s), controls, and accessories; wired for single power connection with control transformer.
   1. Air Flow Configuration: Upflow.
   2. Cabinet: Steel with baked enamel finish, easily removed and secured access doors with safety interlock switches, glass fiber insulation with reflective liner.

C. Supply Fan: Centrifugal type rubber mounted with direct or belt drive with adjustable variable pitch motor pulley.
   1. Motor: NEMA MG 1; 1750 rpm single speed, permanently lubricated, hinge mounted.

D. Air Filters: 1 inch thick glass fiber disposable type arranged for easy replacement.

E. Evaporator Coils: Copper tube aluminum fin assembly, galvanized or polymer drain pan sloped in all directions to drain, drain connection, refrigerant piping connections, restricted distributor or thermostatic expansion valve.
   1. Construction and Ratings: In accordance with AHRI 210/240 and UL 207.
   2. Manufacturers: System manufacturer.

2.03 OUTDOOR UNITS

A. Outdoor Units: Self-contained, packaged, pre-wired unit consisting of cabinet, with compressor and condenser.
   1. Comply with AHRI 210/240.
   2. Refrigerant: R-410A.
   3. Cabinet: Galvanized steel with baked enamel finish, easily removed and secured access doors with safety interlock switches, glass fiber insulation with reflective liner.
   4. Construction and Ratings: In accordance with AHRI 210/240 with testing in accordance with ASHRAE Std 23.1 and UL 207.

B. Compressor: Hermetic, 3600 rpm, AHRI 520 resiliently mounted integral with condenser, with positive lubrication, crankcase heater, high pressure control, motor overload protection, service valves and drier. Provide time delay control to prevent short cycling and rapid speed changes.

C. Air Cooled Condenser: Aluminum fin and copper tube coil, AHRI 520 with direct drive axial propeller fan resiliently mounted, galvanized fan guard.
   1. Condenser Fans: Direct-drive propeller type.

D. Coil: Air-cooled, aluminum fins bonded to copper tubes.

E. Accessories: Filter drier, high pressure switch (manual reset), low pressure switch (automatic reset), service valves and gauge ports, thermometer well (in liquid line).
   1. Provide thermostatic expansion valves.
   2. Provide heat pump reversing valves.

F. Operating Controls:
   1. Control by room thermostat to maintain room temperature setting.
   2. Low Ambient Kit: Provide refrigerant pressure switch to cycle condenser fan on when condenser refrigerant pressure is above 285 psig and off when pressure drops below 140 psig for operation to 0 degrees F.

2.04 ACCESSORY EQUIPMENT

A. Room Thermostat: Wall-mounted, electric solid state microcomputer based room thermostat with remote sensor to maintain temperature setting; low-voltage; with following features:
   1. Automatic switching from heating to cooling. 4H/2C.
   2. Preferential rate control to minimize overshoot and deviation from setpoint.
   3. Instant override of setpoint for continuous or timed period from one hour to 31 days.
   4. Short cycle protection.
   5. Programming based on every day of the week.

6. Selection features including degree F or degree C display, 12 or 24 hour clock, keyboard disable, remote sensor, fan on-auto.
7. Battery replacement without program loss.
8. Thermostat Display:
    a. Actual room temperature.
    b. Programmed temperature.
    c. Programmed time.
    d. Duration of timed override.
    e. System Mode Indication: Heating, Cooling, Fan Auto, Off, and On, Auto or On, Off.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with NFPA 90A and NFPA 90B.

B. Install refrigeration systems in accordance with ASHRAE Std 15.

C. Pipe drain from cooling coils to nearest floor drain or building exterior as shown on the Drawings.

END OF SECTION 23 81 26.13

SECTION 26 01 00
ELECTRICAL GENERAL PROVISIONS

PART 1 GENERAL

1.01 SCOPE OF WORK

A. This Contractor shall provide all materials, equipment and labor necessary to install and set into operation the electrical equipment as shown on the Engineering Drawings and as contained herein.

1.02 QUALITY ASSURANCE

A. See the General and Supplementary General Conditions and Architectural Divisions.

B. All work shall be in accordance with the North Carolina State Building Code, which includes the 2020 edition of the National Electrical Code.

C. The Contractor shall be responsible for obtaining all permits and shall notify inspection departments as work progresses.

D. Wherever the words "Approved", "Approval", and "Approved Equal" appear, it is intended that items other than the model numbers specified shall be subject to the approval of the Engineer.

E. "Provide" as used herein shall mean that the Contractor responsible shall furnish and install said item or equipment. “Furnish" as used herein shall mean that the Contractor responsible shall acquire and make available said item or equipment and that installation shall be by others. "Install" as used herein shall mean that the Contractor responsible shall make installation of items or equipment furnished by others.

F. All personnel under this Contractor’s supervision shall be qualified to perform those portions of the work assigned to them. Personnel (including project managers) deemed to be negative to the overall success of the project shall be removed from the project and replaced with qualified personnel who will be positive for the project. Upon written notification that particular personnel have been deemed negative to the overall success of the project, this Contractor shall immediately replace such particular personnel. The engineer shall be sole arbiter and any decision regarding fitness of this Contractor’s personnel for this project shall not be subject to appeal.

1.03 SUBMITTALS

A. See General and Supplementary General Conditions and Division 1.

B. Within ten (10) days after notification of the award of the Contract and written notice to begin work, the Contractor shall submit for approval to the Architect/Engineer a detailed list of equipment and material which he proposes to use.

C. The Contractor shall provide an electronic pdf copy of the submittal data on the products, methods, etc. proposed for use on the project. The submittal shall contain complete submittal data on all products, methods, etc. proposed for use on the project.

D. Each submittal shall bear the approval of the Contractor indicating that he has reviewed the data and found it to meet the requirements of the specifications as well as space limitations and other project conditions. The submittals shall be clearly identified showing project name, manufacturer's catalog number and all necessary performance and fabrication data. Detailed submittal data shall be provided when items are to be considered as substitution for specified items. Acceptance for approval shall be in writing from the Engineer.

E. The Contractor shall submit to the Engineer a set of accurately marked-up plans indicating all changes encountered during the construction. Final payment will be contingent on receipt of these as-built plans.

F. The Contractor shall furnish an electronic copy of maintenance and operating instructions.

G. The Contractor shall submit to the Engineer a duplicate set of final electrical inspection certificates prior to final payment.

1.04 PRODUCT DELIVERY, STORAGE AND HANDLING

A. All material and equipment shall be delivered and unloaded by the Contractor within the project site as noted herein or as directed by the Owner.

B. The Contractor shall protect all material and equipment from breakage, theft or weather damage. No material or equipment shall be stored on the ground.

C. The material and equipment shall remain the property of the Contractor until the project has been completed and turned over to the Owner.

D. Where equipment cannot be stored at the site due to exposure to the elements or lack of storage space , the contractor shall store all equipment in a bonded warehouse until the time of installation.

1.05 WORK CONDITIONS AND COORDINATION

A. The Contractor shall review the entire set of plans to establish points of connection and the extent of electrical work to be provided in his Contract.

B. The contractor is responsible for reviewing the complete set of contract documents. Coordinate all phasing requirements with architectural drawings. Coordinate equipment locations and utility routing with all trades to ensure code compliance and constructibility.

C. This Contractor shall be responsible for all electrical work and make final connections to equipment installed in his Contract.

D. Pipe, conduit and duct chases required for installation of work shall be provided by the General Contractor unless otherwise noted. This Contractor shall be responsible for coordinating the location of all required chases.

E. All work shall be coordinated with other trades. Cutting of new work and subsequent patching shall be approved by Architect/ Engineer and shall be at the Contractor's expense with no extra cost to the Owner.

1.06 GUARANTEE

A. See the General and Supplementary General Conditions.

B. Where extended warranties or guarantees are available from the manufacturer, the Contractor shall prepare the necessary Contract Documents to validate these warranties as required by the manufacturer and present them to the Architect/Engineer.

PART 2 PRODUCTS

2.01 MATERIAL QUALITY

A. Material and equipment shall be new, unless noted otherwise, of the highest grade and quality and free from defects or other imperfections. Material and equipment found defective shall be removed and replaced at the Contractor's expense.

2.02 EQUIPMENT LISTINGS

A. All materials and equipment shall be third party listed by an agency accredited by the NCBCC and NC Department of Insurance (NC DOI). The list of accredited agencies may be obtained on NCDOI's web site.

PART 3 EXECUTION

3.01 INSPECTION

A. If any part of this Contractor's work is dependent for its proper execution or for its subsequent efficiency or appearance on the character or conditions of contiguous work not executed by him, the Contractor shall examine and measure such contiguous work and report to the Architect or Engineer in writing any imperfection therein, or conditions that render it unsuitable for the reception of this work. Should the Contractor proceed without making such written report, he shall be held to have accepted such work and the existing conditions and he shall be responsible for any defects in this work consequent hereon and will not be relieved of the obligation of any guarantee because of any such imperfection or condition.

B. After the designer pre-final inspection and confirmation that the final punch list items have been completed. The contractor shall schedule a final electrical inspection with the SCO office. Inspections shall be Monday through Friday unless specifically coordinated with the SCO office.

3.02 INSTALLATION

A. All work shall be performed in a manner indicating proficiency in the trade.

B. All conduit, pipes, ducts, etc., shall be either parallel to building walls or plumb where installed in a vertical position and shall be concealed when located in architecturally finished areas.

C. Any cutting or patching required for installation of this Contractor's work shall be kept to a minimum. Written approval shall be required by the Architect/Engineer if cutting of primary structure is involved.

D. All patching shall be done in such a manner as to restore the areas or surfaces to match existing finishes.

E. The Contractor shall lay-out and install his work in advance of pouring concrete floors or walls. He shall furnish and install all sleeves or openings through poured masonry floors or walls above grade required for passage of all conduits, pipes or duct installed by him. The Contractor shall furnish and install all inserts and hangers required to support his equipment.

F. The Contractor shall be responsible for removing all spray-on fireproofing overspray from all equipment, light fixtures, and all other materials provided as part of the electrical contract.

3.03 PERFORMANCE

A. The Contractor shall perform all excavation and backfill operations necessary for installation of his work.

B. Rock excavation shall be defined in the Supplementary General Conditions, Division 1 or Division 2. Unless specifically stated, neither rock excavation nor a unit price for rock excavation shall be required in the bid.

3.04 ERECTION

A. All support steel, angles, channels, pipes or structural steel stands and anchoring devices that may be required to rigidly support or anchor material and equipment shall be provided by this Contractor.

3.05 FIELD QUALITY CONTROL

A. The Contractor shall conform to the requirements of Division 3 for concrete testing.

B. The Contractor shall test his entire installation and shall furnish the labor and materials required for these tests. Tests shall be performed in accordance with the requirements of the particular section of the specifications and in accordance with the requirements of the State Ordinances and Codes, and the National Electrical Code. The Contractor shall notify the Architect or Engineer of his readiness for such test. A final inspection by the Electrical Inspector or Local Authority Having Jurisdiction is required, and an inspection certificate is required prior to authorization of final payment.

C. Testing required for compliance with the Contract shall be stated in subsequent sections.

D. All tests specified shall be completely documented indicating time of day, date, temperature and all other pertinent test information including the entity conducting the test.

E. All required documentation of readings required by each test shall be submitted to the Engineer prior to, and as one of the prerequisites for, final acceptance of the project.

3.06 ADJUST AND CLEAN

A. All equipment and installed materials shall be thoroughly clean and free of all dirt, oil, grit, grease, etc.

B. Factory painted equipment shall not be repainted unless damaged areas exist. These areas shall be touched up with a material suitable for the intended service. In no event shall nameplates be painted.

C. At a scheduled meeting, the Contractor shall instruct the Owner or the Owner's representative in the operation and maintenance of all equipment installed under his Contract (in the presence of the Engineer).

3.07 MAINTENANCE AND OPERATING MANUAL

A. The Contractor shall prepare an electronic submission of a manual describing the proper maintenance and system operation. This manual shall not consist of standard factory printed data intended for dimension or design purposes (although these may be included), but shall be

prepared to describe this particular job. This manual shall include the following:

B. Data on all equipment as listed on the fixture and equipment schedules on the plans. Also data on all fire alarm, telephone system, public address system, security system, lighting control systems, CCTV, MATV, CATV, generator, battery backup system, etc. that are applicable for the project.

C. Warranties as required for each product.

D. A check list for periodic maintenance of all equipment requiring maintenance. (i.e., fire alarm system, security system, generator, battery backup system, etc.)

E. Maintenance and spare parts data for all equipment.

F. As-Built wiring for equipment containing field wired systems. (i.e., fire alarm, security, data system, CATV, telephone, public address, etc.)

G. The manuals shall be dated and signed by the Contractor when completed.

H. The operating and maintenance manuals shall be submitted to the Engineer for approval. When the manuals are considered complete by the Engineer, they will be turned over to the Owner for their permanent use.

END OF SECTION 26 01 00 26 01 00

SECTION 26 05 05
ELECTRICAL DEMOLITION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Electrical demolition.

PART 2 PRODUCTS

2.01 MATERIALS AND EQUIPMENT

A. Materials and equipment for patching and extending work.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify field measurements and circuiting arrangements are as indicated.

B. Report discrepancies to Architect before disturbing existing installation.

3.02 PREPARATION

A. Disconnect electrical systems in walls, floors, and ceilings to be removed.

B. Coordinate utility service outages with utility company.

C. Provide temporary wiring and connections to maintain existing systems in service during construction. When work must be performed on energized equipment or circuits, use personnel experienced in such operations.

D. Existing Electrical Service: Maintain existing system in service until new system is complete and ready for service. Disable system only to make switchovers and connections. Minimize outage duration.
   1. Obtain permission from Owner at least 48 hours before de-energizing system.

E. Fire alarm system shall be maintained to all occupied portions of the building.
   1. Notify Owner and Fire Marshall a least 48 hours before partially or completely disabling system.
   2. Contractor shall provide a fire watch in accordance with NFPA 72 and local authority requirements while fire alarm system is down due to construction.
   3. Make notifications at least 24 hours in advance.
   4. Make temporary connections to maintain service in areas adjacent to work area.

F. Existing Telephone System: Maintain existing system in service until new system is complete and ready for service. Disable system only to make switchovers and connections. Minimize outage duration.
   1. Notify Owner at least 24 hours before partially or completely disabling system.
   2. Notify telephone utility company at least 24 hours before partially or completely disabling system.
   3. Make temporary connections to maintain service in areas adjacent to work area.

3.03 DEMOLITION AND EXTENSION OF EXISTING ELECTRICAL WORK

A. Perform work for removal and disposal of equipment and materials containing toxic substances regulated under the Federal Toxic Substances Control Act (TSCA) in accordance with applicable federal, state, and local regulations. Lamps are to be disposed of in accordance with NC G.S. 130A - 310.60. Applicable equipment and materials include, but are not limited to:
   1. PCB-containing electrical equipment, including transformers, capacitors, and switches.
   2. PCB- and DEHP-containing lighting ballasts.
   3. Mercury-containing lamps and tubes, including fluorescent lamps, high intensity discharge (HID), arc lamps, ultra-violet, high pressure sodium, mercury vapor, ignitron tubes, neon, and incandescent.

B. Remove, relocate, and extend existing installations to accommodate new construction.

C. Remove abandoned wiring to source of supply.

D. Remove exposed abandoned conduit, including abandoned conduit above accessible ceiling finishes. Where conduit cannot be removed from floors or walls, cut conduit flush with walls and floors, and patch surfaces.

E. Disconnect abandoned outlets and remove devices. Remove abandoned outlets if conduit servicing them is abandoned and removed. Provide blank cover for abandoned outlets that are not removed.

F. Repair adjacent construction and finishes damaged during demolition and extension work.

G. Maintain access to existing electrical installations that remain active. Modify installation or provide access panel as appropriate.

H. Remove all devices from walls or ceilings shown to be removed on the Architectural drawings wether shown on the electrical demolition plans or not.

I. Where existing downstream devices are to remain, extend existing branch circuit conduit and conductors to maintain service.

3.04 CLEANING AND REPAIR

A. Clean and repair existing materials and equipment that remain or that are to be reused.

END OF SECTION 26 05 05

SECTION 26 05 19
POWER CONDUCTORS AND CABLES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Single conductor building wire.

B. Underground feeder and branch-circuit cable.

C. Service entrance cable.

D. Wiring connectors.

E. Electrical tape.

F. Oxide inhibiting compound.

G. Wire pulling lubricant.

1.02 REFERENCE STANDARDS

A. ASTM B3 - Standard Specification for Soft or Annealed Copper Wire 2013 (Reapproved 2018).

B. ASTM B8 - Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft 2011 (Reapproved 2017).

C. ASTM B33 - Standard Specification for Tin-Coated Soft or Annealed Copper Wire for Electrical Purposes 2010, with Editorial Revision (2020).

D. ASTM B787/B787M - Standard Specification for 19 Wire Combination Unilay-Stranded Copper Conductors for Subsequent Insulation 2004 (Reapproved 2020).

E. NFPA 70 - National Electrical Code; National Fire Protection Association, Including All Applicable Amendments and Supplements; 2020.

1.03 SUBMITTALS

A. Product Data: Provide manufacturer's standard catalog pages and data sheets for conductors and cables, including detailed information on materials, construction, ratings, listings, and available sizes, configurations, and stranding.

B. Field Quality Control Test Reports.

C. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

D. Project Record Documents: Record actual installed circuiting arrangements. Record actual routing of exterior below grade conduit and associated hand holes or man holes..

E. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.

1.04 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum five years documented experience.

C. Product Listing Organization Qualifications: Third party agencies shall be amongst those accredited by the NCBCC (North Carolina Building Code Council) to label Electrical and Mechanical Equipment.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store conductors and cables in accordance with manufacturer's instructions.

