PROJECT MANUAL
FOR
BID DOCUMENTS

BUILDING 500 KITCHEN& DINING HVAC RENOVATIONS

WRIGHTSBORO ELEMENTARY SCHOOL
2716 CASTLE HAYNE ROAD
WILMINGTON, NC 28401

NHCS
Engaging Students, Achieving Excellence

NHCS PROJECT NO. 21-9230
DECEMBER 14, 2020

PROJECT DESIGNER

CHEATHAM AND ASSOCIATES, P.A.
3412 ENTERPRISE DRIVE
WILMINGTON, NC 28405
910.452.4210 | FAX 910.452.4211
WWW.CHEATHAMPA.COM
NC LICENSE NO. C-1073
PROJECT NO. 20048

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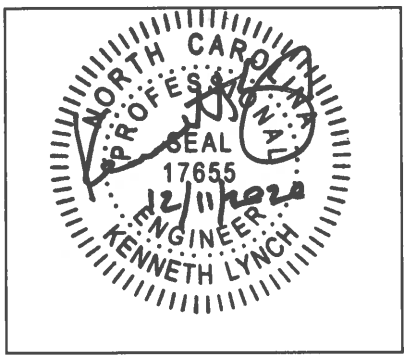
DESIGN PROFESSIONALS OF RECORD

MECHANICAL ENGINEER

Kenneth Lynch, PE, LEED AP
License No. 17655
Cheatham and Associates, P.A.
NC License No. C-1073



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TECHNICAL SPECIFICATIONS

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INVITATION TO BID

New Hanover County Schools invites licensed mechanical contractors to bid on Wrightsboro Building 500 Kitchen and Dining HVAC replacement. Emailed bids will be received by the Office of Facility Planning & Construction, thru Cheatham and Associates, P.A., at klynch@cheathampa.com by 2:00 on January 7, 2021. All bids will be opened and recorded starting at 2:00. This project will be bid and awarded in accordance with G.S. 143-131, Informal Bidding Procedures.

The project consists of replacing two split system air conditioning units in Building 500, which is the kitchen and cafeteria.

Licensed Mechanical Contractors must have a minimum of five (5) years of experience on competitively bid publicly funded construction projects e.g. City, County, State or School Systems.

A Pre-Bid Conference will be held on December 16th, 2020, at 2:00 at the project site, Wrightsboro Elementary School, 2716 Castle Hayne Road, Wilmington, NC 28401. The Design Consultant and a representative from New Hanover County Schools will be available at that time to answer questions concerning the project. Questions after that time shall be submitted in writing to the Design Consultant, Ken Lynch at Cheatham and Associates, P.A. Consulting Engineers at 3412 Enterprise Drive, Wilmington, NC 28405 or to Leanne Lawrence, Director of Facility Planning & Construction, New Hanover County Schools 6410 Carolina Beach Road Wilmington, North Carolina 28412.

Complete plans and specifications may be obtained from Cheatham and Associates, P.A. Consulting Engineers, 3412 Enterprise Drive, Wilmington, NC 28405, 910.452.4210 during normal office hours beginning December 14, 2020. Electronic copies of the documents can be obtained at no charge via Cheatham and Associates Dropbox by emailing request to: admin@cheathampa.com. If hard copies are requested, a refundable plan deposit in the amount of $200 is required. Partial sets will not be available. Plan deposits shall be made payable to New Hanover County Schools and mailed to Cheatham and Associates, attention Ken Lynch. The deposit will be refunded upon return of the Contract Documents in good condition within thirty (30) days. Contract documents are also available for review at New Hanover County Schools' Office of Facility Planning and Construction.

New Hanover County Schools has a verifiable ten percent (10%) goal for participation by minority businesses in the total value of the work. Bidders are required on school construction and renovation projects to make a "good faith effort" to meet this goal. Bidders shall identify on its bid the minority businesses that it will use on the project. Bidders shall submit along with the bid an affidavit listing the "good faith efforts" it has made pursuant to Section I – Information for Bidders, Article I-8, Minority Participation, and the total dollar value of the bid that will be performed by the minority businesses. A bidder that performs all of the work under the contract with its own workforce may submit an affidavit to that effect in lieu of the aforementioned affidavit otherwise required under this subsection.

New Hanover County Schools reserves the right to reject any and all bids, waive informalities and irregularities in bidding, and to accept bids which are considered to be in the best interest of the School System.

Dated For Publication: December 13, 2020

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SECTION I

INFORMATION FOR BIDDERS

I-1. SUBMISSION OF BIDS AND BID OPENING:

A. Bids will be received in accordance with the Invitation to Bid.

B. The Bidder shall assume full responsibility for timely delivery at the location designated for receipt of Bids. The time with respect to the bid will be the Standard Time for the United States as maintained by the Time Services Department of the U.S. Naval Observaory: http://www.usno.navy.mil/USNO/time/display-clocks/simpletime . Bids will not be accepted after the time(s) set forth in the Invitation to Bid.

I-2. BIDDING DOCUMENTS:

A. Bidding Documents include the Invitation to Bid, Information for Bidders, Bid Form, the Bid Security, Affidavit's of Minority Participation and the Contract Documents, including any Addenda issued prior to receipt of bids. All requirements and obligations of the Bidding Documents are hereby incorporated by reference into the Contract Documents and are binding on the Successful Bidder upon award of the contract.

B. Bidders may obtain complete sets of the Bidding Documents as designated in the Invitation to Bid in the number and for the deposit, if any, stated therein.

C. Bidders shall use complete sets of Bidding Documents in preparing Bids; neither the Owner nor the Design Consultant shall assume any responsibility for errors or misinterpretations resulting from the use of incomplete sets of Bidding Documents.

D. The Owner in making copies of the Bidding Documents available on the above terms does so only for the purpose of obtaining Bids on the Work and does not confer a license or grant for any other use.