1.06 FIELD CONDITIONS

A. Do not install or otherwise handle thermoplastic-insulated conductors at temperatures lower than 14 degrees F, unless otherwise permitted by manufacturer's instructions. When installation below this temperature is unavoidable, notify Architect and obtain direction before proceeding with work.

PART 2 PRODUCTS

2.01 CONDUCTOR AND CABLE APPLICATIONS

A. Do not use conductors and cables for applications other than as permitted by NFPA 70 and product listing.

B. Provide single conductor building wire installed in suitable raceway unless otherwise indicated, permitted, or required.

C. Nonmetallic-sheathed cable is not permitted.

D. Service entrance cable is not permitted.
   1. For underground service entrance, installed in raceway.

2.02 CONDUCTOR AND CABLE GENERAL REQUIREMENTS

A. Provide products that comply with requirements of NFPA 70.

B. Provide products listed, classified, and labeled as suitable for the purpose intended.

C. All conductors shall be labeled two feet on centers indicating size, type, voltage, rating, and manufacturer's name.

D. Provide new conductors and cables manufactured not more than one year prior to installation.

E. Unless specifically indicated to be excluded, provide all required conduit, boxes, wiring, connectors, etc. as required for a complete operating system.

F. Comply with NEMA WC 70.

G. Conductor Material:
   1. Provide copper conductors except where aluminum conductors are specifically indicated. Substitution of aluminum conductors for copper is not permitted. Conductor sizes indicated are based on copper unless specifically indicated as aluminum. Conductors designated with the abbreviation "AL" indicate aluminum.
   2. Copper Conductors: Soft drawn annealed, 98 percent conductivity, uncoated copper conductors.
   3. Aluminum Conductors (only where specifically indicated or permitted for substitution): AA-8000 series aluminum alloy conductors.

H. Minimum Conductor Size:12 AWG.

I. Maximum Conductor Size: 500 kcmil

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 to the farthest outlet shall not exceed five percent (5%).
   1. Where the branch circuit conductor length from the panel to the first outlet on a 277 volt circuit exceeds 125 feet, the branch circuit conductors from the panel to the first outlet shall not be smaller than #10 AWG. Increase the branch circuit conductor size an additional wire size for reach 125’ of additional length of the entire circuit. The ground conductor size shall be increased proportionately to the increase in the phase conductors per 2020 NEC 250.122(B).
   2. Where the conductor length from the panel to the first outlet on a 120 volt circuit exceeds 50 feet, the branch circuit conductors from the panel to the first outlet shall not be smaller than #10 AWG. Increase the branch circuit conductor size an additional wire size for reach 100’ of additional length of the entire circuit. The ground conductor size shall be increased proportionately to the increase in the phase conductors per 2020 NEC 250.122(B).

K. Conductor Color Coding:
   1. Color code conductors as indicated unless otherwise required by the authority having jurisdiction. Maintain consistent color coding throughout project.
   2. Color Coding Method:
      a. Conductors #10 AWG and smaller shall be factory color coded.
      b. Conductors #3 and larger shall be factory color coded on the entire length.
   3. Color Code:
      a. 480Y/277 V, 3 Phase, 4 Wire System:

1) Phase A: Brown.
2) Phase B: Orange.
3) Phase C: Yellow.
4) Neutral/Grounded: Gray.

b. 208Y/120 V, 3 Phase, 4 Wire System:
1) Phase A: Black.
2) Phase B: Red.
3) Phase C: Blue.
4) Neutral/Grounded: White.

c. Equipment Ground, All Systems: Green.
d. 0 - 10V Dimming conductors: Violet and Grey

2.03 BUILDING WIRE

A. Approved Manufacturers as listed below or approved equal:
1. Copper or Aluminum Building Wire:
a. Triangle
b. Okonite
c. Houston Wire and Cable
d. or approved equal

B. Description: Single conductor insulated wire.

C. Conductor Stranding:
1. Feeders and Branch Circuits:
a. Size 10 AWG and Smaller: Solid.
b. Size 8 AWG and Larger: Class B Stranded.

D. Insulation Voltage Rating: 600 V.

E. Insulation:
1. Copper Building Wire: Type THHN/THWN or XHHW-2.
2. Conductors routed on roofs or other exterior surface where raceway is exposed to direct sunlight shall be type XHHW-2 insulation.
3. Aluminum Building Wire (only where specifically indicated or permitted for substitution): Type XHHW-2.

2.04 WIRING CONNECTORS

A. Description: Wiring connectors appropriate for the application, suitable for use with the conductors to be connected, and listed as complying with UL 486A-486B or UL 486C as applicable.

B. Connectors for Grounding and Bonding: Comply with Section 26 05 26.

C. Wiring Connectors for Splices and Taps:
1. Splices or taps shall not be allowed for feeder conductors unless specifically noted on plans.
2. Where a splice or tap for feeder conductors is noted on the plans, connectors shall be Blackburn insulated multi-tap or approved equal.
3. Splices in branch circuit conductors shall be allowed in accessible junction boxes, troughs, or gutters.
a. Copper Conductors #10 AWG and smaller: Use twist-on insulated spring connectors.
b. Copper Conductors #8 AWG and larger: Use mechanical connectors with gum rubber tape or friction tape. Solderless mechanical connectors with UL listed insulating covers may be used at contractor's option.
4. Use of split bolts is not allowed.
5. "Sta-kon" or other permanent type crimp connectors shall not be used for branch circuit connections.

D. Wiring Connectors for Terminations:
1. Provide terminal lugs for connecting conductors to equipment furnished with terminations designed for terminal lugs.
2. Provide compression adapters for connecting conductors to equipment furnished with mechanical lugs when only compression connectors are specified.

3. Where over-sized conductors are larger than the equipment terminations can accommodate, provide connectors suitable for reducing to appropriate size, but not less than required for the rating of the overcurrent protective device.

E. Twist-on Insulated Spring Connectors: Rated 600 V, 221 degrees F for standard applications and 302 degrees F for high temperature applications; pre-filled with sealant and listed as complying with UL 486D for damp and wet locations.

2.05 ACCESSORIES

A. Electrical Tape:
   1. Vinyl Color Coding Electrical Tape: Integrally colored to match color code indicated; listed as complying with UL 510; minimum thickness of 7 mil; resistant to abrasion, corrosion, and sunlight; suitable for continuous temperature environment up to 221 degrees F.
      a. Product: Okonite 2000 or approved equal.
   2. Vinyl Insulating Electrical Tape: Complying with ASTM D3005 and listed as complying with UL 510; minimum thickness of 7 mil; resistant to abrasion, corrosion, and sunlight; conformable for application down to 0 degrees F and suitable for continuous temperature environment up to 221 degrees F.

B. Oxide Inhibiting Compound: Listed; suitable for use with the conductors or cables to be installed.

C. Wire Pulling Lubricant: Listed; suitable for use with the conductors or cables to be installed and suitable for use at the installation temperature.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that interior of building has been protected from weather.

B. Verify that work likely to damage wire and cable has been completed.

C. Verify that raceways, boxes, and equipment enclosures are installed and are properly sized to accommodate conductors and cables in accordance with NFPA 70.

D. Verify that field measurements are as indicated.

E. Verify that conditions are satisfactory for installation prior to starting work.

3.02 PREPARATION

A. Clean raceways thoroughly to remove foreign materials before installing conductors and cables.

3.03 INSTALLATION

A. Circuiting Requirements:
   1. Circuit routing indicated is diagrammatic.
   2. Maintain separation of Class 1, Class 2, and Class 3 remote-control, signaling, and power-limited circuits in accordance with NFPA 70.
   3. 0 - 10V lighting dimming conductors may not be routed in the same raceway with line voltage conductors.
   4. Maintain separation of wiring for emergency systems in accordance with NFPA 70.
   5. Common Neutrals: Unless otherwise indicated, sharing of neutral/grounded conductors among up to three single phase branch circuits of different phases installed in the same raceway is not permitted. Provide dedicated neutral/grounded conductor for each individual branch circuit.
   6. A dedicated green equipment grounding conductor shall be provided for all raceways containing branch circuit or feeder conductors. Equipment ground conductor shall be sized in accordance with the NEC.

B. Install products in accordance with manufacturer's instructions.

C. Install conductors and cable in a neat and workmanlike manner. Neatly train and lace wiring inside boxes, equipment, and panelboards.

D. Installation in Raceway:
   1. Tape ends of conductors and cables to prevent infiltration of moisture and other contaminants.

2. Pull all conductors and cables together into raceway at same time.
3. Do not damage conductors and cables or exceed manufacturer's recommended maximum pulling tension and sidewall pressure.
4. Use suitable wire pulling lubricant for conductors #4 AWG or larger, except when lubricant is not recommended by the manufacturer.

E. Paralleled Conductors: Install conductors of the same length and terminate in the same manner.

F. Secure and support conductors and cables in accordance with NFPA 70 using suitable supports and methods approved by the authority having jurisdiction. Provide independent support from building structure. Do not provide support from raceways, piping, ductwork, or other systems.

G. Install conductors with a minimum of 12 inches of slack at each outlet.

H. Neatly train conductors inside boxes, wireways, panelboards and other equipment enclosures. Condcutors shall not be laced or bundled to avoid overheating.

I. Group or otherwise identify neutral/grounded conductors with associated ungrounded conductors inside enclosures in accordance with NFPA 70.

J. Make wiring connections using specified wiring connectors.
1. Remove appropriate amount of conductor insulation for making connections without cutting, nicking or damaging conductors.
2. Do not remove conductor strands to facilitate insertion into connector.
3. Clean contact surfaces on conductors and connectors to suitable remove corrosion, oxides, and other contaminates. Do not use wire brush on plated connector surfaces.
4. Connections for Aluminum Conductors: Fill connectors with oxide inhibiting compound where not pre-filled by manufacturer.

K. Insulate ends of spare conductors using vinyl insulating electrical tape.

L. Unless specifically indicated to be excluded, provide final connections to all equipment and devices, including those furnished by others, as required for a complete operating system.

3.04 FIELD QUALITY CONTROL

A. All tests shall be completely documented indicating time of day, date, temperature and all pertinent test information. All required documentation shall be submitted to the Engineer prior to, and as a prerequisite for, final acceptance of the project. All test results shall be included in the Owner's operation and maintenance manual.

B. Inspect and test in accordance with NETA ATS, Section 7.3.2.
1. Perform each of the following visual and electrical tests:
a. Compare cable data with drawings and specifications to ensure compliance with contract documents.
b. Inspect exposed sections of conductor and cable for physical damage and correct connection according to the single-line diagram.
c. Test bolted connections for high resistance using one of the following:
1) A low-resistance ohmmeter.
2) Calibrated torque wrench.
d. Inspect compression-applied connectors for correct cable match and indentation.
e. Inspect for correct identification.
f. Inspect cable jacket and condition.
g. Continuity test on each conductor and cable.
h. Uniform resistance of parallel conductors.

C. Insulation resistance test is required for all feeder conductors prior to energizing feeders, sub-feeders, or service entrance conductors.
1. All current carrying feeder phase conductors and neutrals shall be tested as installed, and before connections are made, for insulation resistance and accidental grounds. This shall be done with a 500 volt insulation resistance tester. In the procedures listed below shall be followed:
a. Minimum readings shall be one million (1,000,000) or more ohms for #6 AWG wire and smaller, 250,000 ohms or more for #4 AWG wire or larger, between conducts and between conductor and the grounding conductor.

b. 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 insulation resistance reading between the neutral bar and the grounded enclosure. If this reading is 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 250,000 ohms from the neutral bar to the grounded panel can be achieved with only the neutral feeder disconnected.

c. The Contractor shall send a letter to the Engineer certifying that the above has been done and tabulating the insulation resistance readings for each panel. This shall be done at least four (4) days prior to final inspection.

d. At final inspection, The Contractor shall furnish a insulation resistance tester and show the Engineer's representatives that the panels comply with the above requirements. He shall also furnish a hook-on type ammeter and voltmeter to take current and voltage readings as directed by the representatives.

e. Results of the test shall be made available to the engineer at the required pre-energization walk through.

2. Disconnect surge protective devices (SPDs) prior to performing any high potential testing. Replace SPDs damaged by performing high potential testing with SPDs connected.

D. Correct deficiencies and replace damaged or defective conductors and cables and re-test as indicated above. Contractor shall submit new test results to the Engineer to demonstrate the deficiency has been corrected.

END OF SECTION 26 05 19

SECTION 26 05 26
GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Grounding and bonding requirements.

B. Conductors for grounding and bonding.

C. Connectors for grounding and bonding.

D. Ground bars.

E. Ground rod electrodes.

1.02 REFERENCE STANDARDS

A. IEEE 81 - IEEE Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Grounding System 2012.

B. NEMA GR 1 - Grounding Rod Electrodes and Grounding Rod Electrode Couplings 2022.

C. NETA ATS - Standard For Acceptance Testing Specifications For Electrical Power Equipment And Systems 2021.

D. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

E. UL 467 - Grounding and Bonding Equipment Current Edition, Including All Revisions.

1.03 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Verify exact locations of underground metal water service pipe entrances to building.
   2. Coordinate the work with other trades to provide steel reinforcement complying with specified requirements for concrete-encased electrode.
   3. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

B. Sequencing:
   1. Do not install ground rod electrodes until final backfill and compaction is complete.

1.04 SUBMITTALS

A. Product Data: Provide manufacturer's standard catalog pages and data sheets for grounding and bonding system components.

B. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

C. Field quality control test reports.

D. Project Record Documents: Record actual locations of grounding electrode system components and connections.

1.05 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

C. Product Listing Organization Qualifications: Third party agencies shall be amongst those accredited by the NCBCC (North Carolina Building Code Council) to label Electrical and Mechanical Equipment.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.01 GROUNDING AND BONDING REQUIREMENTS

A. Existing Work: Where existing grounding and bonding system components are indicated to be reused, they may be reused only where they are free from corrosion, integrity and continuity are verified, and where acceptable to the authority having jurisdiction.

B. Do not use products for applications other than as permitted by NFPA 70 and product listing.

C. Unless specifically indicated to be excluded, provide all required components, conductors, connectors, conduit, boxes, fittings, supports, accessories, etc. as necessary for a complete grounding and bonding system.

D. Where conductor size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.

E. Grounding System Resistance:
   1. Achieve specified grounding system resistance under normally dry conditions unless otherwise approved by Architect. Precipitation within the previous 48 hours does not constitute normally dry conditions.
   2. Grounding Electrode System: Not greater than 5 ohms to ground, when tested according to IEEE 81 using "fall-of-potential" method.
   3. Between Grounding Electrode System and Major Electrical Equipment Frames, System Neutral, and Derived Neutral Points: Not greater than 0.5 ohms, when tested using "point-to-point" methods.

F. Grounding Electrode System:
   1. Provide connection to required and supplemental grounding electrodes indicated to form grounding electrode system.
      a. Provide continuous grounding electrode conductors without splice or joint.
      b. Install grounding electrode conductors in raceway where exposed to physical damage. Bond grounding electrode conductor to metallic raceways at each end with bonding jumper.
   2. Metal Underground Water Pipe(s):
      a. Provide connection to underground metal domestic and fire protection (where present) water service pipe(s) that are in direct contact with earth for at least 10 feet at an accessible location not more than 5 feet from the point of entrance to the building.
      b. Provide bonding jumper(s) around insulating joints/pipes as required to make pipe electrically continuous.
      c. Provide bonding jumper around water meter of sufficient length to permit removal of meter without disconnecting jumper.
   3. Metal In-Ground Support Structure:
      a. Provide connection to metal in-ground support structure that is in direct contact with earth in accordance with NFPA 70.
   4. Concrete-Encased Electrode:
      a. Where metallic structural components meet the definition of a concrete encased electrode as defined in NEC 250.52, the concrete encased electrode shall be bonded to the grounding electrode system per NEC 250.50. Coordinate with the structure prior to pouring concrete foundations.
      b. Provide connection to concrete-encased electrode consisting of not less than 20 feet of either steel reinforcing bars or bare copper conductor not smaller than 4 AWG embedded within concrete foundation or footing that is in direct contact with earth in accordance with NFPA 70.
   5. Ground Rod Electrode(s):
      a. Space electrodes not less than 10 feet from each other and any other ground electrode until maximum allowed resistance to ground is achieved.
      b. Where location is not indicated, locate electrode(s) at least 5 feet outside building perimeter foundation as near as possible to electrical service entrance; where possible, locate in softscape (uncovered) area.
   6. Provide additional ground electrode(s) as required to achieve specified grounding electrode system resistance.

7. Ground Bar: Provide ground bar in main electrical room, separate from service equipment enclosure, for common connection point of grounding electrode system bonding jumpers as permitted in NFPA 70. Connect grounding electrode conductor provided for service-supplied system grounding to this ground bar.
    a. Ground Bar Size: 1/4" x 2" x 18" unless otherwise indicated or required.
    b. Where ground bar location is not indicated, locate in accessible location as near as possible to service disconnect enclosure.
8. unless otherwise noted. Location as identified on plans.
9. Ground Riser: Provide common grounding electrode conductor not less than 3/0 AWG for tap connections to multiple separately derived systems as permitted in NFPA 70.

G. Service-Supplied System Grounding:
1. For each service disconnect, provide grounding electrode conductor to connect neutral (grounded) service conductor to grounding electrode system. Unless otherwise indicated, make connection at neutral (grounded) bus in service disconnect enclosure.
2. For each service disconnect, provide main bonding jumper to connect neutral (grounded) bus to equipment ground bus where not factory-installed. Do not make any other connections between neutral (grounded) conductors and ground on load side of service disconnect.