I-3. DEFINITIONS:

A. THE BID:

A Bid is a complete and properly signed proposal to do the work or designated portion thereof for the sums stipulated therein, submitted in accordance with the Bidding Documents and G. S. 143-131, Informal Bidding Procedures.

B. BASE BID:

The Base Bid is the sum stated in the Bid for which the Bidder offers to perform the Work described in the Bidding Documents as the base, to which work may be added or from which work may be deleted for sums stated in Alternate Bids, if any.

C. ALTERNATES:

An Alternate Bid (or Alternate) is an amount stated in the Bid to be added to or deducted from the amount of the Base Bid if the corresponding change in the Work, as described in the Bidding Documents, is accepted.

D. HE/HIS:

The term He or His is not intended to be gender specific.

I-4. QUALIFICATION OF BIDDER:

A. The Contractor must have been engaged in the performance of the type of work described in the Contract Documents for a period of no less that TWO years prior to submitting a bid.

B. Prior to Contract award or within seven days of the Owner's request to do so, the successful Bidder shall be prepared to provide sufficient references from customers with contracts of similar or greater size and scope, and other proof showing to Owner's satisfaction that Contractor is sufficiently experienced and capable of properly performing its proposed Contract with the Owner. Low Bidders that have failed to successfully perform one or more previous contracts with Owner must provide at least three (3) such references in writing from projects performed subsequent to such low bidder's most recent nonperformance of a contract with the Owner. In addition to references, Contractor must demonstrate that his present organization, direct labor force and prior work experience is of adequate size and development to maintain responsible control of the project and to schedule, coordinate and perform the work in an expeditious manner and in accordance with the Contract Documents.

C. Bidders, whether residents or nonresidents in North Carolina will be required to show evidence of a valid North Carolina State Contractor's Licence Number before their bids will be considered.

D. The Owner will consider, in determining the qualifications of a Bidder, his record in the performance of any contracts for construction work into which he may have entered with the Owner or with similar public or private bodies or corporations. The Owner expressly reserves the right to reject the bid of any Bidder if such record discloses that such Bidder, in the opinion of the Owner, has not properly performed such contracts or has habitually and without just cause neglected the payment of bills, or has otherwise disregarded his obligations to Subcontractors, material suppliers or employees.

E. The Owner may make such investigation as they deem necessary to determine the ability of the Bidder to perform the work, and the Bidder shall furnish to the Owner all such information and data for this purpose as they may request. The Owner reserves the right to reject any bid if the evidence submitted by, or investigation of such Bidder, fails to satisfy the Owner that such Bidder is a responsive and responsible Bidder in accordance with N.C. Gen. Stat. 143-128 and 143-129, and the criteria set forth herein. The Owner may require AIA Document A305 Contractor's Qualification Statement (or equivalent). Conditional bids will not be accepted.

I-5. BIDDER'S REPRESENTATIONS:

Each Bidder by submitting his Bid represents that:

A. He has read and understands the Bidding Documents and his Bid is made in accordance therewith; and Bidder agrees to be bound by the terms and requirements set forth in the Bidding and Contract Documents;

B. He has visited the site, has familiarized himself with the local conditions under which the Work is to be performed in accordance with Article I-9 herein, and has correlated his observations with the requirements of the proposed Contract Documents;

C. His Bid is based upon the materials, systems and equipment required by the Bidding Documents without exception; and

D. He has the capability, in all respects, and the moral and business integrity, reliability, technical ability, financial resources, plant, management, superintendents, equipment and materials which will assure effective and efficient good faith performance in full compliance with the Contract Documents and with any and all schedules and Milestone and Completion dates required by the Owner. The Bidder acknowledges and represents in his estimating, planning and scheduling of the Work that the Contract Time has made allowances for normal inclement weather indigenous to the Project Site. The Bidder hereby certifies that the work shall be completed, in place, in full accordance with the Contract Documents, within the time limits specified.

E. He agrees that upon receipt of the Notice of Award, he will execute the Contract, and will deliver proof of insurance coverage as required by the Bidding Documents.

F. He agrees to execute the Contract within ten (10) buisness days from the date of Notice of Award, and in case he fails or neglects to appear within the specified time to execute the Contract, he will be considered as having abandoned the Contract, and the Bid Security accompanying this Proposal will be forfeited to the Owner by reason of such failure on the part of the Bidder.

G. He has made a "good faith effort" to meet New Hanover County School's verifiable ten percent (10%) goal for participation by minority businesses in the total value of the work. The Bidder shall identify on its bid the minority businesses that it will use on the project. The Bidder shall submit along with the bid an affidavit listing the "good faith efforts" it has made pursuant to subsection (f) of G.S. 143-128.2 and the total dollar value of the bid that will be performed by the minority businesses. A bidder that performs all of the work under the contract with its own workforce may submit an affidavit to that effect in lieu of the aforementioned affidavit otherwise required under this subsection.

I-6. BID SECURITY:

A. Bid security is not required for this project.

I-7. FORFEITURE OF BID BOND**:**

NOT USED

I-8. MINORITY BUSINESS ENTERPRISES

It is the policy of the Owner to encourage the use of minority businesses in all school construction contracts and have a verifiable percentage goal of ten percent (10%) participation in the total value of the work. It is the intent of this policy that the Owner, as awarding authority for school construction projects, and the Prime Contractors and Subcontractors performing the construction contracts awarded shall cooperate and in good faith do all things legal, proper, and reasonable to achieve the verifiable goal of ten percent (10%) participation. Each bidder will take specific actions to insure a good faith effort in the recrutment and selection of minority businesses including but not limited to:

SUBMITTED WITH BID:

A. For bids that will include subcontracts: The Bidders must earn at least 50 points from the good faith efforts listed below, and submit with their bid an affidavit identifying which efforts were utilized. This affidavit is Affidavit A – Listing of Good Faith Efforts and is included as an attachment to Section I, Information to Bidders, and Section II, Bid Form.

1. **(10 pts)** Contact minority businesses that could reasonably be expected to submit a quote and that are known to the contractor, or available on State or local government maintained lists, at

least 10 days before the bid date and notify them of the nature and scope of the work to be performed.

2. **(10 pts)** Make the construction plans, specifications and requirements available for review by prospective minority businesses, or provide these documents to them at least 10 days before the bids are due.

3. **(15 pts)** Break down or combine elements of work into economically feasible units to facilitate minority participation.

4. **(10 pts)** Work 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)** Attend prebid meetings scheduled by the public owner.

6. **(20 pts)** Provide assistance in getting required bonding or insurance or provide alternatives to bonding or insurance for subcontractors.

7. **(15 pts)** Negotiate in good faith with interested minority businesses and do 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)** Provide 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. Assist 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)** Negotiate 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)** Provide quick pay agreements and policies to enable minority contractors and suppliers to meet cash-flow demands.

B. For Bids that include work performed with its own workforce: A Bidder that performs all of the work under a contract with its own workforce may submit with their bid an affidavit to that effect in lieu of the affidavit mentioned in the previous subsection A. This affidavit is Affidavit B – Intent to Perform Contract with Own Forces and is included as an attachment to Section I, Information to Bidders, and Section II, Bid Form.

NOTE: The Bidder must include either Affidavit A – Listing of Good Faith Efforts or Affidavit B – Intent to Perform Contract with Own Worfforce with its bid. Failure to include either of these affidavits with the bid may result in declaring the bid non-responsive.

C. Each Bidder shall identify on its bid the minority businesses that it will use on the project and the cooresponding dollar value of the bid. Section II, Bid Form, provides space for the Bidder to enter this information.

SUBMITTED BY THE LOWEST RESPONSIBLE, RESPONSIVE BIDDER WITHIN 72 HOURS AFTER NOTIFICATION OF BEING LOW BIDDER

D. An affidavit that includes a description of the portion of work to be executed by the minority businesses, expressed as a percentage of the total contract price, which is equal to or greater than the verifiable ten percent (10%) goal. This affidavit is Affidavit C – Portion of the Work to be Performed by Minority Firms and is included as an attachement to Section II, Information to Bidders.

E. Documentation of its good faith effort to meet the verifiable ten percent (10%) goal. The documentation must include evidence of all good faith efforts that were implemented, inclduing any advertisements, solicitations, and evidence of other specific actions demonstrating recruitment and selection of minority businesses for participation in the contract. This affidavit is Affidavit D – Good Faith Efforts and is included as an attachment to Section II, Information to Bidders.

NOTE: The lowest responsible and responsive bidder must submit either Affidavit C – Portion of the Work to be Performed by Minority Firms or Affidavit D – Good Faith Efforts within 72 hours after notification of being low bidder. Failure to submit either of these affidavits within the time provided may result in declaring the bid non-responsive.

I-9. SITE CONDITIONS AND CONDITIONS OF THE WORK:

A. Each bidder must acquaint himself thoroughly as to the character and nature of the work to be done. Each bidder furthermore must make a careful examination of the site of the work and inform himself fully as to the difficulties to be encountered in the performance of the work, the facilities for delivering, storing and placing materials and equipment, and other conditions relating to construction and labor.

B. No plea of ignorance of conditions that exist or may hereafter exist on the site of the work, or difficulties that may be encountered in the execution of the work, as a result of failure to make necessary investigations and examinations, will be accepted as an excuse for any failure or omission on the part of the successful Bidder to fulfill in every detail all the requirements of the Contract Documents and to complete the work or the consideration set forth therein, or as a basis for any claim whatsoever.

C. Insofar as possible, the Successful Bidder, in carrying out his work, must employ such methods or means as will not cause interruption of or interference with the work of the Owner or any separate contractor.

I-10. BIDDER'S QUESTIONS, ADDENDA AND INTERPRETATIONS:

A. Bidders and Sub-bidders shall promptly notify the Design Consultant of any ambiguity, inconsistency or error which they may discover upon examination of the Bidding and Contract Documents or of the site and local conditions. No interpretation of the meaning of the drawings, specifications or other contract documents will be made to any Bidder orally.

B. Every request for such interpretation should be in writing addressed to the Design Consultant with a copy forwarded to the Owner.

C. Any and all such interpretations and any supplemental instructions will be in the form of written addenda to the Bidding Documents which, if issued, will be transmitted to all prospective Bidders (at the respective addresses furnished for such purposes) not later than three calendar days prior to the date fixed for the opening of bids. Neither the Design Consultant nor the Owner will be responsible for any other explanations or interpretations of the proposed documents. Failure of any Bidder to receive any such addendum or interpretation shall not relieve any bidder from any obligation under his bid as submitted. All addenda so issued shall become part of the Contract Documents.

D. Each Bidder shall ascertain prior to submitting his bid that he has received all Addenda issued, and he shall acknowledge receipt and inclusion in his proposal of all Addenda.

F. The Design Consultant and a representative from New Hanover County Schools will be available at a Pre-Bid Conference to answer questions concerning the project. The date and time of the Pre-Bid Conference shall be determined in the Invitation to Bid. Questions after that time shall be submitted in writing to the Design Consultant or to Leanne Lawrence, Director of Facility Planning New Hanover County Schools 6410 Carolina Beach Road Wilmington, North Carolina 28412.

I-11. SECURITY FOR FAITHFUL PERFORMANCE:

Performance and Payment Bonds:

X Performance and Payment Bonds are not required for this Contract, or

☐ The Successful bidder shall furnish a Performance Bond in an amount equal to one hundred percent (100%) of the Contract Sum as security for the faithful performance of this Contract and also a Labor and Material Payment Bond in an amount not less than one hundred percent (100%) of the Contract Sum, as security for the payment of all persons performing labor and furnishing materials under this Contract. The successful Bidder shall provide a Performance Bond and a Labor and Material Payment Bond, in accordance with State law and shall be delivered to the Owner no later than the date of execution of the Contract by the successful Bidder. See Section III.