H. Separately Derived System Grounding:
1. Separately derived systems include, but are not limited to:
    a. Transformers.
    b. Uninterruptible power supplies (UPS), when configured as separately derived systems.
    c. Generators, when neutral is switched in the transfer switch.
2. Provide grounding electrode conductor to connect derived system grounded conductor to nearest effectively grounded metal building frame. Unless otherwise indicated, make connection at neutral (grounded) bus in source enclosure.
3. Provide bonding jumper to connect derived system grounded conductor to nearest metal building frame and nearest metal water piping in the area served by the derived system, where not already used as a grounding electrode for the derived system. Make connection at same location as grounding electrode conductor connection.
4. Where common grounding electrode conductor ground riser is used for tap connections to multiple separately derived systems, provide bonding jumper to connect the metal building frame and metal water piping in the area served by the derived system to the common grounding electrode conductor.
5. Provide system bonding jumper to connect system grounded conductor to equipment ground bus. Make connection at same location as grounding electrode conductor connection. Do not make any other connections between neutral (grounded) conductors and ground on load side of separately derived system disconnect.

I. Bonding and Equipment Grounding:
1. Provide bonding for equipment grounding conductors, equipment ground busses, metallic equipment enclosures, metallic raceways and boxes, device grounding terminals, and other normally non-current-carrying conductive materials enclosing electrical conductors/equipment or likely to become energized as indicated and in accordance with NFPA 70.
2. Provide insulated equipment grounding conductor in each feeder and branch circuit raceway. Do not use raceways as sole equipment grounding conductor.
3. Where circuit conductor sizes are increased for voltage drop, increase size of equipment grounding conductor proportionally in accordance with NFPA 70.
4. Unless otherwise indicated, connect wiring device grounding terminal to branch circuit equipment grounding conductor and to outlet box with bonding jumper.
5. Terminate branch circuit equipment grounding conductors on solidly bonded equipment ground bus only. Do not terminate on neutral (grounded) or isolated/insulated ground bus.
6. Provide bonding jumper across expansion or expansion/deflection fittings provided to accommodate conduit movement.
7. Provide bonding for interior metal piping systems in accordance with NFPA 70. This includes, but is not limited to:

a. Metal water piping where not already effectively bonded to metal underground water pipe used as grounding electrode.
b. Metal gas piping.
c. Metal process piping.

J. Communications Systems Grounding and Bonding:
1. Provide intersystem bonding termination at service equipment or metering equipment enclosure and at disconnecting means for any additional buildings or structures in accordance with NFPA 70.
2. Provide bonding jumper in raceway from intersystem bonding termination to each communications room or backboard and provide ground bar for termination.
a. Bonding Jumper Size: #3/0 AWG.
b. Raceway Size: 1" trade size unless otherwise indicated or required.
c. Ground Bar Size: 1/4" x 2" x 18" unless otherwise indicated or required.
d. Ground Bar Mounting Height: 18 inches above finished floor unless otherwise indicated.

2.02 GROUNDING AND BONDING COMPONENTS

A. General Requirements:
1. Provide products listed, classified, and labeled as suitable for the purpose intended.
2. Provide products listed and labeled as complying with UL 467 where applicable.

B. Conductors for Grounding and Bonding, in Addition to Requirements of Section 26 05 26:
1. Use insulated copper conductors unless otherwise indicated.
a. Exceptions:
1) Use bare copper conductors where installed underground in direct contact with earth.
2) Use bare copper conductors where directly encased in concrete (not in raceway).
2. Where insulated grounding conductors are used conductors shall be colored solid green.
3. Grounding electrode conductors #4 AWG and larger shall be installed in raceway.

C. Connectors for Grounding and Bonding:
1. Description: Connectors appropriate for the application and suitable for the conductors and items to be connected; listed and labeled as complying with UL 467.
2. Unless otherwise indicated, use exothermic welded connections for underground, concealed and other inaccessible connections.
3. Unless otherwise indicated, use double crimp compression connectors or exothermic welded connections for accessible connections.

D. Ground Bars:
1. Description: Copper rectangular ground bars with mounting brackets and insulators.
2. Size: As indicated elsewhere in this section.
3. Holes for Connections: All mechanical connectors shall be double hole double crimp compression connectors..

E. Ground Rod Electrodes:
1. Comply with NEMA GR 1.
2. Material: Copper-bonded (copper-clad) steel.
3. Size: 3/4 inch diameter by 10 feet length, unless otherwise indicated.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that work likely to damage grounding and bonding system components has been completed.

B. Verify that field measurements are as indicated.

C. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Install grounding and bonding system components in a neat and workmanlike manner.

C. Boxes with concentric, eccentric or oversized knockouts shall be provided with bonding bushings and jumpers. The jumper shall be sized per NEC table 250-122 and lugged to the box.

D. Ground Rod Electrodes: Unless otherwise indicated, install ground rod electrodes vertically. Where encountered rock prohibits vertical installation, install at 45 degree angle.
   1. Outdoor Installations: Unless otherwise indicated, install with top of rod 6 inches below finished grade.

E. Make grounding and bonding connections using specified connectors.
   1. Remove appropriate amount of conductor insulation for making connections without cutting, nicking or damaging conductors. Do not remove conductor strands to facilitate insertion into connector.
   2. Remove nonconductive paint, enamel, or similar coating at threads, contact points, and contact surfaces.
   3. Exothermic Welds: Make connections using molds and weld material suitable for the items to be connected in accordance with manufacturer's recommendations.
   4. Compression Connectors: Secure connections using manufacturer's recommended tools and dies. Connectors must be UL listed for use with grounding electrode conductors.

F. Identify grounding and bonding system components in accordance with Section 26 05 53.

3.03 FIELD QUALITY CONTROL

A. Inspect and test in accordance with NETA ATS Section 7.13.
   1. After installing grounding system but before permanent electrical circuits have been energized, test for compliance with requirements.
   2. Verify that ground system was installed in accordance with the contract documents and NEC Article 250.
   3. Inspect physical and mechanical condition. Verify tightness of accessible, bolted, electrical connections with a calibrated torque wrench according to manufacturer's written instructions.
      a. Perform resistance measurements through bolted connections with a low-resistance ohmmeter.
   4. Test completed grounding system at each location where a maximum ground-resistance level is specified, at service disconnect enclosure grounding terminal at ground test wells and at individual ground rods. Make tests at ground rods before any conductors are connected.
      a. Measure ground resistance no fewer than two full days after last trace of precipitation and without soil being moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural ground resistance.
      b. Perform tests by fall-of-potential method according to IEEE 81.

B. Perform ground electrode resistance tests under normally dry conditions. Precipitation within the previous 48 hours does not constitute normally dry conditions.

C. Investigate and correct deficiencies where measured ground resistances do not comply with specified requirements.

D. Submit detailed reports indicating inspection and testing results and corrective actions taken.

END OF SECTION 26 05 26

SECTION 26 05 29
HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Support and attachment requirements and components for equipment, conduit, cable, boxes, and other electrical work.

1.02 RELATED REQUIREMENTS

A. Section 26 05 33.13 - Conduit for Electrical Systems: Additional support and attachment requirements for conduits.

B. Section 26 05 36 - Cable Trays for Electrical Systems: Additional support and attachment requirements for cable tray.

C. Section 26 05 33.16 - Boxes and Cabinets: Additional support and attachment requirements for boxes.

1.03 REFERENCE STANDARDS

A. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

B. Sequencing:

1.05 SUBMITTALS

A. Product Data: Provide manufacturer's standard catalog pages and data sheets for channel (strut) framing systems, non-penetrating rooftop supports, and post-installed concrete and masonry anchors.

B. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

1.06 QUALITY ASSURANCE

1.07 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.01 SUPPORT AND ATTACHMENT COMPONENTS

A. General Requirements:
   1. Provide all required hangers, supports, anchors, fasteners, fittings, accessories, and hardware as necessary for the complete installation of electrical work.
   2. Provide products listed, classified, and labeled as suitable for the purpose intended, where applicable.
   3. Where support and attachment component types and sizes are not indicated, select in accordance with manufacturer's application criteria as required for the load to be supported. Include consideration for vibration, equipment operation, and shock loads where applicable.
   4. Do not use products for applications other than as permitted by NFPA 70 and product listing.

B. Conduit and Cable Supports: Straps, clamps, etc. suitable for the conduit or cable to be supported.
   1. Conduit Straps: One-hole or two-hole type; steel or malleable iron.
   2. Conduit Clamps: Bolted type unless otherwise indicated.

C. Anchors and Fasteners:
   1. Concrete: Use preset concrete inserts, expansion anchors, or screw anchors.
   2. Solid or Grout-Filled Masonry: Use expansion anchors or screw anchors.
   3. Hollow Masonry: Use toggle bolts.

4. Hollow Stud Walls: Use toggle bolts.
5. Steel: Use beam clamps, machine bolts, or welded threaded studs.
6. Sheet Metal: Use sheet metal screws, bolts, or bolts.
7. Wood: Use wood screws.
8. Plastic and lead anchors are not permitted.
9. Powder-actuated fasteners are not permitted.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that mounting surfaces are ready to receive support and attachment components.

C. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Perform work in accordance with NECA 1 (general workmanship).

C. Provide independent support from building structure. Do not provide support from piping, ductwork, or other systems.

D. Do not provide support from suspended ceiling support system or ceiling grid.

E. Unless specifically indicated or approved by Architect, do not provide support from roof deck.

F. Do not penetrate or otherwise notch or cut structural members without approval of Structural Engineer.

G. Equipment Support and Attachment:
   1. Securely fasten floor-mounted equipment. Do not install equipment such that it relies on its own weight for support.

H. Conduits installed on the interior of exterior building walls shall be spaced off the wall surface a minimum of 1/4 inch using "clamp-backs" or strut.

I. Remove temporary supports.

3.03 FIELD QUALITY CONTROL

A. Inspect support and attachment components for damage and defects.

B. Repair cuts and abrasions in galvanized finishes using zinc-rich paint recommended by manufacturer. Replace components that exhibit signs of corrosion.

C. Correct deficiencies and replace damaged or defective support and attachment components.

END OF SECTION 26 05 29

SECTION 26 05 33.13
CONDUIT FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Galvanized steel rigid metal conduit (RMC).

B. PVC-coated galvanized steel rigid metal conduit (RMC).

C. Flexible metal conduit (FMC).

D. Liquidtight flexible metal conduit (LFMC).

E. Electrical metallic tubing (EMT).

F. Rigid polyvinyl chloride (PVC) conduit.

G. Conduit fittings.

H. Accessories.

1.02 REFERENCE STANDARDS

A. ANSI C80.1 - American National Standard for Electrical Rigid Steel Conduit (ERSC) 2020.

B. ANSI C80.3 - American National Standard for Electrical Metallic Tubing -- Steel (EMT-S) 2020.

C. ANSI C80.6 - American National Standard for Electrical Intermediate Metal Conduit 2018.

D. ASTM B633 - Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel 2023.

E. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware 2023.

F. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products 2017.

G. NECA 101 - Standard for Installing Steel Conduits (Rigid, IMC, EMT) 2020.

H. NECA 111 - Standard for Installing Nonmetallic Raceways (RNC, ENT, LFNC) 2017.

I. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.03 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate minimum sizes of conduits with the actual conductors to be installed, including adjustments for conductor sizes increased for voltage drop.
   2. Coordinate the arrangement of conduits with structural members, ductwork, piping, equipment and other potential conflicts installed under other sections or by others.
   3. Verify exact conduit termination locations required for boxes, enclosures, and equipment installed under other sections or by others.
   4. Coordinate the work with other trades to provide roof penetrations that preserve the integrity of the roofing system and do not void the roof warranty.
   5. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

B. Sequencing:
   1. Do not begin installation of conductors and cables until installation of conduit is complete between outlet, junction and splicing points.

1.04 SUBMITTALS

A. Product Data: Provide manufacturer's standard catalog pages and data sheets for conduits and fittings.

B. Project Record Documents: Record actual routing for conduits installed underground exterior to the building envelope.

1.05 QUALITY ASSURANCE

A. Conduit shall be delivered to the project site in bundles of full length pipes, each length marked with the trademark of the manufacturer and the Underwriters' Laboratories, Inc. stamp. Each conduit length shall be straight, true and free from scales, blisters, burrs and other imperfections.
   1. Product Listing Organization Qualifications: Third party agencies shall be amongst those accredited by the NCBCC (North Carolina Building Code Council) to label Electrical and Mechanical Equipment.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store conduit and fittings in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.01 CONDUIT APPLICATIONS

A. Do not use conduit and associated fittings for applications other than as permitted by NFPA 70 and product listing.

B. Unless otherwise indicated and where not otherwise restricted, use the conduit types indicated for the specified applications.

C. Embedded Within Concrete:
   1. Within Slab on Grade: Not permitted.
   2. Within Slab Above Ground: Not permitted.
   3. Within Poured Concrete Walls Above Ground: Use galvanized steel rigid metal conduit, intermediate metal conduit (IMC), PVC-coated galvanized steel rigid metal conduit, rigid PVC conduit, or reinforced thermosetting resin conduit (RTRC).

D. Outdoors: Apply raceways as indicated below unless otherwise noted
   1. Above ground conduit: Rigid galvanized steel conduit with 90o rigid elbow below grade transition to PVC.
   2. Roof: Rigid galvanized steel conduit supported on rubber blocks and unistrut frame. Conduit must be at least 3-1/2" above roof surface.
   3. Feeders: Schedule 40 PVC concrete encased
   4. Branch circuits: Schedule 40 PVC direct buried
   5. Telecommunications: Schedule 40 PVC concrete encased
   6. Connections to vibrating equipment including transformers, generators, and other motor driven equipment: Liquid tight flexible metal conduit.
   7. Boxes and enclosures above ground Nema Type 4
   8. Where rigid polyvinyl (PVC) conduit is used for feeder conductors, transition to galvanized steel rigid metal conduit a minimum of three feet horizontally prior to emerging from underground.
   9. Where rigid polyvinyl (PVC) conduitis used for branch circuits, use galvanized steel rigid metal conduit elbows for bends.

E. Indoors: Finished spaces (not subject to physical damage)
   1. Raceway shall be routed concealed in interior portions of furred spaces, ceilings, and cavities, unless other than concrete or solid plaster where possible.
   2. Raceways 2 inch or less shall be allowed to be EMT conduit.
   3. All raceways concealed in exterior walls shall be rigid galvanized steel conduit.
   4. All raceways larger than 2 inch shall be rigid galvanized conduit.
   5. Where surface mounted conduit is required in finished spaces, contractor shall utilize surface metal raceway wire mold.
   6. Where there is a transition between RGS in a wall to EMT above ceiling, it shall be made at a junction box above accessible ceiling.
   7. Interior, Damp or Wet Locations: Use galvanized steel rigid metal conduit.

F. Stub Ups
   1. All feeder stub ups shall transition below grade from PVC to rigid a minimum of 3 feet horizontally from stub up location.
   2. All branch circuit stub ups, where exposed or in non-CMU walls, shall transition to rigid galvanized steel at 90 degree elbow.

3. Schedule 40 rigid polyvinyl (PVC) stub ups are only allowed where conduits come up in CMU walls or the bottom of floor mounted equipment.

G. Unfinished spaces subject to damage (Electrical, Mechanical etc.)
   1. All conduit in unfinished spaces shall rigid galvanized steel. Conduit is not considered subject to damage when installed at least 10 feet above finished floor or tight to structure.
   2. Conduits are not required to transition to transition to rigid galvanized steel where they are routed down into panelboards or other wall mounted equipment.

H. Exposed, Interior finished spaces: Use surface metal raceway as identified on the drawings.
   1. Surface metal raceway shall be manufactured by Wiremold or approved equal.
   2. A separate equipment ground conductor shall be run in the surface metal raceway.

I. Connection to vibrating equipment shall be made with flexible metal conduit or liquid tight flexible metal conduit depending on the environment installed.

J. Connections to Luminaires Above Accessible Ceilings: Use flexible metal conduit shall be allowed.
   1. Maximum Length: 6 feet.

K. Connections to Vibrating Equipment:
   1. Dry Locations: Use flexible metal conduit.
   2. Damp, Wet, or Corrosive Locations: Use liquidtight flexible metal conduit.
   3. Maximum Length: 6 feet unless otherwise indicated.
   4. Vibrating equipment includes, but is not limited to:
      a. Transformers.
      b. Motors.
      c. Generators.

2.02 CONDUIT REQUIREMENTS

A. Existing Work: Where existing conduits are indicated to be reused, they may be reused only where they comply with specified requirements, are free from corrosion, and integrity is verified by pulling a mandrel through them.

B. Provide all conduit, fittings, supports, and accessories required for a complete raceway system.

C. Provide products listed, classified, and labeled as suitable for the purpose intended.

D. Minimum Conduit Size, Unless Otherwise Indicated:
   1. Interior: 3/4 inch (21 mm) trade size.
   2. Flexible Connections to Luminaires: 1/2 inch (13 mm) trade size.
   3. Exterior: 1 inch (27 mm) trade size.

2.03 GALVANIZED STEEL RIGID METAL CONDUIT (RMC)

A. Manufacturers:
   1. Allied Tube & Conduit.
   2. Republic Conduit.
   3. Wheatland Tube Company.
   4. or approved equal.

B. Description: NFPA 70, Type RMC standard weight mild steel, hot dipped galvanized, sherardised or zinc-coated rigid metal conduit complying with ANSI C80.1 and listed and labeled as complying with UL 6.

C. Fittings:
   1. Manufacturers:
      a. Thomas & Betts Corporation.
      b. Rayco.
      c. Appleton.
      d. or approved equal.
   2. Connectors and Couplings: Use steel compression fittings with insulated throats.

2.04 INTERMEDIATE METAL CONDUIT (IMC)

A. Description: NFPA 70, Type IMC galvanized steel intermediate metal conduit complying with ANSI C80.6 and listed and labeled as complying with UL 1242.

B. Fittings:
   1. Non-Hazardous Locations: Use fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
   2. Material: Use steel or malleable iron.
   3. Connectors and Couplings: Use threaded type fittings only. Threadless set screw and compression (gland) type fittings are not permitted.