I-12. TIME OR COMPLETION AND LIQUIDATED DAMAGES FOR NON-COMPLETION:

The time for completion of this Contract and liquidated damages for non-completion within the stipulated time shall be as fixed in the Bid Documents.

I-13. LOCATION OF WORK:

The site of the proposed work is on Owner owned property, public streets, easements and/or other right-of-ways, as shown on the drawings.

I-14. LIABILITY INSURANCE AND WORKMEN'S COMPENSATION:

The Successful Bidder will be required to maintain Commercial General Liability, Workmen's Compensation and other insurance in the amounts and under the terms stipulated in the contract.

I-15. BIDDERS REFERRED TO LAWS:

A. The attention of Bidders is called to the provisions of all Municipal, County and State laws, regulations, ordinances and resolutions, including but not limited to, (the Human Rights Ordinance; the Equal Opportunity, Small and Minority Business Enterprises and the Construction Safety Resolutions); as well as laws, regulations, ordinance resolutions and permits relating to obstructing streets, maintaining signals, storing and handling of explosives, affecting the Bidder, or his employees or his work hereunder in his relation to the Owner or any other person. The Bidder shall obey all such laws, regulations, ordinances, permits or resolutions controlling or limiting Contractors while engaged in the prosecution of work under this Contract.

B. The provisions of this contract shall be interpreted in accordance with the laws of North Carolina and in accordance with the laws, ordinances, regulations, permits and resolutions of local Municipalities and New Hanover County.

I-16. TAXES

All applicable Federal, State and Local Taxes shall be included in the Bidder's proposal. The successful bidder shall provide the Owner with documentation of North Carolina sales taxes paid for all purchases on the project in a form provided by the Owner and included as an attachment to this Section II, Information to Bidders.

I- 17. RIGHT TO REJECT BIDS:

The Owner expressly reserves the right to reject any or all bids, to waive any informalities or irregularities in the bids received, and to accept that bid which in its judgment, best serves the interest of the Owner.

I-18. EQUAL PRODUCTS AND SUBSTITUTIONS:

A. Whenever possible, the Design Consultant shall specify in the plans the required performance and design characteristics for materials as required by N.C. Gen. Stat. § 133-3. When it is impossible or impractical to specify the required performance and design characteristics for materials, the Design Consultant may use a certain brand, make, manufacturer, article, device, product, material, fixture, form or type construction by name, make or catalog number to convey the general style, type, character and standard of quality of the aricle desired. Unless specifically stated to the contrary, any Bidder may, with Owner approval, use any article, device, product, material, fixture, form or type of construction which in the judgment of the Design Consultant is equal to that specified considering quality, workmanship, economy of operation, durability, suitably for the purpose intended, and acceptability for use on the project. Such requests must be submitted five (5) days prior to bid opening date. Approval by the Owner prior to bid opening will be in the form of an Addendum to the Specifications issued to all prospective Bidders indicating that the additional makes or brands appear to be equivalent to those specified. Nothing in this paragraph is intended to restrict or inhibit free and open competition on school system projects.

I-19. PREPARATION AND SUBMITTAL OF BID:

A. Bids shall be submitted utilizing the Bid Form as bound herein as Section II, or otherwise provided with the Contract Documents, and shall be complete in every respect. The total bid amount shall be entered in words and figures in the space provided. Where applicable, the unit price or lump sum items, and their extensions, shall be entered in figures in the respective columns provided for each bid item. All entries shall be typewritten or printed in ink. The signatures of all persons shall be in longhand. Any entry of amount that appears on the face of the bid to have involved an erasure, deletion, white-out and/or substitution or other such change or alteration, shall show by them the initials of the person signing the bid and the date of the change or alteration. A failure to comply with this requirement may be cause for disqualification of the bid.

B. For Unit Price bids, in the event of any discrepancies between the unit prices and the extensions thereof or the total bid amount, the unit prices shall govern. For Lump Sum bids, in the event of a discrepancy between the bid amount in writing and that in figures, the written value shall govern.

C. Bids shall not contain any restatement or qualifications of work to be done, and alternate bids will not be considered unless called for. No oral bids or modifications will be considered.

D. The amount of a bid submitted by a subcontractor to the general contractor under the single prime contracting system shall not exceed the bid, if any, for the same work by that subcontractor to the Owner under the multiple prime system.

E. Each single-prime bid shall identify the major subcontractors, including but not limited to the contractors selected to perform the mechanical, electrical and plumbing portions of the work, and the subcontractors' respective bid prices for the work.

I-20. MODIFICATION OR WITHDRAWAL OF BID:

A. A Bidder may withdraw his bid from consideration if such bid was based upon a mistake as provided in North Carolina General Statute 143-129.1.

B. Prior to the time and date designated for receipt of bids, any bid submitted may be modified or withdrawn by notice to the party receiving bids at the place designated for receipt of bids. Such notice shall be in writing over the signature of the Bidder or by telegrams; if by telegram, written confirmation over the signature of the Bidder shall be mailed and postmarked on or before the date and time set for receipt of bids, and it shall be so worded as not to reveal the amount of the original bid.

C. Withdrawn bids may be resubmitted up to the time designated for the receipt of Bids provided that they are then fully in conformance with this Information for Bidders.

D. Bid security, if any is required, shall be in an amount sufficient for the bid as modified or resubmitted.

I- 21. DETAILED BID BREAKDOWN:

If the Owner directs, the Bidder shall provide a detailed breakdown of his bid acceptable to the Owner. In addition to verifying accounting requirements, the breakdown may be used by the Owner to determine whether the Bidder has grossly misjudged the requirements of any area. Failure to provide the requested detailed breakdown may result in rejection of the bid proposal.

I- 22. AWARD OF CONTRACT:

The contract will be awarded to the lowest responsive and responsible bidder under the single prime system taking into consideration quality, performance, and the time specified in the bids for the performance of the contract.

A. The lowest single prime bidder shall be determined by the aggregate amount of the unit prices set forth in the form of bid, if work is bid on a unit price basis, or the aggregate amount of the Base Bid, plus any Alternates selected by the Owner. Bids will be received and awarded according to state law.

B. A Responsive Bidder shall mean a Bidder who has submitted a bid which conforms, in all material respects, to the Bidding Documents.

C. A Responsible Bidder shall mean a Bidder who has the capability, in all respects, to perform fully the contract requirements and the moral and business integrity and reliability which will assure good faith performance. In determining responsibility, the following criteria will be considered:

1. The ability, capacity and skill of the Bidder to perform the contract or provide the service required;

2. Whether the bidder can perform the contract or provide the service promptly, or within the time specified, without delay or interference;

3. The character, integrity, reputation, judgment, experience and efficiency of the Bidder;

4. The quality of performance of previous contracts or services. For example the following information will be considered:

a. The administrative and consultant cost overruns incurred by Owners on previous contracts with Bidder,

b. The Bidder's compliance record with contract general conditions on other projects,

c. The submittal by the bidder of excessive and/or unsubstantiated extra cost proposals and claims on other projects,

d. The Bidder's record for completion of the work within the Contract Time or within Contract Milestones and Bidders compliance with scheduling and coordination requirements on other projects,

e. The Bidder's demonstrated cooperation with the Owner or the Design Consultant and other contractors on previous contracts,

f. Whether the work performed and materials furnished on previous contracts was in accordance with the Contract Documents;

5. The previous and existing compliance by the bidder with laws and ordinances relating to contracts or services;

6. The sufficiency of the financial resources and ability of the Bidder to perform the contract or provide the service;

7. The quality, availability and adaptability of the goods or services to the particular use required;

8. The ability of the Bidder to provide future maintenance and service for the warranty period of the contract;

9. Whether the Bidder is in arrears to the Owner on debt or contract or is a defaulter on surety to the Owner;

10. Whether the bidder has demonstrated a good faith effort to use M/WBE's as subcontractors;

11. Such other information as may be secured by the Owner having a bearing on the decision to award the contract, to include, but not limited to:

a. The ability, experience and commitment of the Bidder to properly and reasonably plan, schedule, coordinate and execute the Work,

b. Whether the Bidder has ever been debarred from bidding or found ineligible for bidding on any other projects.

D. The purpose of the above is to enable the Owner in its opinion, to select the lowest responsible bidder. The ability of the low Bidder to provide the required bonds will not of itself demonstrate responsibility of the Bidder.

E. The Owner reserves the right to require from the Bidder: (1) submissions of references, within seven days of bid opening, to include a listing of previous and current projects and (2) financial statements indicating current financial status, prepared in accordance with generally accepted accounting principles, by a CPA licensed to do business in North Carolina, (3)AIA Document A305 Contractor's Qualification Statement and (4) any other information deemed necessary in order to establish the responsiveness and responsibility of the bidder.

F. The Owner reserves the right to defer award of this contract for a period of forty-five (45) days after the due date of bids. During this period of time, the Bidder shall guarantee the prices quoted in his bid.

I- 23. FINAL COMPLETION AND FINAL PAYMENT REQUIREMENTS:

1. When the Design Consultant and the Owner find the Work acceptable under the Contract Documents and the Contract fully performed, they will approve a final Certificate of Payment stating that to the best of their knowledge, information and belief, and on the basis of their observations and inspections, the Work has been completed in accordance with the terms and conditions of the Contract Documents and that the entire balance found to be due the Contractor, and noted in said final Certificate, is due and payable, except for an amount mutually agreed upon for any work remaining incomplete or uncorrected for which the Owner is entitled a credit under the Contract Documents. If the Design Consultant and the Owner find the Work to be incomplete or unacceptable, the costs of reinspections shall be paid by the Contractor.

2. Final Payment shall not be made to the Contractor until all of the required project close-out documents, as listed on the Close-Out Document Checklist, have been submitted and approved.

END OF SECTION I - INFORMATION FOR BIDDERS

SECTION II

BID FORM

FOR: Wrightsboro Building 500 Kitchen and Dining HVAC Replacement
21-9230

TO: New Hanover County Schools
Facility Planning & Construction Department
6410 Carolina Beach Road
Wilmington, North Carolina 28412

FROM: _____
BIDDER

_____
ADDRESS

_____
CITY STATE ZIP

_____
PHONE FAX EMAIL ADDRESS

1. BASE BID PROPOSAL:

Having become completely familiar with the local conditions affecting the cost of work at the place where work is to be executed, and having carefully examined the site conditions as they currently exist, and having carefully examined Bidding Documents prepared by Cheatham and Associates, P.A. Consulting Engineers and titled "Wrightsboro Building 500 Kitchen and Dining HVAC Replacement".

Dated December 14, 2020 together with any addenda to such Bidding Documents as listed hereinafter, the undersigned hereby proposes and agrees to provide all labor, materials, plant, equipment, transportation and other facilities as necessary and/or required to execute all of the work described by the aforesaid Bidding Documents for the lump sum consideration of: (Bidder shall write in the amount of the base bid here)

_____ Dollars ($ _____)

Allowance _____ $5000.00

Total Base Bid _____

said amount being hereinafter referred to as the Total Base Bid or Total Base Bid Proposal.

2. ALTERNATES:

The undersigned proposes to perform alternates for stated additions to or deductions from the Base Bid. Additions and deductions shall include any modifications of work or additional work that undersigned may be required to perform by reason of the acceptance of any alternate. (Bidder shall write in the amounts for the alternates listed below)

ALTERNATE NO. 1: Duct cleaning as noted on sheet M-001.

Adjust Base Bid by ADDING _____

_____ Dollars ($ _____)

ALTERNATE NO. 2: Furnish and install new exterior safety switch disconnects as noted on sheet E-101.

Adjust Base Bid by ADDING _____

_____ Dollars ($ _____)

3. SUBCONTRACTOR LISTING

Bidders are requested to identify below the names of major subcontractors, including but not limited to contractors selected to perform the mechanical, electrical and plumbing portions of the work, and the subcontractors' respective bid prices for the work. This information is requested to be submitted at bid time.