2.05 PVC-COATED GALVANIZED STEEL RIGID METAL CONDUIT (RMC)

A. Manufacturers:
   1. Allied Tube & Conduit.
   2. Republic Conduit.
   3. Wheatland Tube Company.
   4. or approved equal.

B. Description: NFPA 70, Type RMC galvanized steel rigid metal conduit with external polyvinyl chloride (PVC) coating complying with NEMA RN 1 and listed and labeled as complying with UL 6.

C. Exterior Coating: Polyvinyl chloride (PVC), nominal thickness of 40 mil.

D. PVC-Coated Fittings:
   1. Manufacturer: Same as manufacturer of PVC-coated conduit to be installed.
   2. Non-Hazardous Locations: Use fittings listed and labeled as complying with UL 514B.
   3. Exterior Coating: Polyvinyl chloride (PVC), minimum thickness of 40 mil.

2.06 FLEXIBLE METAL CONDUIT AND LIQUIDTIGHT FLEXIBLE METAL CONDUIT (FMC LFMC)

A. Manufacturers:
   1. Allied Tube & Conduit.
   2. Republic Conduit.
   3. Wheatland Tube Company.
   4. or approved equal.

B. Description: NFPA 70, Type FMC standard wall steel flexible metal conduit listed and labeled as complying with UL 1, and listed for use in classified firestop systems to be used.

C. Description: NFPA 70, Type LFMC polyvinyl chloride (PVC) jacketed steel flexible metal conduit listed and labeled as complying with UL 360.

D. Spiral strip construction shall allow the conduit to bend up to four times its internal radius.

E. Fittings shall be compression type with insulated throats and listed for use with conduit specified.

2.07 ELECTRICAL METALLIC TUBING (EMT)

A. Manufacturers:
   1. Allied Tube & Conduit.
   2. Republic Conduit.
   3. Wheatland Tube Company.
   4. or approved equal.

B. Description: NFPA 70, Type EMT cold-rolled steel electrical metallic tubing with zinc coating on the inside and protected on the inside by a zinc, enamel or equivalent corrosion-resistant coating complying with ANSI C80.3 and listed and labeled as complying with UL 797.

C. Fittings:
   1. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
   2. Material: Use steel or malleable iron.
   3. Connectors and Couplings: Use hexagonal compression (gland) type.
      a. Do not use indenter type connectors and couplings.
      b. Do not use set-screw type connectors and couplings.

2.08 RIGID POLYVINYL CHLORIDE (PVC) CONDUIT

A. Manufacturers:
   1. Allied Tube & Conduit.
   2. Republic Conduit.
   3. Wheatland Tube Company.
   4. or approved equal.

B. Description: NFPA 70, Type PVC rigid polyvinyl chloride conduit complying with NEMA TC 2 and listed and labeled as complying with UL 651; Schedule 40 or Schedule 80 as indicated; rated for use with conductors rated 90 degrees C.

C. Fittings:
   1. Manufacturer: Same as manufacturer of conduit to be connected.
   2. Description: Fittings complying with NEMA TC 3 and listed and labeled as complying with UL 651; material to match conduit.

2.09 ACCESSORIES

A. Corrosion Protection Tape: PVC-based, minimum thickness of 20 mil.

B. Conduit Joint Compound: Corrosion-resistant, electrically conductive; suitable for use with the conduit to be installed.

C. Solvent Cement for PVC Conduit and Fittings: As recommended by manufacturer of conduit and fittings to be installed.

D. Pull Strings: Use nylon cord with average breaking strength of not less than 200 pound-force.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that mounting surfaces are ready to receive conduits.

C. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Install conduit in a neat and workmanlike manner tight against walls, columns or ceilings.

C. The conduit shall bend cold 90 degrees about a radius equal to ten (10) times its own diameter without signs of flaw or fracture in either pipe or protective coverings. All bends and offsets shall be made on a forming tool to prevent the conduit or its coating from being damaged in the bending.

D. Install galvanized steel rigid metal conduit (RMC) in accordance with NECA 101.

E. Install intermediate metal conduit (IMC) in accordance with NECA 101.

F. Install PVC-coated galvanized steel rigid metal conduit (RMC) using only tools approved by the manufacturer.

G. Install rigid polyvinyl chloride (PVC) conduit in accordance with NECA 111.

H. Conduit Routing:
   1. Unless dimensioned, conduit routing indicated is diagrammatic.
   2. Conceal all conduits unless specifically indicated to be exposed.
   3. Conduits in the following areas may be exposed, unless otherwise indicated:
      a. Electrical rooms.
      b. Mechanical equipment rooms.
   4. Arrange conduit to maintain maximum headroom, clearances, and access.
   5. Arrange conduit to provide no more than the equivalent of four 90 degree bends between pull points.
   6. Arrange conduit to provide no more than 100 feet between pull points.
   7. In every instance, conduit shall be installed in such a manner that the conductors may readily and easily be drawn or pulled in without strain or damage to the insulation; and, also, so that defective conductors may be readily and easily withdrawn and replaced by new conductors.

Long radius bends and a sufficient number of approved pull and junction boxes shall be approved for this purpose, and as may be directed by the Engineer. All conduit shall be securely supported and grounded.

8. Arrange conduit to prevent moisture traps. Provide drain fittings at low points and at sealing fittings where moisture may collect.
9. Where conduits join any couplings or threaded fittings, the ends shall be made watertight.
10. Maintain minimum clearance of 12 inches between conduits and hot surfaces. This includes, but is not limited to:

I. Conduit Support:
1. Provide all required hangers, supports, anchors, fasteners, fittings, accessories, and hardware as necessary for the complete installation of electrical work.
2. Secure and support conduits in accordance with NFPA 70 and Section 26 05 29 using suitable supports and methods approved by the authority having jurisdiction.
3. Provide independent support from building structure. Do not provide support from piping, ductwork, or other systems.
4. Installation Above Suspended Ceilings: Do not provide support from ceiling support system. Do not provide support from ceiling grid or allow conduits to lay on ceiling tiles.
5. Use conduit strap to support single surface-mounted conduit.
   a. Use clamp back spacer with conduit strap for damp and wet locations to provide space between conduit and mounting surface.
6. Use metal channel (strut) with accessory conduit clamps to support multiple parallel surface-mounted conduits.
7. Use conduit clamp to support single conduit from beam clamp or threaded rod.
8. Use trapeze hangers assembled from threaded rods and metal channel (strut) with accessory conduit clamps to support multiple parallel suspended conduits.
9. Steel Components: Use corrosion resistant materials suitable for the environment where installed.
   a. Indoor Dry Locations: Use zinc-plated steel or approved equivalent unless otherwise indicated.
   b. Outdoor and Damp or Wet Indoor Locations: Use galvanized steel, stainless steel, or approved equivalent unless otherwise indicated.
   c. Zinc-Plated Steel: Electroplated in accordance with ASTM B633.
   d. Galvanized Steel: Hot-dip galvanized after fabrication in accordance with ASTM A123/A123M or ASTM A153/A153M.
10. Metal Channel (Strut) Framing Systems: Factory-fabricated continuous-slot metal channel (strut) and associated fittings, accessories, and hardware required for field-assembly of supports.
    a. Minimum Channel Thickness: Steel sheet, 12 gage, 0.1046 inch.
    b. Minimum Channel Dimensions: 1-5/8 inch width by 13/16 inch height.

J. Connections and Terminations:
1. Use approved zinc-rich paint or conduit joint compound on field-cut threads of galvanized steel conduits prior to making connections.
2. Where two threaded conduits must be joined and neither can be rotated, use three-piece couplings or split couplings. Do not use running threads.
3. Use suitable adapters where required to transition from one type of conduit to another.
4. Terminate threaded conduits in boxes and enclosures using threaded hubs or double lock nuts for dry locations and raintight hubs for wet locations.
5. Provide insulating bushings or insulated throats at all conduit terminations to protect conductors.
6. Secure joints and connections to provide maximum mechanical strength and electrical continuity.
7. Condulet fittings shall not be used in lieu of pull boxes.

K. Penetrations:
1. Do not penetrate or otherwise notch or cut structural members, including footings and grade beams.
2. Make penetrations perpendicular to surfaces unless otherwise indicated.

3. Where conduits penetrate waterproof membrane, seal as required to maintain integrity of membrane.
    a. All raceway penetrating exterior walls or other water proof membranes shall slope away from the building with a minimum slope of 4" over 100 feet.
4. Make penetrations for roof-mounted equipment within associated equipment openings and curbs where possible to minimize roofing system penetrations. Where penetrations are necessary, seal as required to preserve integrity of roofing system and maintain roof warranty.
5. Install firestopping to preserve fire resistance rating of partitions and other elements. Refer to penetration details on plans.
6. Where conduits cross building expansion joints or pass between areas with a temperature difference of 14 degrees C, provide expansion fittings on all raceway.

L. Underground Installation:
1. Minimum Cover, Unless Otherwise Indicated or Required:
    a. Underground, Exterior: 24 inches.
2. Provide underground warning tape six to eight inches below finished grade directly above raceway. Tape shall be six inches wide with a minimum thickness of seven mil, non-distorting, colorfast, no-stretch, 600 pound tensile strength per six inch width, ultraviolet light fast. Message must repeat within a maximum of 40 inches. Painted legend shall be indicative of the type of underground line.

M. Concrete Encasement: Where conduits not otherwise embedded within concrete are indicated to be concrete-encased, provide concrete in accordance with Section 03 30 00 with minimum concrete cover of 3 inches on all sides unless otherwise indicated.

N. Ductbanks containing conductors of 600 volts or more shall be concrete encased with red dyed concrete.

O. Conduit Movement Provisions: Where conduits are subject to movement, provide expansion and expansion/deflection fittings to prevent damage to enclosed conductors or connected equipment. This includes, but is not limited to:
1. Where conduits cross structural joints intended for expansion, contraction, or deflection.
2. Where calculated in accordance with NFPA 70 for rigid polyvinyl chloride (PVC) conduit installed above ground to compensate for thermal expansion and contraction.
3. Where conduits are subject to earth movement by settlement or frost.

P. Condensation Prevention: Where conduits cross barriers between areas of potential substantial temperature differential, provide sealing fitting or approved sealing compound at an accessible point near the penetration to prevent condensation. This includes, but is not limited to:
1. Where conduits pass from outdoors into conditioned interior spaces.
2. Where conduits pass from unconditioned interior spaces into conditioned interior spaces.
3. Where conduits penetrate coolers or freezers.

Q. Provide 200 pound tensile strength pull string in all empty conduits and in conduits where conductors and cables are to be installed by others. Leave minimum slack of 12 inches at each end. All empty conduits shall terminate in a junction box.

R. All ducts shall be sealed at terminations, using sealing compound and plugs, as required to withstand 15 psi minimum hydrostatic pressure.

3.03 FIELD QUALITY CONTROL

A. Repair cuts and abrasions in galvanized finishes using zinc-rich paint recommended by manufacturer. Replace components that exhibit signs of corrosion.

B. Where coating of PVC-coated galvanized steel rigid metal conduit (RMC) contains cuts or abrasions, repair in accordance with manufacturer's instructions.

C. Correct deficiencies and replace damaged or defective conduits.

3.04 CLEANING

A. Clean interior of conduits to remove moisture and foreign matter.

3.05 PROTECTION

A. Immediately after installation of conduit, use suitable manufactured plugs to provide protection from entry of moisture and foreign material and do not remove until ready for installation of conductors.

END OF SECTION 26 05 33.13

SECTION 26 05 33.16
BOXES AND CABINETS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Outlet and device boxes up to 100 cubic inches, including those used as junction and pull boxes.

B. Cabinets and enclosures, including junction and pull boxes larger than 100 cubic inches.

C. Floor boxes.

1.02 REFERENCE STANDARDS

A. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum) 2020.

B. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.03 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate the work with other trades to avoid placement of ductwork, piping, equipment, or other potential obstructions within the dedicated equipment spaces and working clearances for electrical equipment required by NFPA 70.
2. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.
3. Coordinate minimum sizes of boxes with the actual installed arrangement of conductors, clamps, support fittings, and devices, calculated according to NFPA 70.
4. Coordinate minimum sizes of pull boxes with the actual installed arrangement of connected conduits, calculated according to NFPA 70.
5. Coordinate the placement of boxes with millwork, furniture, devices, equipment, etc. installed under other sections or by others.
6. Coordinate the work with other trades to preserve insulation integrity.
7. Coordinate the work with other trades to provide walls suitable for installation of flush-mounted boxes where indicated.
8. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.04 SUBMITTALS

A. Product Data: Provide manufacturer's standard catalog pages and data sheets for outlet and device boxes, junction and pull boxes, cabinets and enclosures, and floor boxes.

B. Project Record Documents: Record actual locations for outlet and device boxes, cabinets and enclosures, and floor boxes.

1.05 QUALITY ASSURANCE

A. Product Listing Organization Qualifications: Third party agencies shall be amongst those accredited by the NCBCC (North Carolina Building Code Council) to label Electrical and Mechanical Equipment.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.01 BOXES

A. General Requirements:

1. The Electrical Contractor shall provide junction boxes, pull boxes, cable, support boxes, and wiring troughs as required by NEC and as otherwise indicated in the Drawings.
2. Do not use boxes and associated accessories for applications other than as permitted by NFPA 70 and product listing.
3. Provide all boxes, fittings, supports, and accessories required for a complete raceway system and to accommodate devices and equipment to be installed.
4. Provide products listed, classified, and labeled as suitable for the purpose intended.

5. Where box size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.
6. Provide grounding terminals within boxes where equipment grounding conductors terminate.
7. Each outlet designated on the plans shall be provided with an outlet box.
8. In general, outlets shall be installed at the heights indicated. The Contractor shall examine the plans of and coordinate with all other trades to assure mounting heights are correct for the intended purpose. Assure that all mounting heights comply with the latest version of ADA. Outlets installed at incorrect heights shall be relocated to the correct elevation at the Contractor's expense.

B. Outlet and Device Boxes Up to 100 cubic inches, Including Those Used as Junction and Pull Boxes:
1. Use sheet-steel boxes for dry locations unless otherwise indicated or required.
2. Use cast iron boxes or cast aluminum boxes for damp or wet locations unless otherwise indicated or required; furnish with compatible weatherproof gasketed covers.
3. Outlet boxes shall be 4" square, 2 1/8" deep unless otherwise noted.
4. Use suitable concrete type boxes where flush-mounted in concrete.
5. Use suitable masonry type boxes where flush-mounted in masonry walls.
6. Do not use "through-wall" boxes designed for access from both sides of wall.
7. Sheet-Steel Boxes: Comply with NEMA OS 1, and list and label as complying with UL 514A.
8. Cast Metal Boxes: Comply with NEMA FB 1, and list and label as complying with UL 514A; furnish with threaded hubs.
9. Junction boxes larger than 4" square shall be galvanized and without pre-formed knockouts.
10. Boxes for Supporting Luminaires and Ceiling Fans: Listed as suitable for the type and weight of load to be supported; furnished with fixture stud to accommodate mounting of luminaire where required.
11. Boxes for Ganged Devices: Use multigang boxes of single-piece construction. Do not use field-connected gangable boxes.
12. Manufacturers Recessed:
    a. Steel City Electric Company
    b. Metropolitan
    c. B & C
    d. or approved equal.
13. Manufacturers Surface:
    a. Crouse-Hinds
    b. Appleton
    c. Rayco
    d. or approved equal.

C. Cabinets and Enclosures, Including Junction and Pull Boxes Larger Than 100 cubic inches:
1. Comply with NEMA 250, and list and label as complying with UL 50 and UL 50E, or UL 508A.
2. NEMA 250 Environment Type, Unless Otherwise Indicated:
3. Junction and Pull Boxes Larger Than 100 cubic inches:
    a. Provide screw-cover or hinged-cover enclosures unless otherwise indicated.
    b. Boxes 12" square and Larger: Provide hinged-cover enclosures with quick access latches.
4. Cabinets and Hinged-Cover Enclosures, Other Than Junction and Pull Boxes:
    a. Provide lockable hinged covers, all locks keyed alike unless otherwise indicated.
5. Manufacturers Surface:
    a. Cooper.
    b. Hoffman.
    c. Hubbell Incorporated.
    d. or approved equal..

D. Floor Boxes:
1. Description: Floor boxes compatible with floor box service fittings provided; with partitions to separate multiple services; furnished with all components, adapters, covers, faceplates, and trims required for complete installation. Number of gangs as identified on plans.

2. Cover and finish options shall be selected by architect prior to ordering.
3. Use cast iron floor boxes within slab on grade.
    a. Protect moisture barrier during floor box installation.
4. Use sheet-steel floor boxes or fire rated poke throughs within slab above grade.
5. Metallic Floor Boxes: Fully adjustable (with integral means for leveling adjustment prior to and after concrete pour).
6. Manufacturer:
    a. Legrand Wiremold
    b. Hubbell Incorporated
    c. Thomas & Betts Corporation
    d. or approved equal.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that mounting surfaces are ready to receive boxes.

C. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Perform work in a neat and workmanlike manner.

C. Arrange equipment to provide maximum clearances.

D. Unless otherwise indicated, provide separate boxes for line voltage and low voltage systems.

E. Flush-mount boxes in finished areas unless specifically indicated to be surface-mounted.

F. Box Locations:
1. Locate boxes in accessible locations.
2. Locate boxes so that wall plates do not span different building finishes.
3. Locate boxes so that wall plates do not cross masonry joints.
4. Unless otherwise indicated, where multiple outlet boxes are installed at the same location at different mounting heights, install along a common vertical center line.
5. Do not install flush-mounted boxes on opposite sides of walls back-to-back. Provide minimum 6 inches horizontal separation unless otherwise indicated.
6. Fire Resistance Rated Walls: Install flush-mounted boxes such that the required fire resistance will not be reduced.