Name of Subcontractor	Amount of Bid

4A. UNIT PRICES

No unit process used this project.

4B. ALLOWANCES

Total Base Bid includes all cash allowances listed below. Unused amounts will be credited to the Owner by Change Order at the end of the project.

Owner Allowance	$ 5,000.00

TOTAL OF ALLOWANCES: $ 5,000.00.

5. SCHEDULE / WORKING HOURS

The following dates shall be adhered to unless modified by written agreement between Owner and Contractor, and executed as a Change Order to the Contract.

Notice to Proceed: Contract Activities	February 8, 2021
Notice to Proceed: Construction Activities on Site	April 1, 2021
Substantial Completion:	April 12, 2021
Final Completion:	April 26, 2021

Owner reserves the right to withhold Notice to Proceed by up to 30 days. Contractor may not begin work until a written Notice to Proceed is issued. For each day that the Notice to Proceed is withheld pursuant to this paragraph, the dates established for Substantial and Final Completion shall be adjusted. The Contractor shall not be entitled to additional compensation if the Owner withholds the issuance of the Notice to Proceed pursuant to this paragraph.

Normal working days and hours are: Monday through Friday, 7am – 5pm, excluding school Holidays.

6. MINORITY BUSINESSES:

Please circle the Ownership category of your firm:
Non-Minority / Black / Hispanic / Asian-American / American Indian / White Female / Socially & Economically Disadvantaged.

If Ownership is Minority Female (circle):
NO – Firm is not minority owned.
YES – Firm is minority-female owned.

Source of Ownership category (certification/ verification) (circle one):
Not Applicable / State of NC HUB / State of NC DOT / Local Agency / Federal Agency / Out-of State Agency / Self-Identified / Unknown

Each Bidder shall identify on its bid the minority businesses that it will use on the project and the corresponding total dollar value of the bid. (Bidder shall write in the names and subcontract amount of minority businesses used in bid)

Name of Minority Business	Subcontract Amount
TOTAL:	

In addition to the information above, the Bidder must complete and provide with the bid one of the following affidavits:

Affidavit A – Listing of Good Faith Efforts
This affidavit documents the good faith efforts of the Bidder and is to be submitted with the bid if the Bidder is subcontracting portions of the work.

Affidavit B – Intent to Perform Contract with Own Forces
This affidavit documents the intent of the Bidder to perform the contract with its own workforce and is to be submitted with the bid if the Bidder is not subcontracting portions of the work.

NOTE: The Bidder must include either Affidavit A or Affidavit B must be submitted with the bid. Failure to include either of these affidavits may result in declaring the bid non-responsive.

7. ADDENDA ACKNOWLEDGEMENT:

The undersigned acknowledges receipt of the following addenda: (Bidder to write in the number and date appearing on each addendum received)

Addendum No.	Date	Addendum No.	Date

8. **BID SECURITY**: Bid security is not required for this project.

9. The undersigned declares that the person or persons signing this Proposal is/are fully authorized to sign on behalf of the firm listed and to fully bind the firm listed to all the Proposal's conditions and provisions thereof.

10. It is agreed that no person or persons or company other than the firm listed below or as otherwise indicated has any interest whatsoever in this proposal or the contract that may be entered into as a result of the Proposal and that in all respects the proposal is legal and firm, submitted in good faith without collusion or fraud.

11. It is agreed that the undersigned has complied or will comply with all requirements of local, state, and national laws, and that no legal requirement has been or will be violated in making or accepting this Proposal, in awarding the contract to him and/or in the prosecution of the work required.

12. It is agreed that the undersigned shall provide any information deemed necessary by the Owner to establish the responsiveness and responsibility of the bidder.

13. The undersigned acknowledges that he has received a copy of the Owner–Contractor Agreement.

14. The following information is provided pursuant to the Contract Documents:

    1. Legal Name of Firm:

    _____

    a. If Firm is a corporation, state that corporation is organized under the laws of the State of _____ Please affix corporate seal to this Form of Bid.

    b. If Firm is a partnership, state names of partners: _____

    _____

    c. If Firm is an individual using a trade name, state name of individual: _____

    _____

    2. North Carolina Contractor's License Number: _____

Respectfully submitted, this

_____ day of _____, 2021

(Signature) _____

(Name Typed) _____

(Title) _____

(SEAL IF BIDDER IS A CORPORATION)

END OF SECTION II – BID FORM

Enclosure

1. Either Affidavit A or B
2. Either Affidavit C or D

AFFIDAVIT A
Listing Of Good Faith Efforts

County of _____

Affidavit of _____
(Name of Bidder)

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 – (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.

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 North Carolina, County of_____

Subscribed and sworn to before me this _____day of _____20____

Notary Public_____

My commission expires _____

AFFIDAVIT B
Intent To Perform Contract With Own Forces

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 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 North Carolina, County of _____

Subscribed and sworn to before me this _____ day of _____ 20 ____

Notary Public _____

My commission expires _____

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AFFIDAVIT C
Portion of the Work to be Performed by Minority Firms

County of _____

(Note: this form is to be submitted ONLY by the apparent lowest responsible, responsive bidder. This form is not to be included with bid.)

If the portion of the work to be executed by minority businesses as defined in GS143-128.2(g) is equal to or greater than 10% of the bidders total contract price, then the Bidder must complete this affidavit.
Either Affidavit C or Affidavit D 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
(Name of Bidder)

on the _____
(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	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**)

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 North Carolina, County of_____

Subscribed and sworn to before me this _____day of _____20____

Notary Public_____

My commission expires _____

AFFIDAVIT D
Good Faith Efforts

County of _____

(Note: this form is to be submitted ONLY by the apparent lowest responsible, responsive bidder. This form is not to be included with bid.)

If the goal of 10% participation by minority business **is not** achieved, the Bidder must complete this affidavit.
Either Affidavit C or Affidavit D shall be provided by the apparent lowest responsible, responsive Bidder within **72 hours** after notification of being low Bidder.

Affidavit of: _____
(Name of Bidder)

I do certify the attached documentation as true and accurate representation of my good faith efforts. Attach additional sheets if required

Name and Phone Number	Minority Category	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**)

Documentation of the Bidder's good faith efforts to meet the goals set forth in these provisions. Examples of documentation include, but are not limited to, the following evidence:

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.

Date:_____ Name of Authorized Officer:_____

Signature:_____

Title:_____

SEAL

State of North Carolina, County of_____

Subscribed and sworn to before me this _____ day of _____ 20____

Notary Public_____

My commission expires _____

OWNER-CONTRACTOR AGREEMENT

THIS AGREEMENT is made this 29th day of January 2021 by and between the New Hanover County Board of Education (herein referred to as the "Owner"), whose mailing address is 6410 Carolina Beach Road, Wilmington, NC, 28412 and _____ (herein referred to as the "Contractor"), whose mailing address is _____, North Carolina _____. Correspondence, submittals, and notices relating to or required under this Agreement shall be sent in writing to the above addresses unless either party is notified in writing by the other of a change in address.

In consideration of the promises made herein and other good and valuable consideration, the following terms and conditions are hereby mutually agreed to, by and between the Owner and Contractor for the Wrightsboro Building 500 Kitchen and Dining HVAC Replacement/ 21-9230-1 project.
The following documents, if any, are attached as Exhibits to this Contract and incorporated by reference herein.
Exhibit A- Project Bid/ Proposal
Exhibit B- Scope of Work
Exhibit C- Project Schedule
Exhibit D- Sexual Offender Registry and Criminal Background Check Certification Form
Exhibit E- Allowance Expenditure Authorization Form
Exhibit F- Change Proposal Form
Exhibit G- Contractor's Sales Tax Form
Exhibit H- E-Verify

1. Scope of Services. The Contractor shall perform the Work described on Exhibit B in accordance with the schedule attached as Exhibit C. The Work shall be performed in accordance with the terms of this Agreement and any plans and specifications referenced herein, all of which are incorporated into this Agreement. The Contractor shall provide all materials, tools, equipment, and labor, and supply all other services and things necessary to fully and properly perform and complete the Work as required by this Agreement. The Contractor shall perform the Work in compliance with all governmental laws and regulations. The Contractor shall also, unless otherwise specified, supply and pay for all transportation, utilities, fuel, sanitary facilities, and incidentals necessary for the completion of the Work, and be responsible for the safe, proper and lawful construction of the Work, and shall perform the Work in the best and most workmanlike manner, as shown on or stated in any plans or specifications referenced herein, or reasonably implied therefrom. All materials shall be new and of quality specified. 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 any plans or specifications referenced herein. The Contractor shall keep the site and surrounding area reasonably free from rubbish at all times. Before final inspection and acceptance of the Work, the Contractor shall thoroughly clean the site, and completely prepare the Work and site for use by the Owner. The Contractor shall commence the Work promptly upon the date established in the Notice to Proceed and achieve Substantial and Final Completion by the dates established below.
2. Representation of the Contractor. In order to execute this Agreement and recognizing that the Owner is relying thereon, the Contractor, by executing this Agreement, makes the following express commitments to the Owner:
   (A) The Contractor is fully qualified and licensed to act as the Contractor for the full scope of work for this Project and shall maintain any and all licenses, permits, insurance, and any authorizations necessary to act as the contractor.
   (B) The Contractor has become familiar with the Project site and all conditions under which the Project is to be constructed and has identified to the Owner any and all issues.
   (C) The Contractor has received and carefully reviewed all contract documents as listed above in Paragraph 1 and has found them complete, accurate, adequate, and sufficient for construction.
   (D) The Contractor warrants title of all material, supplies, and equipment installed or incorporated into this Project and agrees upon completion of all work delivered to Owner free of any claims, liens, and charges.
3. Payments. Provided that the Contractor shall strictly and completely perform all of its obligations under this Agreement, the Owner shall pay the Contractor $_____. No compensation shall be paid for any additional work that is not approved in advance by the Owner. One progress payment per month, if any, may be made by the Owner to the Contractor only after certification that a portion of the Work is complete. Under no circumstances will the Owner make more than one payment per month. The Owner shall pay the Contractor within thirty (30) business days following approval of a payment request. Each payment request shall be signed by the Contractor and shall constitute the Contractor's surety that the quantity of work has reached the level for which payment is requested, that the work has been properly installed or performed in strict conformance with the requirements of this Agreement, and that the Contractor knows of no reason why payment should not be made as requested. The submission of a payment request also constitutes an affirmative representation and warranty that all work is free and clear of any lien, claim, or other encumbrance upon payment from the Owner. Final payment will be withheld until Contractor has provided Owner with copies of all Operation and Maintenance (O & M) Manuals and warranties applicable to the Work.

   If requested by the Owner, the Contractor shall provide to the Owner a Schedule of Values for approval apportioning the Contract Price among the different elements of the Project for purposes of periodic and final payment within ten (10) calendar days of the date of commencement. The Schedule of Values shall be presented in enough detail to adequately apportion the contract to allow for breakdown of payments and shall include overhead and profit within each item. The Contractor's schedule of values shall not inflate any portion of the work. The Contractor acknowledges that the same documentation required for a Change in the Work shall be provided as backup for the Allowance Expenditure Authorization Form (Exhibit E).

The amount of each payment request shall be computed as follows:

(A) take that portion of the Contract Sum properly allocable to completed Work as determined by multiplying the percentage completion of each portion of the Work by the share of the Contract Sum allocated to that portion of the Work in the schedule of values, less maximum retainage allowed by law. Pending final determination of cost to the Owner of changes in the Work, amounts not in dispute shall be included as amended;
(B) add that portion of the Contract Sum properly allocable to materials and equipment delivered and suitably stored at the site for subsequent incorporation in the completed construction (or, if approved in advance by the Owner, suitably stored off the site at a location agreed upon in writing), less maximum retainage allowed by law;
(C) subtract the aggregate of previous payments made by the Owner; and
(D) subtract amounts, if any, for which the Owner has withheld or nullified a Certificate for Payment.