G. Box Supports:
1. Secure and support boxes in accordance with NFPA 70 and Section 26 05 29 using suitable supports and methods approved by the authority having jurisdiction.

H. Install boxes plumb and level.

I. Flush-Mounted Boxes:
1. Install boxes in noncombustible materials such as concrete, tile, gypsum, plaster, etc. so that front edge of box or associated raised cover is not set back from finished surface more than 1/4 inch or does not project beyond finished surface.
2. Install boxes in combustible materials such as wood so that front edge of box or associated raised cover is flush with finished surface.
3. Repair rough openings around boxes in noncombustible materials such as concrete, tile, gypsum, plaster, etc. so that there are no gaps or open spaces greater than 1/8 inch at the edge of the box.

J. Install boxes as required to preserve insulation integrity.

K. Metallic Floor Boxes: Install box level at the proper elevation to be flush with finished floor.

L. Boxes in damp or wet locations shall be provided with gaskets and covers.

M. Install permanent barrier between ganged wiring devices when voltage difference between adjacent devices exceeds 300 V.

N. Close unused box openings.

O. Install blank wall plates on junction boxes and on outlet boxes with no devices or equipment installed or designated for future use.

3.03 CLEANING

A. Clean interior of boxes to remove dirt, debris, plaster and other foreign material.

3.04 PROTECTION

A. Immediately after installation, protect boxes from entry of moisture and foreign material until ready for installation of conductors.

END OF SECTION 26 05 33.16

SECTION 26 05 33.23
SURFACE RACEWAYS FOR ELECTRICAL SYSTEMS

PART 2 PRODUCTS

1.01 RACEWAY REQUIREMENTS

A. Provide all components, fittings, supports, and accessories required for a complete raceway system.

B. Provide products listed, classified, and labeled as suitable for the purpose intended.

C. Do not use raceways for applications other than as permitted by NFPA 70 and product listing.

END OF SECTION 26 05 33.23

SECTION 26 05 53
IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Electrical identification requirements.

B. Identification nameplates and labels.

C. Wire and cable markers.

D. Underground warning tape.

E. Warning signs and labels.

1.02 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Verify final designations for equipment, systems, and components to be identified prior to fabrication of identification products.

B. Sequencing:
   1. Do not conceal items to be identified, in locations such as above suspended ceilings, until identification products have been installed.
   2. Do not install identification products until final surface finishes and painting are complete.

1.03 SUBMITTALS

A. Product Data: Provide manufacturer's standard catalog pages and data sheets for each product.

B. Shop Drawings: Provide schedule of items to be identified indicating proposed designations, materials, legends, and formats.

1.04 FIELD CONDITIONS

A. Do not install adhesive products when ambient temperature is lower than recommended by manufacturer.

PART 2 PRODUCTS

2.01 IDENTIFICATION REQUIREMENTS

A. Identification for Equipment:
   1. Use identification nameplate to identify each piece of electrical distribution and control equipment and associated sections, compartments, and components.
      a. Switchboards:
         1) Identify ampere rating.
         2) Identify voltage and phase.
         3) Identify power source and circuit number. Include location.
         4) Use identification nameplate to identify main overcurrent protective device.
         5) Use identification nameplate to identify load(s) served for each branch devicewhere not identified in a panelboard schedule.
      b. Panelboards:
         1) Identify ampere rating.
         2) Identify voltage and phase.
         3) Identify power source and circuit number. Include location.
         4) Use typewritten circuit directory to identify load(s) served.
      c. Transformers:
         1) Identify kVA rating.
         2) Identify voltage and phase for primary and secondary.
         3) Identify power source and circuit number. Include location.
         4) Identify load(s) served. Include location.
      d. Enclosed switches, circuit breakers, and motor controllers:
         1) Identify voltage and phase.
         2) Identify power source and circuit number. Include location.
         3) Identify load(s) served. Include location.

e. Enclosed Contactors:
   1) Identify ampere rating.
   2) Identify voltage and phase.
   3) Identify coil voltage.
   4) Identify load(s) and associated circuits controlled. Include location.
f. Transfer Switches:
   1) Identify voltage and phase.
   2) Identify power source and circuit number for both normal power source and standby power source. Include location.
   3) Identify load(s) served. Include location.
   4) Identify short circuit current rating based on the specific overcurrent protective device type and settings protecting the transfer switch.

2. Service Equipment:
   a. For buildings or structures supplied by more than one service, or any combination of branch circuits, feeders, and services, use identification nameplate at each service disconnecting means to identify all other services, feeders, and branch circuits supplying that building or structure. Verify format and descriptions with authority having jurisdiction.
3. Emergency System Equipment:
   a. Use identification nameplate or voltage marker to identify emergency system equipment in accordance with NFPA 70.
4. Use identification nameplate to identify disconnect location for equipment with remote disconnecting means.
5. Available Fault Current Documentation: Use identification label to identify the available fault current and date calculations were performed at locations requiring documentation by NFPA 70 including but not limited to the following.
   a. Service equipment.
6. Arc Flash Hazard Warning Labels: Comply with Section 26 05 73.

B. Identification for Conductors and Cables:
1. Color Coding for Power Conductors 600 V and Less: Comply with Section 26 05 19.
2. Identification for Communications Conductors and Cables: Comply with Section 27 10 00.
3. Use underground warning tape to identify power and communication feeders and branch circuits exterior to the building.

C. Identification for Cable Tray: Comply with Section 26 05 36.

D. Identification for Boxes:
1. Use color coded boxes to identify specified systems.
   a. Color-Coded Boxes: Field-painted per the same color coding as identified in this section for the system contained within.
   b. Fire alarm junction boxes shall be painted on all sides including the box cover.
2. For boxes concealed above accessible ceilings or exposed in mechanical or electrical rooms use neatly handwritten text using indelible marker to identify circuits enclosed.
3. For exposed boxes in public areas, use only type written labels.

E. Identification for Devices:
1. Wiring Device and Wallplate Finishes: Comply with Section 26 27 26.
2. Use identification label to identify fire alarm system devices.
3. For devices concealed above suspended ceilings, provide additional identification on ceiling tile below device location.
4. Use identification label to identify receptacles protected by upstream GFI protection, where permitted.

F. Color Coding
1. Phenolic Nameplates and associated conduit and boxes shall be identified with the following color scheme. Note: For existing buildings the contractor shall field verify the existing building standard and revise the color scheme to match the existing field conditions. Failure to match existing conditions will result in the contractor correcting the mislabeled equipment at his expense.
   a. Blue surface white core - 120/208V equipment.

b. Black surface white core - 277/480V equipment.
c. Bright red surface white core - fire alarm equipment.
d. Dark red (burgundy) surface white core - security equipment.
e. Green surface white core - emergency systems.
f. Orange surface white core - telephone systems.
g. Brown surface white core - data systems.
h. White surface black core - paging systems.
i. Purple surface white core - TV systems.

2.02 IDENTIFICATION NAMEPLATES AND LABELS

A. Identification Nameplates:
1. Materials:
a. Indoor Clean, Dry Locations: Use plastic nameplates.
b. Outdoor Locations: Use plastic nameplates suitable for exterior use.
2. Plastic Nameplates: Two-layer or three-layer laminated electrically non-conductive phenolic with beveled edges; minimum thickness of 1/16 inch; engraved text.
3. Mounting Holes for Mechanical Fasteners: Two, centered on sides for sizes up to 1 inch high; Four, located at corners for larger sizes.
4. Nameplates shall be secured with self tapping stainless steel screws; if screws have sharp ends they shall be protected, otherwise rivets shall be used.

B. Identification Labels:
1. Materials: Use self-adhesive laminated plastic labels; UV, chemical, water, heat, and abrasion resistant.
a. Use only for indoor locations.
2. Text: Use factory pre-printed or machine-printed text. Do not use handwritten text.

C. Format for Equipment Identification:
1. Minimum Size: 1 inch by 2.5 inches.
2. Text: All capitalized unless otherwise indicated.
3. Minimum Text Height:
a. Equipment Designation: 1/2 inch.
b. Exception: Provide minimum text height of 1 inch for equipment located more than 10 feet above floor or working platform.

D. Wiring device circuit labels.
1. All wiring devices (receptacles and switches) shall be labeled with the circuit serving the device. Label shall be a typed adhesive label affixed to the front of the wiring device face plate. Label shall have black text on clear background.

2.03 UNDERGROUND WARNING TAPE

A. Foil-backed Detectable Type Tape: 3 inches wide, with minimum thickness of 7 mil, unless otherwise required for proper detection.

B. Legend: Type of service, continuously repeated over full length of tape.

C. Color:
1. Tape for Buried Power Lines: Black text on red background.
2. Tape for Buried Communication, Alarm, and Signal Lines: Black text on orange background.

2.04 WARNING SIGNS AND LABELS

A. Comply with ANSI Z535.2 or ANSI Z535.4 as applicable.

B. Warning Signs:
1. Materials:
a. Indoor Dry, Clean Locations: Use factory pre-printed rigid plastic or self-adhesive vinyl signs.
b. Outdoor Locations: Use factory pre-printed rigid aluminum signs.
2. Rigid Signs: Provide four mounting holes at corners for mechanical fasteners.

C. Warning Labels:

1. Materials: Use factory pre-printed or machine-printed self-adhesive polyester or self-adhesive vinyl labels; UV, chemical, water, heat, and abrasion resistant; produced using materials recognized to UL 969.
2. Machine-Printed Labels: Use thermal transfer process printing machines and accessories recommended by label manufacturer.

PART 3 EXECUTION

3.01 PREPARATION

A. Clean surfaces to receive adhesive products according to manufacturer's instructions.

3.02 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Install identification products to be plainly visible for examination, adjustment, servicing, and maintenance.

C. Install identification products centered, level, and parallel with lines of item being identified.

D. Secure nameplates to exterior surfaces of enclosures using stainless steel screws.

E. Install self-adhesive labels and markers to achieve maximum adhesion, with no bubbles or wrinkles and edges properly sealed.

F. Install underground warning tape above buried lines with one tape per trench at six to eight inches below finished grade.

G. Secure rigid signs using stainless steel screws.

H. Mark all handwritten text, where permitted, to be neat and legible.

3.03 FIELD QUALITY CONTROL

A. Replace self-adhesive labels and markers that exhibit bubbles, wrinkles, curling or other signs of improper adhesion.

END OF SECTION 26 05 53

SECTION 26 05 73
POWER SYSTEM STUDIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Short-circuit study.

B. Protective device coordination study.

C. Arc flash and shock risk assessment.
   1. Includes arc flash hazard warning labels.

D. Criteria for the selection and adjustment of equipment and associated protective devices not specified in this section, as determined by studies to be performed.

1.02 REFERENCE STANDARDS

A. IEEE 1584 - IEEE Guide for Performing Arc-Flash Hazard Calculations 2018, with Errata (2019).

B. NFPA 70 - National Electrical Code; National Fire Protection Association, Including All Applicable Amendments and Supplements; 2017.

C. NFPA 70E - Standard for Electrical Safety in the Workplace 2024.

1.03 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate the work to provide equipment and associated protective devices complying with criteria for selection and adjustment, as determined by studies to be performed.
   2. Notify Architect of any conflicts with or deviations from the contract documents. Obtain direction before proceeding with work.

B. Sequencing:
   1. Submit study reports prior to or concurrent with product submittals.
   2. Contractor shall be responsible for making any and all changes to the purchased equipment as recommended in the study results. Changes to the electrical distribution equipment, generator, transfer switches, and breakers due to study recommendations and to comply with the requirements of this section shall not incur an additional cost to the project. This includes but is not limited to changes in equipment or breakers to meet required maximum fault current levels, changes in breaker models, types or frame sizes to achieve selective coordination where required, changes in breaker models or types to achieve the required minimum AIC rating for transfer switches.
   3. Do not order equipment until matching study reports and product submittals have both been evaluated by Architect.
   4. Verify naming convention for equipment identification prior to creation of final drawings, reports, and arc flash hazard warning labels to match equipment name plates.
   5. Study shall be updated prior to project completion. All changes throughout construction shall be incorporated in the update.
   6. After study has been updated with construction changes, print and apply labels.
   7. Final study shall be included in the O&M manuals.

1.04 SUBMITTALS

A. Study preparer's qualifications.

B. Study reports, stamped or sealed and signed by study preparer.

C. Product Data:
   1. Include characteristic time-current trip curves for protective devices.
   2. Clearly indicate short circuit current ratings for all equipment. Series rating is not allowed.

D. All submittals transmitted to the engineer for approval shall have a digital copy of the report and model files included on a USB drive.

E. Arc Flash Hazard Warning Label Samples: One of each type required. All labels shall be rated to withstand the environment where installed.

F. Certification that field adjustable protective devices have been set in accordance with requirements of studies.

G. Project Record Documents: Revise studies as required to reflect as-built conditions.
   1. Include hard copies with operation and maintenance data submittals.
   2. Include computer software files used to prepare studies with file name(s) cross-referenced to specific pieces of equipment and systems.

1.05 POWER SYSTEM STUDIES

A. Scope of Studies:
   1. Perform analysis of new electrical distribution system as indicated on drawings.
   2. Except where study descriptions below indicate exclusions, analyze system at each bus from primary protective devices of utility source down to each piece of equipment involved, including parts of system affecting calculations being performed (e.g. fault current contribution from motors).
   3. Include in analysis alternate sources and operating modes (including known future configurations) to determine worst case conditions.
      a. Known Operating Modes:
         1) Utility as source.
         2) Generator as source.

B. General Study Requirements:
   1. Perform studies utilizing computer software complying with specified requirements; manual calculations are not permitted.

C. Data Collection:
   1. Compile information on project-specific characteristics of actual installed equipment, protective devices, feeders, etc. as necessary to develop single-line diagram of electrical distribution system and associated input data for use in system modeling.
      a. Utility Source Data: Include primary voltage, maximum and minimum three-phase and line-to-ground fault currents, impedance, X/R ratio, and primary protective device information.
         1) Obtain up-to-date information from Utility Company.
         2) Include in the report documentation the following information
            (a) Utility Company: Contractor to Determine.
               (1) Point of Contact: Contractor to Determine.
               (2) Address: Contractor to Determine.
               (3) Phone: Contractor to Determine.
               (4) Email: Contractor to Determine.
               (5) Utility Company Project Reference Number: Contractor to Determine.
               (6) Date Fault Current was obtained from power company.
      b. Generators: Include manufacturer/model, kW and voltage ratings, and impedance.
      c. Motors 25HP and greater: Include manufacturer/model, type (e.g. induction, synchronous), horsepower rating, voltage rating, and full load amps.
      d. Branch circuit and overcurrent protective device information associated with all industrial control panels, including HVAC control panels.
      e. Transformers: Include primary and secondary voltage ratings, kVA rating, winding configuration, percent impedance, and X/R ratio.
      f. Protective Devices:
         1) Circuit Breakers: Include manufacturer/model, type (e.g. thermal magnetic, electronic trip), frame size, trip rating, voltage rating, interrupting rating, available field-adjustable trip response settings, and features (e.g. zone selective interlocking).
         2) Fuses: Include manufacturer/model, type/class (e.g. Class J), size/rating, and speed (e.g. time delay, fast acting).
      g. Conductors: Include feeder size, material (e.g. copper, aluminum), insulation type, voltage rating, number per phase, raceway type, and actual length.

h. Contractor shall maintain a log of all conductor sizes and lengths to be used in the power systems study.

D. Short-Circuit Study:
1. For purposes of determining equipment short circuit current ratings, consider conditions that may result in maximum available fault current, including but not limited to:
a. Maximum utility fault currents.
b. Maximum motor contribution.
2. For each bus location, calculate the maximum available three-phase bolted symmetrical and asymmetrical fault currents. For grounded systems, also calculate the maximum available line-to-ground bolted fault currents.
3. Calculate the short circuit current at the following additional locations:
a. Elevator Controllers.
b. Industrial Control Panels, including HVAC control panels.
c. Motor Control Centers.

E. Protective Device Coordination Study:
1. Analyze alternate scenarios considering known operating modes (e.g. utility as source, generator as source).
2. Analyze protective devices on the normal power system and associated settings for suitable margins between time-current curves to achieve best possible coordination while providing adequate protection for equipment and conductors.
3. For emergency systems analyze protective devices and associated settings so that full selective coordination is achieved per NEC 700.27

F. Arc Flash and Shock Risk Assessment:
1. Comply with NFPA 70E.
2. Perform incident energy and arc flash boundary calculations in accordance with IEEE 1584 (as referenced in NFPA 70E Annex D), where applicable.
3. Analyze alternate scenarios considering conditions that may result in maximum incident energy, including but not limited to:
a. Maximum and minimum utility fault currents.
b. Maximum and minimum motor contribution.
c. Known operating modes (e.g. utility as source, generator as source).

G. Study Reports:
1. General Requirements:
a. Identify date of study and study preparer.
b. Identify study methodology and software product(s) used.
c. Identify scope of studies, assumptions made, implications of possible alternate scenarios, and any exclusions from studies.
d. Include single-line diagram and associated input data used for studies; identify buses on single-line diagram as referenced in reports, and indicate bus voltage.
e. Include conclusions and recommendations.
2. Short-Circuit Study:
a. For each scenario, identify at each bus location:
1) Calculated maximum available symmetrical and asymmetrical fault currents (both three-phase and line-to-ground where applicable).
2) Fault point X/R ratio.
3) Associated equipment short circuit current ratings.
b. Identify locations where the available fault current exceeds the equipment short circuit current rating, along with recommendations.
3. Protective Device Coordination Study:
a. For each scenario, include time-current coordination curves plotted on log-log scale graphs.
b. For each graph include (where applicable):
1) Partial single-line diagram identifying the portion of the system illustrated.
2) Protective Devices: Time-current curves with applicable tolerance bands for each protective device in series back to the source, plotted up to the maximum available

fault current at the associated bus.
3) Transformers: Inrush points and damage curves.
4) Generators: Full load current, overload curves, decrement curves, and short circuit withstand points.
5) Motors: Full load current, starting curves, and damage curves.

c. For each protective device, identify fixed and adjustable characteristics with available ranges and recommended settings.
1) Circuit Breakers: Include long time pickup and delay, short time pickup and delay, and instantaneous pickup.
2) Include ground fault pickup and delay.
3) Include fuse ratings.

d. Identify cases where either full selective coordination or adequate protection is not achieved, along with recommendations.

4. Arc Flash and Shock Risk Assessment:
a. For the worst case for each scenario, identify at each bus location:
1) Calculated incident energy and associated working distance.
2) Calculated arc flash boundary.
3) Bolted fault current.
4) Arcing fault current.
5) Clearing time.
6) Arc gap distance.

b. For purposes of producing arc flash hazard warning labels, summarize the maximum incident energy and associated data reflecting the worst case condition of all scenarios at each bus location.

c. Include recommendations for reducing the incident energy at locations where the calculated maximum incident energy exceeds 8 calories per sq cm.

5. For Oneline diagram indicate the following:
a. At each Bus:
1) Equipment ID.
2) Voltage.
3) 3 Phase Fault Current.
4) 1 Phase Fault Current.
5) X/R ratio.

b. At each breaker:
1) Equipment ID.
2) Device Amperage.
3) Voltage Rating.
4) Interrupting Rating.
5) Breaker Settings (If applicable).

c. At each source:
1) Device ID.
2) Voltage.
3) 3 Phase Fault Current.
4) 1 Phase Fault Current.
5) X/R Rating.

d. At each Generator:
1) Equipment ID.
2) Rated kW.
3) Rated kVA.
4) Voltage.

e. At each Transformer:
1) Equipment ID.
2) Rated kVA.
3) Primary Voltage.
4) Secondary Voltage.

5) Percent Impedance.

f. At each Motor:

1) Equipment ID.

2) Rated Horse Power.

1.06 QUALITY ASSURANCE

A. Study Preparer Qualifications: Professional electrical engineer licensed in the State in which the Project is located and with minimum three years experience in the preparation of studies of similar type and complexity using specified computer software.

1. Study preparer may be employed by the manufacturer of the electrical distribution equipment.

B. Computer Software for Study Preparation: Use the latest edition of commercially available software utilizing specified methodologies.

1. Acceptable Software Products:

a. EasyPower LLC: www.easypower.com/#sle.

b. ETAP/Operation Technology, Inc: www.etap.com/#sle.

c. SKM Systems Analysis, Inc: www.skm.com/#sle.

PART 2 PRODUCTS

2.01 ARC FLASH HAZARD WARNING LABELS

A. Provide warning labels complying with ANSI Z535.4 to identify arc flash hazards for each work location analyzed by the arc flash and shock risk assessment.

1. Materials: Label shall be vinyl adhesive with moisture and UV resistance. Paper adhesive labels will not be accepted.
2. Label Information shall comply with 2015 NFPA 70E.
3. Legend: Provide custom legend in accordance with NFPA 70E based on equipment-specific data as determined by arc flash and shock risk assessment.

a. Include at least the following information:

1) Arc flash boundary.

2) Available incident energy and corresponding working distance.

3) Site-specific PPE (personnel protective equipment) requirements.

4) Nominal system voltage.

5) Limited approach boundary.

6) Restricted approach boundary.

7) Equipment identification.

8) Date calculations were performed.

PART 3 EXECUTION

3.01 INSTALLATION

A. Labels shall be cut with straight and perpendicular lines.

B. Labels shall be installed neatly and consistently from one piece of equipment to another.

C. Clean surface of equipment so that it is free of dirt, dust, or other foreign substance prior to applying labels.

3.02 FIELD QUALITY CONTROL

A. Adjust equipment and protective devices for compliance with studies and recommended settings.

END OF SECTION 26 05 73

SECTION 26 24 16
PANELBOARDS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Power distribution panelboards.

B. Lighting and appliance panelboards.

C. Overcurrent protective devices for panelboards.

1.02 REFERENCE STANDARDS

A. UL 67 - Panelboards Current Edition, Including All Revisions.

B. UL 489 - Molded-Case Circuit Breakers, Molded-Case Switches and Circuit Breaker Enclosures Current Edition, Including All Revisions.

C. NFPA 70 - National Electrical Code; National Fire Protection Association, Including All Applicable Amendments and Supplements; 2017.

1.03 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate the work with other trades to avoid placement of ductwork, piping, equipment, or other potential obstructions within the dedicated equipment spaces and working clearances for electrical equipment required by NFPA 70.
   2. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.
   3. Coordinate the work with other trades to provide walls suitable for installation of flush-mounted panelboards where indicated.
   4. Verify with manufacturer that conductor terminations are suitable for use with the conductors to be installed.
   5. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.04 SUBMITTALS

A. Product Data: Provide manufacturer's standard catalog pages and data sheets for panelboards, enclosures, overcurrent protective devices, and other installed components and accessories.
   1. Contractor shall confirm that all lug sizes and quantities submitted are compatible with the conductors specified on the contract documents. Changes required to lug sizes and quantities due to lack of coordination between the contractor and the supplier are to be made at the contractor's expense.

B. Shop Drawings: Indicate outline and support point dimensions, voltage, main bus ampacity, overcurrent protective device arrangement and sizes, short circuit current ratings, conduit entry locations, conductor terminal information, and installed features and accessories.
   1. It is the contractor's responsibility to ensure that the equipment submitted to comply with the requirements of this section are in compliance with the requirements and recommendations of the power system studies. Any changes recommended by the power system study shall be incorporated at no expense to the project.

C. Field Quality Control Test Reports.

D. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

E. Project Record Documents: Record actual installed locations of panelboards and actual installed circuiting arrangements.

F. Maintenance Data: Include information on replacement parts and recommended maintenance procedures and intervals.

1.05 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.

C. Product Listing Organization Qualifications: Third party agencies shall be amongst those accredited by the NCBCC (North Carolina Building Code Council) to label Electrical and Mechanical Equipment.

D. Contractor shall schedule a pre-energization site visit with the Engineer. Meeting shall be scheduled at least 7 days in advance. The results of the megger test and service ground resistance test shall be made available to the Engineer prior to scheduling the pre-energization site visit.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store panelboards in accordance with manufacturer's instructions.

B. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.

C. Handle carefully in accordance with manufacturer's written instructions to avoid damage to panelboard internal components, enclosure, and finish.

1.07 FIELD CONDITIONS

A. Maintain ambient temperature within the following limits during and after installation of panelboards:
   1. Panelboards Containing Circuit Breakers: Between 23 degrees F and 104 degrees F.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. ABB/GE: www.geindustrial.com/#sle.

B. Eaton Corporation.

C. Schneider Electric; Square D Products.

D. Source Limitations: Furnish panelboards and associated components produced by the same manufacturer as the other electrical distribution equipment used for this project and obtained from a single supplier.

2.02 PANELBOARDS - GENERAL REQUIREMENTS

A. Provide products listed, classified, and labeled as suitable for the purpose intended.

B. Unless otherwise indicated, provide products suitable for continuous operation under the following service conditions:
   1. Altitude: Less than 6,600 feet.
   2. Ambient Temperature:
      a. Panelboards Containing Circuit Breakers: Between 23 degrees F and 104 degrees F.

C. Short Circuit Current Rating:
   1. Provide panelboards with listed short circuit current rating not less than the available fault current at the installed location as indicated on the drawings.
   2. When a power system study is included in the contract short circuit current ratings shall be verified with the study prior to submitting equipment for approval. Any changes required to meet the maximum available fault current shall be made in the submittal.
   3. Series rating is not allowed.

D. Panelboards Used for Service Entrance: Listed and labeled as suitable for use as service equipment according to UL 869A.

E. Mains: Configure for top or bottom incoming feed as indicated or as required for the installation.

F. Branch Overcurrent Protective Devices: Replaceable without disturbing adjacent devices.

G. Bussing: Sized in accordance with UL 67 temperature rise requirements.
   1. Provide fully rated neutral bus unless otherwise indicated, with a suitable lug for each feeder or branch circuit requiring a neutral connection.

2. Provide solidly bonded equipment ground bus in each panelboard, with a suitable lug for each feeder and branch circuit equipment grounding conductor.

H. Conductor Terminations: Suitable for use with the conductors to be installed.

I. Enclosures: Comply with NEMA 250, and list and label as complying with UL 50 and UL 50E.
1. Environment Type per NEMA 250: As indicated on the drawings.
2. Boxes: Galvanized steel unless otherwise indicated.
3. Fronts:
a. Fronts for Surface-Mounted Enclosures: Same dimensions as boxes.
b. Fronts for Flush-Mounted Enclosures: Overlap boxes on all sides to conceal rough opening.
c. All covers shall be door in door type where one door can be opened to access the breakers and and dead front and the second door opens to the wire bending space adjacent to the dead front.
d. Door in door covers shall feature a full length piano hinge.
4. Lockable Doors: All locks keyed alike unless otherwise indicated.

J. Future Provisions: Prepare all unused spaces for future installation of devices including bussing, connectors, mounting hardware and all other required provisions.

K. Selectivity: Where the requirement for selectivity is indicated, furnish products as required to achieve selective coordination.

L. Load centers are not acceptable.

2.03 POWER DISTRIBUTION PANELBOARDS

A. Description: Panelboards complying with NEMA PB 1, power and feeder distribution type, circuit breaker type, and listed and labeled as complying with UL 67; ratings, configurations and features as indicated on the drawings.

B. Conductor Terminations:
1. Main and Neutral Lug Material: Copper, suitable for terminating copper conductors only.
2. Main and Neutral Lug Type: Compression.

C. Bussing:
1. Phase and Neutral Bus Material: Copper.
2. Ground Bus Material: Copper.

D. Circuit Breakers:
1. Provide bolt-on type.
2. Provide thermal magnetic circuit breakers for circuit breaker frame sizes less than 250 amperes.
3. Provide electronic trip circuit breakers for circuit breaker frame sizes 250 amperes and above.

E. Enclosures:
1. Fronts: Provide door-in-door trim with hinged cover for access to load terminals and wiring gutters, and separate lockable hinged door with concealed hinges for access to overcurrent protective device handles without exposing live parts.
2. Provide clear plastic circuit directory holder mounted on inside of door.

2.04 LIGHTING AND APPLIANCE PANELBOARDS

A. Description: Panelboards complying with NEMA PB 1, lighting and appliance branch circuit type, circuit breaker type, and listed and labeled as complying with UL 67; ratings, configurations and features as indicated on the drawings.

B. Conductor Terminations:
1. Main and Neutral Lug Material: Copper, suitable for terminating copper conductors only.
2. Main and Neutral Lug Type: Compression.

C. Bussing:
1. Phase Bus Connections: Arranged for sequential phasing of overcurrent protective devices.
2. Phase and Neutral Bus Material: Copper.
3. Ground Bus Material: Copper.

D. Circuit Breakers: Thermal magnetic bolt-on type unless otherwise indicated.

E. Provide electronic trip circuit breakers for circuit breaker frame sizes [250] amperes and above.

F. Enclosures:
   1. Fronts: Provide door-in-door trim with hinged cover for access to load terminals and wiring gutters, and separate lockable hinged door with concealed hinges for access to overcurrent protective device handles without exposing live parts.
   2. Provide clear plastic circuit directory holder mounted on inside of door.

2.05 OVERCURRENT PROTECTIVE DEVICES

A. Molded Case Circuit Breakers:
   1. Description: Quick-make, quick-break, over center toggle, trip-free, trip-indicating circuit breakers listed and labeled as complying with UL 489, and complying with FS W-C-375 where applicable; ratings, configurations, and features as indicated on the drawings.
   2. Interrupting Capacity:
      a. Provide circuit breakers with interrupting capacity as required to provide the short circuit current rating indicated.
      b. Fully Rated Systems: Provide circuit breakers with interrupting capacity not less than the short circuit current rating indicated.
   3. Conductor Terminations:
      a. Provide compression lugs.
      b. Lug Material: Copper, suitable for terminating copper conductors only.
   4. Thermal Magnetic Circuit Breakers: For each pole, furnish thermal inverse time tripping element for overload protection and magnetic instantaneous tripping element for short circuit protection.
      a. Provide field-adjustable magnetic instantaneous trip setting for circuit breaker frame sizes 100 amperes and larger.
   5. Electronic Trip Circuit Breakers: Furnish solid state, microprocessor-based, true rms sensing trip units.
   6. Provide electronic trip circuit breakers for circuit breaker frame sizes larger than 250 amperes.
      a. Provide the following individually field-adjustable trip response settings:
         1) Long time pickup, adjustable by setting dial.
         2) Long time delay.
         3) Short time pickup and delay.
         4) Instantaneous pickup.
         5) Ground fault pickup and delay where ground fault protection is indicated.
   7. Do not use handle ties in lieu of multi-pole circuit breakers.
   8. Provide multi-pole circuit breakers for multi-wire branch circuits as required by NFPA 70.
   9. Provide the following features and accessories where indicated or where required to complete installation:
      a. Shunt Trip: Provide coil voltage as required for connection to indicated trip actuator.
      b. Handle Pad-Lock Provision: For locking circuit breaker handle in OFF position.
         1) Provide handle locks for all breakers serving fire alarm equipment or elevator emergency communication systems. Handle locks shall be Space Age Electronics ELOCK series or approved equal.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that the ratings and configurations of the panelboards and associated components are consistent with the indicated requirements.

C. Verify that mounting surfaces are ready to receive panelboards.

D. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

A. Perform work in accordance with NECA 1 (general workmanship).

B. Install products in accordance with manufacturer's instructions.

C. Install panelboards securely, in a neat and workmanlike manner.

D. Arrange equipment to provide at least clearances in accordance with manufacturer's instructions and NFPA 70.

E. Provide required support and attachment in accordance with Section 26 05 29.

F. Install panelboards plumb.

G. Mount panelboards such that the highest position of any operating handle for circuit breakers or switches does not exceed 79 inches above the floor or working platform.

H. Provide grounding and bonding in accordance with Section 26 05 26.

I. Install all field-installed branch devices, components, and accessories.

J. Set field-adjustable circuit breaker tripping function settings as directed. If a power system study is included in the contract, set breakers according to the recommendations made in the study.

K. Provide filler plates to cover unused spaces in panelboards.

L. Provide circuit breaker lock-on devices to prevent unauthorized personnel from de-energizing essential loads where indicated. Also provide for the following:
   1. Emergency and night lighting circuits.
   2. Fire detection and alarm circuits.
   3. Intrusion detection and access control system circuits.
   4. Video surveillance system circuits.

M. Identify panelboards in accordance with Section 26 05 53.

3.03 FIELD QUALITY CONTROL

A. Molded Case Circuit Breakers: Perform inspections and tests listed in NETA ATS, Section 7.6.1.1 for all main circuit breakers and circuit breakers larger than 600 amperes. Tests listed as optional are not required.
   1. Verify equipment nameplate is in accorance with contract documents.
   2. Inspect physical and mechanical condition.
   3. Inspect anchorage and anlignment.
   4. Verify unit is clean.
   5. Operate breaker to enusre smooth operation.
   6. Perform breaker adjustamants in accorance with the power system study.
   7. Perform resistance measurements through bolted connectionswith a low-resistance ohmmeter.
   8. Perform insulation-resistance test for one minute on each pole, phase-to-phase and phase-to-ground with circuit breaker closed.
   9. Perform contact/pole resistance test.
   10. Determine long-time and short time pickup and delay settings by primary current injection.
   11. Determine ground fault pickup and time delay by primary current injection.

B. Ground Fault Protection Systems: Test in accordance with manufacturer's instructions as required by NFPA 70.

C. Test GFCI circuit breakers to verify proper operation.

D. Test AFCI circuit breakers to verify proper operation.

E. Test shunt trips to verify proper operation.

F. Correct deficiencies and replace damaged or defective panelboards or associated components.

G. For Services and feeders 1000 amperes and larger, and any installation utilizing selective coordination, the following test should be performed on the circuit breakers. Testing shall be performed by a qualified manufacturer's factory technician at the job site. All readings shall be tabulated.
   1. Phase Tripping tolerance (within 20% of UL requirements).

2. Trip time (per phase) in seconds.
3. Instantaneous trip (amps) per phase.
4. Insulation resistance (in megohms) at 1000-volts DC (phase to phase, and line to load).

3.04 ADJUSTING

A. Adjust tightness of mechanical and electrical connections to manufacturer's recommended torque settings.

B. Adjust alignment of panelboard fronts.

C. Load Balancing: For each panelboard, rearrange circuits such that the difference between each measured steady state phase load does not exceed 20 percent and adjust circuit directories accordingly. Maintain proper phasing for multi-wire branch circuits.

3.05 CLEANING

A. Clean dirt and debris from panelboard enclosures and components according to manufacturer's instructions.

B. Repair scratched or marred exterior surfaces to match original factory finish.

END OF SECTION 26 24 16

SECTION 26 27 26
WIRING DEVICES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Wall switches.

B. Wall dimmers.

C. Receptacles.

D. Wall plates.

E. Floor box service fittings.

F. Poke-through assemblies.

1.02 REFERENCE STANDARDS

A. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

B. UL 20 - General-Use Snap Switches Current Edition, Including All Revisions.

C. UL 498 - Attachment Plugs and Receptacles Current Edition, Including All Revisions.

D. UL 514D - Cover Plates for Flush-Mounted Wiring Devices Current Edition, Including All Revisions.

E. UL 1472 - Solid-State Dimming Controls Current Edition, Including All Revisions.

1.03 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate the placement of outlet boxes with millwork, furniture, equipment, etc. installed under other sections or by others.
   2. Coordinate wiring device ratings and configurations with the electrical requirements of actual equipment to be installed.
   3. Coordinate the placement of outlet boxes for wall switches with actual installed door swings.
   4. Coordinate the installation and preparation of uneven surfaces, such as split face block, to provide suitable surface for installation of wiring devices.
   5. Coordinate the core drilling of holes for poke-through assemblies with the work covered under other sections.
   6. Notify Architect of any conflicts or deviations from Contract Documents to obtain direction prior to proceeding with work.

B. Sequencing:
   1. Do not install wiring devices until final surface finishes and painting are complete.

1.04 SUBMITTALS

A. Product Data: Provide manufacturer's catalog information showing dimensions, colors, and configurations.
   1. Wall Dimmers: Include derating information for ganged multiple devices.

B. Certificates for Surge Protection Receptacles: Manufacturer's documentation of listing for compliance with UL 1449.

C. Field Quality Control Test Reports.

D. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

E. Operation and Maintenance Data:
   1. Wall Dimmers: Include information on operation and setting of presets.
   2. GFCI Receptacles: Include information on status indicators.

F. Project Record Documents: Record actual installed locations of wiring devices.

G. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. Screwdrivers for Tamper-Resistant Screws: Two for each type of screw.

2. Extra Keys for Locking Switches: Two of each type.
3. Extra Wall Plates: Two of each style, size, and finish.

1.05 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.

C. Products: Listed, classified, and labeled as suitable for the purpose intended.

D. Product Listing Organization Qualifications: Third party agencies shall be amongst those accredited by the NCBCC (North Carolina Building Code Council) to label Electrical and Mechanical Equipment.

1.06 DELIVERY, STORAGE, AND PROTECTION

A. Store in a clean, dry space in original manufacturer's packaging until ready for installation.

PART 2 PRODUCTS

2.01 WIRING DEVICE APPLICATIONS

A. Provide wiring devices suitable for intended use and with ratings adequate for load served.

B. For single receptacles installed on an individual branch circuit, provide receptacle with ampere rating not less than that of the branch circuit.

C. Provide weather resistant GFCI receptacles with specified weatherproof covers for receptacles installed outdoors or in damp or wet locations.

D. Provide GFCI protection for receptacles installed within 6 feet of sinks.

E. Provide GFCI protection for receptacles installed in kitchens.

F. Provide GFCI protection for receptacles serving electric drinking fountains.

G. Unless noted otherwise, do not use combination switch/receptacle devices.

H. For flush floor service fittings, use carpet flanges for installations in carpeted floors.

2.02 WIRING DEVICE FINISHES

A. Provide wiring device finishes as described below unless otherwise indicated.

B. Wiring Devices, Unless Otherwise Indicated: White with stainless steel wall plate.

C. Wiring Devices Installed in Finished Spaces: White with stainless steel wall plate.

D. Wiring Devices Installed in Unfinished Spaces: White with galvanized steel wall plate.

E. Wiring Devices Connected to Emergency Power: Redwith stainless steel wall plate.

2.03 WALL SWITCHES

A. Manufacturers:
   1. Hubbell Incorporated: www.hubbell.com/#sle.
   2. Leviton Manufacturing Company, Inc.
   3. Pass & Seymour, a brand of Legrand North America, Inc
   4. Approved Equal.

B. Wall Switches - General Requirements: AC only, quiet operating, general-use snap switches with silver alloy contacts, complying with NEMA WD 1 and NEMA WD 6, and listed as complying with UL 20; types as indicated on the drawings.
   1. Wiring Provisions: Terminal screws for side wiring and screw actuated binding clamp for back wiring with separate ground terminal screw.

C. Standard Wall Switches: Industrial heavy duty grade, 20 A, 120/277 V with standard toggle type switch actuator and maintained contacts; single pole single throw, three way, or four way as indicated on the drawings.

2.04 WALL DIMMERS

A. Manufacturers:
   1. Leviton Manufacturing Company, Inc.

2. Lutron Electronics Company, Inc.
3. Pass & Seymour, a brand of Legrand North America, Inc
4. Or approved equal.

B. Wall Dimmers - General Requirements: Solid-state with continuous full-range even control following square law dimming curve, integral radio frequency interference filtering, power failure preset memory, air gap switch accessible without removing wall plate, complying with NEMA WD 1 and NEMA WD 6, and listed as complying with UL 1472; types and ratings suitable for load controlled as indicated on the drawings.

C. Provide accessory wall switches to match dimmer appearance when installed adjacent to each other.

D. Contractor shall ensure dimmer switch compatibility with luminaire controlled prior to ordering.

2.05 RECEPTACLES

A. Manufacturers:
1. Hubbell Incorporated: www.hubbell.com/#sle.
2. Leviton Manufacturing Company, Inc.
3. Pass & Seymour, a brand of Legrand North America, Inc.
4. Approved equal.
5. Source Limitations: Where wall controls are furnished as part of lighting control system, provide accessory matching receptacles and wallplates by the same manufacturer in locations indicated.

B. Receptacles - General Requirements: Self-grounding, complying with NEMA WD 1 and NEMA WD 6, and listed as complying with UL 498and where applicable FS W-C-596; types as indicated on the drawings.
1. Wiring Provisions: Terminal screws for side wiring or screw actuated binding clamp for back wiring with separate ground terminal screw.
2. NEMA configurations specified are according to NEMA WD 6.

C. Convenience Receptacles:
1. Standard Convenience Receptacles: Industrial Heavy Duty Grade, 20A, 125V, NEMA 5-20R; single or duplex as indicated on the drawings.

D. GFCI Receptacles:
1. GFCI Receptacles - General Requirements: Self-testing, with feed-through protection and light to indicate ground fault tripped condition and loss of protection; listed as complying with UL 943, class A.
   a. Provide test and reset buttons of same color as device.
2. Standard GFCI Receptacles: Extra Heavy Duty Grade, duplex, 20A, 125V, NEMA 5-20R, rectangular decorator style.
3. Weather Resistant GFCI Receptacles: Commercial specification grade, duplex, 20A, 125V, NEMA 5-20R, rectangular decorator style, listed and labeled as weather resistant type complying with UL 498 Supplement SE suitable for installation in damp or wet locations.

2.06 WALL PLATES

A. Manufacturers:
1. Hubbell Incorporated.
2. Leviton Manufacturing Company, Inc.
3. Pass & Seymour, a brand of Legrand North America, Inc.
4. Source Limitations: Where wall controls are furnished as part of lighting control system, provide accessory matching receptacles and wallplates by the same manufacturer in locations indicated.

B. Wall Plates: Comply with UL 514D.
1. Configuration: One piece cover as required for quantity and types of corresponding wiring devices.
2. Size: Semi-Jumbo; Midi Size.
3. Screws: Metal with slotted heads finished to match wall plate finish.

C. Stainless Steel Wall Plates: Brushed satin finish, Type 302 stainless steel.

D. Galvanized Steel Wall Plates: Rounded corners and edges, with corrosion resistant screws.

E. Weatherproof Covers for Wet and Damp Locations: Gasketed, thermoplastic, with self-closing hinged cover and corrosion-resistant screws; listed as suitable for use in wet locations with cover closed - rated extra-duty per NEC Art 406.9(B)(1). Covers must be weatherproof while in use.

2.07 FLOOR BOX SERVICE FITTINGS

A. Manufacturers:
   1. Hubbell Incorporated: www.hubbell.com/#sle.
   2. Thomas & Betts Corporation.
   3. Wiremold, a brand of Legrand North America, Inc.
   4. Or approved equal.

B. Description: Service fittings compatible with floor boxes provided under Section 26 05 33.16 with components, adapters, and trims required for complete installation.

C. Flush Floor Service Fittings:
   1. Dual Service Flush Combination Outlets:
      a. Cover: Round - Finish to be selected by Architect.
      b. Configuration:
         1) Power: Two standard convenience duplex receptacles.
         2) Communications: As indicated on drawings.
         3) Voice and Data Jacks: As indicated on the drawings.
   2. Accessories:
      a. Tile Rings: Finish to match covers; configuration as required to accommodate specified covers.
      b. Carpet Flanges: Finish to match covers; configuration as required to accommodate specified covers.

2.08 POKE-THROUGH ASSEMBLIES

A. Manufacturers:
   1. Hubbell Incorporated: www.hubbell.com/#sle.
   2. Thomas & Betts Corporation.
   3. Wiremold, a brand of Legrand North America, Inc.
   4. Or approved equal.

B. Description: Assembly comprising floor service fitting, poke-through component, fire stops and smoke barriers, and junction box for conduit termination; fire rating listed to match fire rating of floor and suitable for floor thickness where installed.

C. Flush Floor Service Fittings:
   1. Dual Service Flush Combination Outlets:
      a. Cover: Round - Finish to be selected by Architect.
      b. Configuration:
         1) Power: Two standard convenience duplex receptacles.
         2) Communications: As indicated on drawings.
         3) Voice and Data Jacks: As indicated on the drawings.
   2. Accessories:
      a. Closure Plugs: Size and fire rating as required to seal unused core hole and maintain fire rating of floor.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that outlet boxes are installed in proper locations and at proper mounting heights and are properly sized to accommodate devices and conductors in accordance with NFPA 70.

C. Verify that wall openings are neatly cut and will be completely covered by wall plates.

D. Verify that final surface finishes are complete, including painting.

E. Verify that floor boxes are adjusted properly.

F. Verify that branch circuit wiring installation is completed, tested, and ready for connection to wiring devices.

G. Verify that core drilled holes for poke-through assemblies are in proper locations.

H. Verify that conditions are satisfactory for installation prior to starting work.

3.02 PREPARATION

A. Provide extension rings to bring outlet boxes flush with finished surface.

B. Clean dirt, debris, plaster, and other foreign materials from outlet boxes.

3.03 INSTALLATION

A. Perform work in a neat and workmanlike manner.

B. Coordinate locations of outlet boxes provided under Section 26 05 33.16 as required for installation of wiring devices provided under this section.
   1. Orient outlet boxes for vertical installation of wiring devices unless otherwise indicated.
   2. Where multiple receptacles, wall switches, or wall dimmers are installed at the same location and at the same mounting height, gang devices together under a common wall plate.
   3. Locate receptacles for electric drinking fountains concealed behind drinking fountain according to manufacturer's instructions.

C. Install wiring devices in accordance with manufacturer's instructions.

D. Install permanent barrier between ganged wiring devices when voltage between adjacent devices exceeds 300 V.

E. Where required, connect wiring devices using pigtails not less than 6 inches long. Do not connect more than one conductor to wiring device terminals.

F. Connect wiring devices by wrapping conductor clockwise 3/4 turn around screw terminal and tightening to proper torque specified by the manufacturer. Where present, do not use push-in pressure terminals that do not rely on screw-actuated binding.

G. Unless otherwise indicated, connect wiring device grounding terminal to branch circuit equipment grounding conductor and to outlet box with bonding jumper.

H. Provide GFCI receptacles with integral GFCI protection at each location indicated. Do not use feed-through wiring to protect downstream devices.

I. Install wiring devices plumb and level with mounting yoke held rigidly in place.

J. Install wall switches with OFF position down.

K. Install wall dimmers to achieve full rating specified and indicated after derating for ganging as instructed by manufacturer.

L. Do not share neutral conductor on branch circuits utilizing wall dimmers.

M. Install vertically mounted receptacles with grounding pole on top and horizontally mounted receptacles with grounding pole on left.

N. Where receptacles are indicated to be mounted above counters they shall be mounted horizontally.

O. Install wall plates to fit completely flush to wall with no gaps and rough opening completely covered without strain on wall plate. Repair or reinstall improperly installed outlet boxes or improperly sized rough openings.

P. Install blank wall plates on junction boxes and on outlet boxes with no wiring devices installed or designated for future use.

Q. Install poke-through closure plugs in each unused core holes to maintain fire rating of floor.

3.04 FIELD QUALITY CONTROL

A. Inspect each wiring device for damage and defects.

B. Operate each wall switch and wall dimmer with circuit energized to verify proper operation.

C. Test each receptacle to verify operation and proper polarity.

D. Test each GFCI receptacle for proper tripping operation according to manufacturer's instructions.

E. Correct wiring deficiencies and replace damaged or defective wiring devices.

3.05 ADJUSTING

A. Adjust devices and wall plates to be flush and level.

B. Adjust presets for wall dimmers according to manufacturer's instructions as directed by Architect.

3.06 CLEANING

A. Clean exposed surfaces to remove dirt, paint, or other foreign material and restore to match original factory finish.

END OF SECTION 26 27 26

SECTION 26 28 13
FUSES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Fuses.

B. Spare fuse cabinet.

1.02 REFERENCE STANDARDS

A. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

B. UL 248-4 - Low-Voltage Fuses - Part 4: Class CC Fuses Current Edition, Including All Revisions.

C. UL 248-8 - Low-Voltage Fuses - Part 8: Class J Fuses Current Edition, Including All Revisions.

D. UL 248-10 - Low-Voltage Fuses - Part 10: Class L Fuses Current Edition, Including All Revisions.

E. UL 248-12 - Low-Voltage Fuses - Part 12: Class R Fuses Current Edition, Including All Revisions.

F. UL 248-15 - Low-Voltage Fuses - Part 15: Class T Fuses Current Edition, Including All Revisions.

1.03 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate fuse clips furnished in equipment provided under other sections for compatibility with indicated fuses.
   2. Coordinate fuse requirements according to manufacturer's recommendations and nameplate data for actual equipment to be installed.
   3. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.04 SUBMITTALS

A. Product Data: Provide manufacturer's standard data sheets including voltage and current ratings, interrupting ratings, time-current curves, and current limitation curves.
   1. Spare Fuse Cabinet: Include dimensions.

B. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 01 60 00 - Product Requirements, for additional provisions.
   2. Extra Fuses: One set(s) of three for each type and size installed.
   3. Fuse Pullers: One set(s) compatible with each type and size installed.
   4. Spare Fuse Cabinet Keys: Two.

1.05 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

B. Product Listing Organization Qualifications: Third party agencies shall be amongst those accredited by the NCBCC (North Carolina Building Code Council) to label Electrical and Mechanical Equipment.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Bussmann, a division of Eaton Corporation.

B. Littelfuse, Inc.

C. Mersen.

D. Approved equal.

2.02 FUSES

A. Provide products listed, classified, and labeled as suitable for the purpose intended.

B. Unless specifically indicated to be excluded, provide fuses for all fusible equipment as required for a complete operating system.

C. Provide fuses of the same type, rating, and manufacturer within the same switch.

D. Comply with UL 248-1.

E. Unless otherwise indicated, provide cartridge type fuses complying with NEMA FU 1, Class and ratings as indicated.

F. Voltage Rating: Suitable for circuit voltage.

G. Selectivity: Where the requirement for selectivity is indicated, furnish products as required to achieve selective coordination.

H. Provide the following accessories where indicated or where required to complete installation:
   1. Fuseholders: Compatible with indicated fuses.

2.03 SPARE FUSE CABINET

A. Description: Wall-mounted sheet metal cabinet with shelves and hinged door with cylinder lock, suitably sized to store spare fuses and fuse pullers specified.

B. Cabinet shall be located in the main electrical room unless otherwise indicated by owner.

C. Finish: Manufacturer's standard, factory applied grey finish unless otherwise indicated.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that fuse ratings are consistent with circuit voltage and manufacturer's recommendations and nameplate data for equipment.

B. Verify that mounting surfaces are ready to receive spare fuse cabinet.

C. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

A. Do not install fuses until circuits are ready to be energized.

B. Install fuses with label oriented such that manufacturer, type, and size are easily read.

C. Install spare fuse cabinet where indicated.

D. Identify spare fuse cabinet in accordance with Section 26 05 53.

END OF SECTION 26 28 13

SECTION 26 28 16.16
ENCLOSED SWITCHES AND CIRCUIT BREAKERS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Enclosed safety switches.

B. Enclosed circuit breakers.

1.02 REFERENCE STANDARDS

A. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

B. UL 489 - Molded-Case Circuit Breakers, Molded-Case Switches and Circuit Breaker Enclosures; Current Edition, Including All Revisions.

1.03 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate the work with other trades. Avoid placement of ductwork, piping, equipment, or other potential obstructions within the dedicated equipment spaces and within working clearances for electrical equipment required by NFPA 70.
   2. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.
   3. Verify with manufacturer that conductor terminations are suitable for use with the conductors to be installed.
   4. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.04 SUBMITTALS

A. Product Data: Provide manufacturer's standard catalog pages and data sheets for enclosed switches and other installed components and accessories.

B. Shop Drawings: Indicate outline and support point dimensions, voltage and current ratings, short circuit current ratings, conduit entry locations, conductor terminal information, and installed features and accessories.
   1. Include wiring diagrams showing all factory and field connections.
   2. Contractor shall confirm that all lug sizes and quantities submitted are compatible with the conductors specified on the contract documents. Changes required to lug sizes and quantities due to lack of coordination between the contractor and the supplier are to be made at the contractor's expense.
   3. It is the contractor's responsibility to ensure that the equipment submitted to comply with the requirements of this section are in compliance with the requirements and recommendations of the power system studies. Any changes recommended by the power system study shall be incorporated at no expense to the project.

C. Field Quality Control Test Reports.

D. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of product.

E. Project Record Documents: Record actual locations of enclosed switches or circuit breakers.

F. Maintenance Data: Include information on replacement parts and recommended maintenance procedures and intervals.

1.05 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.

C. Product Listing Organization Qualifications: Third party agencies shall be amongst those accredited by the NCBCC (North Carolina Building Code Council) to label Electrical and

Mechanical Equipment.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.

B. Handle carefully in accordance with manufacturer's written instructions to avoid damage to enclosed switch internal components, enclosure, and finish.

1.07 FIELD CONDITIONS

A. Maintain ambient temperature between 23 degrees F and 104 degrees F during and after installation of enclosed circuit breakers.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. ABB/GE; _____: www.geindustrial.com/#sle.

B. Eaton Corporation.

C. Schneider Electric; Square D Products.

D. Source Limitations: Furnish enclosed switches and associated components produced by the same manufacturer as the other electrical distribution equipment used for this project and obtained from a single supplier.

2.02 ENCLOSED SAFETY SWITCHES

A. Description: Quick-make, quick-break enclosed safety switches listed and labeled as complying with UL 98; heavy duty; ratings, configurations, and features as indicated on the drawings.

B. Provide products listed, classified, and labeled as suitable for the purpose intended.

C. All switches shall be heavy duty type.

D. Unless otherwise indicated, provide products suitable for continuous operation under the following service conditions:
   1. Altitude: Less than 6,600 feet.
   2. Ambient Temperature: Between -22 degrees F and 104 degrees F.

E. Horsepower Rating: Suitable for connected load.

F. Voltage Rating: Suitable for circuit voltage.

G. Auxilary Contacts: Suitable for 120v rated control circuit. Contractor is to provide auxilary contacts in any disconnecting means that is downstream from a frequency drive. aux contacts shall be mechanically tied to switching mechanisims and shall provide both a N.O. and N.C. contacts. verify with DIV 23 prior to ordering equipment.

H. Short Circuit Current Rating:
   1. Provide enclosed safety switches, when protected by the fuses or supply side overcurrent protective devices to be installed, with listed short circuit current rating not less than the available fault current at the installed location as indicated on the drawings.
   2. When a power system study is included in the contract, confirm the short circuit current rating of all devices with the results of the study prior to submitting for approval.

I. Enclosed Safety Switches Used for Service Entrance: Listed and labeled as suitable for use as service equipment according to UL 869A.

J. Provide with switch blade contact position that is visible when the cover is open.

K. Fuse Clips for Fusible Switches: As required to accept fuses indicated.
   1. Where NEMA Class R fuses are installed, provide rejection feature to prevent installation of fuses other than Class R.

L. Conductor Terminations: Suitable for use with the conductors to be installed.

M. Provide insulated, groundable fully rated solid neutral assembly where a neutral connection is required, with a suitable lug for terminating each neutral conductor.

N. Provide solidly bonded equipment ground bus in each enclosed safety switch, with a suitable lug for terminating each equipment grounding conductor.

O. Enclosures: Comply with NEMA 250, and list and label as complying with UL 50 and UL 50E.
   1. Environment Type per NEMA 250: As indicated on the drawings.
   2. Finish for Painted Steel Enclosures: Manufacturer's standard, factory applied grey unless otherwise indicated.

P. Provide safety interlock to prevent opening the cover with the switch in the ON position with capability of overriding interlock for testing purposes.

Q. Heavy Duty Switches:
   1. Comply with NEMA KS 1.
   2. Conductor Terminations:
      a. Provide mechanical lugs for switch ratings less than 400 amperes.
      b. Provide compression lugs for switch ratings 400 amperes and above.
      c. Lug Material: Copper, suitable for terminating copper conductors only.
   3. Provide externally operable handle with means for locking in the OFF position, capable of accepting three padlocks.

2.03 ENCLOSED CIRCUIT BREAKERS

A. Description: Units consisting of molded case circuit breakers individually mounted in enclosures.

B. Provide products listed, classified, and labeled as suitable for the purpose intended.

C. Unless otherwise indicated, provide products suitable for continuous operation under the following service conditions:
   1. Altitude: Less than 6,600 feet.
   2. Ambient Temperature: Between 23 degrees F and 104 degrees F.

D. Short Circuit Current Rating:
   1. Provide enclosed circuit breakers with listed short circuit current rating not less than the available fault current at the installed location indicated on the drawings.

E. Enclosed Circuit Breakers Used for Service Entrance: Listed and labeled as suitable for use as service equipment according to UL 869A.

F. Auxilary Contacts: Suitable for 120v rated control circuit. Contractor is to provide auxilary contacts in any disconnecting means that is downstream from a frequency drive. aux contacts shall be mechanically tied to switching mechanisims and shall provide both a N.O. and N.C. contacts. verify with DIV 23 prior to ordering equipment.

G. Conductor Terminations: Suitable for use with the conductors to be installed.

H. Provide thermal magnetic circuit breakers for circuit breaker frame sizes less than 250 amperes.

I. Provide electronic trip circuit breakers for circuit breaker frame sizes 250 amperes and above.

J. Provide insulated, groundable fully rated solid neutral assembly where a neutral connection is required, with a suitable lug for terminating each neutral conductor.

K. Provide solidly bonded equipment ground bus in each enclosed circuit breaker, with a suitable lug for terminating each equipment grounding conductor.

L. Enclosures: Comply with NEMA 250, and list and label as complying with UL 50 and UL 50E.
   1. Environment Type per NEMA 250: As indicated on the drawings.
   2. Finish for Painted Steel Enclosures: Manufacturer's standard, factory applied grey unless otherwise indicated.
   3. Provide surface-mounted enclosures unless otherwise indicated.

M. Provide externally operable handle with means for locking in the OFF position.

N. Ground Fault Protection: Where ground-fault protection is indicated, provide system listed and labeled as complying with UL 1053.
   1. Where electronic circuit breakers equipped with integral ground fault protection are used, provide separate neutral current sensor where applicable.

O. Selectivity: Where the requirement for selectivity is indicated, furnish products as required to achieve selective coordination.

P. MOLDED CASE CIRCUIT BREAKERS
1. Description: Quick-make, quick-break, over center toggle, trip-free, trip-indicating circuit breakers listed and labeled as complying with UL 489, and complying with FS W-C-375 where applicable; ratings, configurations, and features as indicated on the drawings.
2. Interrupting Capacity:
   a. Provide circuit breakers with interrupting capacity as required to provide the short circuit current rating indicated.
   b. Fully Rated Systems: Provide circuit breakers with interrupting capacity not less than the short circuit current rating indicated. Series rating is not allowed.
3. Conductor Terminations:
   a. Provide mechanical lugs for circuit breaker frame sizes less than 400 amperes.
   b. Provide compression lugs for circuit breaker frame sizes 400 amperes and above.
   c. Lug Material: Copper, suitable for terminating copper conductors only.
4. Thermal Magnetic Circuit Breakers: For each pole, furnish thermal inverse time tripping element for overload protection and magnetic instantaneous tripping element for short circuit protection.
   a. Provide field-adjustable magnetic instantaneous trip setting for circuit breaker frame sizes 100 amperes and larger.
5. Electronic Trip Circuit Breakers: Furnish solid state, microprocessor-based, true rms sensing trip units.
   a. Provide the following individually field-adjustable trip response settings:
      1) Long time pickup, adjustable by setting dial.
      2) Long time delay.
      3) Short time pickup and delay.
      4) Instantaneous pickup.
      5) Ground fault pickup and delay where ground fault protection is indicated.
6. Multi-Pole Circuit Breakers: Furnish with common trip for all poles.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that the ratings of the enclosed switches are consistent with the indicated requirements.

C. Verify that mounting surfaces are ready to receive enclosed safety switches.

D. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Install enclosed switches securely, in a neat and workmanlike manner.

C. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.

D. Provide required support and attachment in accordance with Section 26 05 29.

E. Install enclosed switches and breakers plumb.

F. Except where indicated to be mounted adjacent to the equipment they supply, mount enclosed switches such that the highest position of the operating handle does not exceed 79 inches above the floor or working platform.

G. Provide grounding and bonding in accordance with Section 26 05 26.

H. Provide fuses complying with Section 26 28 13 for fusible switches as indicated or as required by equipment manufacturer's recommendations.

I. Set field-adjustable circuit breaker tripping function settings as directed.

J. Where accessories are not self-powered, provide control power source as indicated or as required to complete installation.

K. Identify enclosed switches and breakers in accordance with Section 26 05 53.

3.03 FIELD QUALITY CONTROL

A. Perform inspections and tests listed in NETA ATS, Section 7.5.1.1 for breakers larger than 600A.
   1. Verify equipment nameplate is in accorance with contract documents.
   2. Inspect physical and mechanical condition.
   3. Inspect anchorage and anlignment.
   4. Verify unit is clean.
   5. Operate breaker to enusre smooth operation.
   6. Perform breaker adjustments in accorance with the power system study.
   7. Perform resistance measurements through bolted connectionswith a low-resistance ohmmeter.
   8. Perform insulation-resistance test for one minute on each pole, phase-to-phase and phase-to-ground with circuit breaker closed.
   9. Perform contact/pole resistance test.
   10. Determine long-time and short time pickup and delay settings by primary current injection.
   11. Determine ground fault pickup and time delay by primary current injection.

B. Correct deficiencies and replace damaged or defective enclosed safety switches or associated components.

3.04 ADJUSTING

A. Adjust tightness of mechanical and electrical connections to manufacturer's recommended torque settings.

3.05 CLEANING

A. Clean dirt and debris from switch enclosures and components according to manufacturer's instructions.

B. Repair scratched or marred exterior surfaces to match original factory finish.

END OF SECTION 26 28 16.16

SECTION 26 51 00
INTERIOR AND EXTERIOR LIGHTING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Interior luminaires.

B. Ballasts and drivers.

C. Lamps.

1.02 REFERENCE STANDARDS

A. IES LM-79 - Approved Method: Optical and Electrical Measurements of Solid-State Lighting Products 2019.

B. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

C. NFPA 101 - Life Safety Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

D. UL 924 - Emergency Lighting and Power Equipment Current Edition, Including All Revisions.

E. UL 935 - Fluorescent-Lamp Ballasts Current Edition, Including All Revisions.

F. UL 1598 - Luminaires Current Edition, Including All Revisions.

1.03 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate the installation of luminaires with mounting surfaces installed under other sections or by others. Coordinate the work with placement of supports, anchors, etc. required for mounting. Coordinate compatibility of luminaires and associated trims with mounting surfaces at installed locations.
   2. Coordinate the placement of luminaires with structural members, ductwork, piping, equipment, diffusers, fire suppression system components, and other potential conflicts installed under other sections or by others.
   3. Coordinate the placement of exit signs with furniture, equipment, signage or other potential obstructions to visibility installed under other sections or by others.
   4. Notify Architect of any conflicts or deviations from Contract Documents to obtain direction prior to proceeding with work.

1.04 SUBMITTALS

A. Shop Drawings:
   1. Indicate dimensions and components for each luminaire that is not a standard product of the manufacturer.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets including detailed information on luminaire construction, dimensions, ratings, finishes, mounting requirements, listings, service conditions, photometric performance, installed accessories, and ceiling compatibility; include model number nomenclature clearly marked with all proposed features.
   1. Ballasts: Include wiring diagrams and list of compatible lamp configurations.
   2. Lamps: Include rated life, color temperature, color rendering index (CRI), and initial and mean lumen output.

C. Certificates for Dimming Ballasts: Manufacturer's documentation of compatibility with dimming controls to be installed.

D. Field quality control reports.

E. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

F. Warranties.

G. Operation and Maintenance Data: Instructions for each product including information on replacement parts.

H. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. Extra Lenses and Louvers: Two percent of total quantity installed for each type, but not less than one of each type.
   2. Extra Lamps: Five percent of total quantity installed for each type, but not less than two of each type.
   3. Extra Ballasts: Two percent of total quantity installed for each type, but not less than one of each type.

1.05 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.

C. Product Listing Organization Qualifications: Third party agencies shall be amongst those accredited by the NCBCC (North Carolina Building Code Council) to label Electrical and Mechanical Equipment.

1.06 DELIVERY, STORAGE, AND PROTECTION

A. Receive, handle, and store products according to manufacturer's written instructions.

B. Keep products in original manufacturer's packaging and protect from damage until ready for installation.

1.07 FIELD CONDITIONS

A. Maintain field conditions within manufacturer's required service conditions during and after installation.

PART 2 PRODUCTS

2.01 LUMINAIRE TYPES

A. Furnish products as indicated in luminaire schedule included on the drawings.

2.02 LUMINAIRES

A. Provide products that comply with requirements of NFPA 70.

B. Provide products that are listed and labeled as complying with UL 1598, where applicable.

C. Provide products listed, classified, and labeled as suitable for the purpose intended.

D. Unless otherwise indicated, provide complete luminaires including lamp(s) and all sockets, ballasts, reflectors, lenses, housings and other components required to position, energize and protect the lamp and distribute the light.

E. Unless specifically indicated to be excluded, provide all required conduit, boxes, wiring, connectors, hardware, supports, trims, accessories, etc. as necessary for a complete operating system.

F. Provide products suitable to withstand normal handling, installation, and service without any damage, distortion, corrosion, fading, discoloring, etc.

G. LED Luminaires:
   1. Components: UL 8750 recognized or listed as applicable.
   2. Tested in accordance with IES LM-79 and IES LM-80.
   3. Indoor: Provide a minimum of 2.5 kV integral surge suppression.

H. Luminaires Mounted in Continuous Rows: Provide quantity of units required for length indicated, with all accessories required for joining and aligning.

2.03 BALLASTS AND DRIVERS

A. Ballasts/Drivers - General Requirements:
   1. Provide ballasts containing no polychlorinated biphenyls (PCBs).

2. Minimum Efficiency/Efficacy: Provide ballasts complying with all current applicable federal and state ballast efficiency/efficacy standards.

B. Dimmable LED Drivers:
1. Dimming Range: Continuous dimming from 100 percent to ten percent relative light output unless dimming capability to lower level is indicated in the fixture schedule, without flicker.
2. Control Compatibility: Fully compatible with the dimming controls to be installed. Refer to drawings.
3. Square wave inverters shall not be used with LED emergency lighting. Sinusoidal wave inverters must be used.

2.04 LAMPS

A. Lamps - General Requirements:
1. Unless explicitly excluded, provide new, compatible, operable lamps in each luminaire.
2. Verify compatibility of specified lamps with luminaires to be installed. Where lamps are not specified, provide lamps per luminaire manufacturer's recommendations.
3. Minimum Efficiency: Provide lamps complying with all current applicable federal and state lamp efficiency standards.
4. Color Temperature Consistency: Unless otherwise indicated, for each type of lamp furnish products which are consistent in perceived color temperature. Replace lamps that are determined by the Architect to be inconsistent in perceived color temperature.
a. Unless otherwise noted on the drawings color temperatures shall be as listed below. Notify engineer if there is an inconsistency in color temperatures listed in the fixture schedule prior to ordering.
1) Interior Lighting: 3500 K
2) Exterior Lighting: 4000 K

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that outlet boxes are installed in proper locations and at proper mounting heights and are properly sized to accommodate conductors in accordance with NFPA 70.

C. Verify that suitable support frames are installed where required.

D. Verify that branch circuit wiring installation is completed, tested, and ready for connection to luminaires.

E. Verify that conditions are satisfactory for installation prior to starting work.

3.02 PREPARATION

A. Provide extension rings to bring outlet boxes flush with finished surface.

B. Clean dirt, debris, plaster, and other foreign materials from outlet boxes.

3.03 INSTALLATION

A. Coordinate locations of outlet boxes provided under Section 26 05 33.16 as required for installation of luminaires provided under this section.

B. All luminaire surge suppression shall be evaluated and tested in accordance with ANSI C62.41.2 standard.

C. Install products in accordance with manufacturer's instructions.

D. Provide required support and attachment in accordance with Section 26 05 29.

E. Install luminaires securely, in a neat and workmanlike manner.

F. Install luminaires plumb and square and aligned with building lines and with adjacent luminaires.

G. Suspended Ceiling Mounted Luminaires:
1. Do not use ceiling tiles to bear weight of luminaires.
2. Do not use ceiling support system to bear weight of luminaires unless ceiling support system is certified as suitable to do so.

3. Secure surface-mounted and recessed luminaires to ceiling support channels or framing members or to building structure.
4. Secure pendant-mounted luminaires to building structure.
5. Secure lay-in luminaires to ceiling support channels using listed safety clips at four corners.
6. In addition to ceiling support wires, provide two galvanized steel safety wire(s), minimum 12 gauge, connected from opposing corners of each recessed luminaire to building structure.

H. Wall-Mounted Luminaires: Unless otherwise indicated, specified mounting heights are to center of luminaire.

I. Install accessories furnished with each luminaire.

J. Bond products and metal accessories to branch circuit equipment grounding conductor.

K. Install lamps in each luminaire.

3.04 FIELD QUALITY CONTROL

A. Inspect each product for damage and defects.

B. Operate each luminaire after installation and connection to verify proper operation.

C. Test self-powered exit signs, emergency lighting units, and fluorescent emergency power supply units to verify proper operation upon loss of normal power supply. Test shall be conducted for 90 minutes in accordance with NEC 700. Test shall be conducted a maximum of 10 days prior to final inspection and light level readings recorded at the beginning and end of the test shall be submitted to the engineer for review.

D. Correct wiring deficiencies and repair or replace damaged or defective products. Repair or replace excessively noisy ballasts as determined by Architect.

3.05 ADJUSTING

A. Aim and position adjustable luminaires to achieve desired illumination as indicated or as directed by Architect. Secure locking fittings in place.

B. Aim and position adjustable emergency lighting unit lamps to achieve optimum illumination of egress path as required or as directed by Architect or authority having jurisdiction.

C. Exit Signs with Field-Selectable Directional Arrows: Set as indicated or as required to properly designate egress path as directed by Architect or authority having jurisdiction.

3.06 CLEANING

A. Clean surfaces according to manufacturer's instructions to remove dirt, fingerprints, paint, or other foreign material and restore finishes to match original factory finish.

3.07 CLOSEOUT ACTIVITIES

A. Demonstration: Demonstrate proper operation of luminaires to Architect, and correct deficiencies or make adjustments as directed.

B. After the designer final inspection prior to SCO final inspection and final acceptance replace all lamps that have failed and clean all lenses.

3.08 PROTECTION

A. Protect installed luminaires from subsequent construction operations.

END OF SECTION 26 51 00