When payment is received from the Owner, the Contractor shall promptly pay all subcontractors, materialmen, laborers, and suppliers the amounts that are due for the work covered by such payment. In the event the Owner becomes informed that the Contractor has not paid these parties, the Owner has the right to issue future payments to the Contractor less the amounts owed to any subcontractor, supplier, or laborer. Continued claims for by subcontractors for lack of payment may be deemed a breach of this Agreement by the Contractor.

The Owner shall have the right to refuse to make payment and, if necessary, demand the return of a portion or all of the amount previously paid to the Contractor due to:

(A) the quality of a portion, or all, of the contractor's work is not in accordance with the requirements of this contract;
(B) the quantity of the Contractor's work not being as represented by the contractor's payment request;
(C) the contractor's rate of progress being such that in the Owner's opinion, will not provide for final completion as required by this Contract;
(D) the Contractor's failure to adequately keep records of as-built conditions; and
(E) the Contractor's failure to use payments to pay project related obligation including but not limited to subcontractors, laborers, and material and equipment suppliers.

4. Substantial and Final Completion. When Substantial Completion has been achieved, the Contractor shall notify the Owner in writing that he/she is ready for a pre-final punchlist. At this time, the Contractor shall have already conducted its own internal punchlist of the completed work. The Owner and/or Design Consultant shall conduct an inspection of the completed and provide a written list of unfinished items or items in need of correcting. The Contractor shall bear the cost of any and all corrections of incomplete work, correcting and bringing into conformance all defective or nonconforming work. The Contractor shall notify the Owner when all nonconforming work has been completed and is ready for final inspection and subsequent final payment. If the Contractor feels it is outside of their control to finish the Work within the time prescribed, they must submit proper reasoning to the Owner in writing and at that time it is the Owner's discretion to accept or reject the request.

   Prior to being entitled to receive final payment, the Contractor shall furnish the Owner:

   (A) an affidavit that all of the Contractor's obligations to subcontractors, laborers, equipment and material suppliers, or other third parties involved in the Project, have been paid or otherwise satisfied;
   (B) waiver of right of claim against the Surety bond; and
   (C) all product warranties, operating manuals, instruction manuals, record drawings, test results, and other documents expressly required to complete the Project.

5. Date of Commencement and Substantial Completion. The Contractor shall commence the performance of this Agreement on the date of this contract and diligently continue its performance until final completion. The contract time shall be measured from the date of commencement and the Contractor shall achieve Substantial Completion of the entire Work not later than April 12, 2021, 10:00 a.m. The Contractor shall achieve Final Completion within 14 days of date established above for Substantial Completion.

6. Changes in the Work. If the Owner elects to have a change in the Work performed on a lump sum or a time and material basis, the same shall be performed by the Contractor. The Contractor shall submit to the Owner complete documentation supporting the cost of the change in the Work in a format acceptable to the Owner. The Change Proposal Form attached as Exhibit F shall be used to submit change proposals on the Project. The Owner may require authentication of all time and material tickets and invoices prior to payment for the change in the Work. The failure of the Contractor to provide any required documentation shall constitute a waiver by the Contractor of any claim for the cost of that portion of the change in the Work. Up to 15% of direct material and labor costs can be applied as overhead and profit for the Contractor or any Subcontractor actually performing the work (said overhead and profit to include all small tools), and may further include the reasonably anticipated rental costs in connection with the Change in the Work, plus up to 8% thereof as overhead and profit. The Contractor and/or subcontractor may include up to 8% markup on any Change in the Work performed by a lower-tiered subcontractor. Payroll costs are limited to 39% of the net pay of the worker. Overhead and profit shall not be applied by the entity performing the work to labor burden, any sales and use tax paid for any purpose, or to any transportation or shipping costs incurred by the Contractor or any Subcontractor. Any change in the contract sum resulting from a Change Order shall be mutually agreed upon by the Contractor and the Owner together with any conditions relating thereto. If no mutual agreement can be reached between the Owner and the Contractor, the change in contract price, if any, shall be derived by the Owner determining reasonable actual costs incurred or saved.

7. Insurance. The Contractor shall obtain and maintain in effect during the term of this Agreement, general liability and automobile liability insurance in which the Owner and the Contractor shall each be named as insured parties in an amount not less than $1,000,000, with a $2,000,000 aggregate, for personal injury, including death, to any one person, and from claims for property damages in an amount of not less than $1,000,000 for each occurrence arising from any act or omission of Contractor, its agents, employees or subcontractors. The Contractor shall obtain and maintain in effect during the term of this Agreement a policy or policies of workers' compensation insurance which shall cover all of Contractor's employees and all individuals who enter onto Owner's property on behalf of Contractor pursuant to this Agreement. The Contractor shall promptly furnish to the Owner certificates of insurance evidencing such insurance coverage. Insurance required by this section shall contain an endorsement to provide the Owner at least 10-day's written notice of any intent to cancel or terminate by either the Contractor or insurance company. Contractor's Worker's Compensation policy shall contain an endorsement waiving subrogation against Owner. All such insurance policies shall be provided by insurance companies properly licensed in North Carolina and having a financial rating of at least "A" by A.M. Best or equivalent.

8. Hold Harmless. To the fullest extent allowed by law, the Contractor shall indemnify and hold the Owner harmless from and against any and all losses, liabilities, claims, lawsuits, judgments, and demands whatsoever, including costs of investigation (including reasonable legal fees and all costs) caused by any act or omission or intentional wrongdoing of the Contractor or its agents, employees or subcontractors. The parties agree that this indemnification clause is an "evidence of indebtedness" for purpose of N. C. Gen. Stat. § 6-21.2 and shall survive the termination, completion or expiration of this Agreement.

9. Codes, Permits and Applicable Laws. The Contractor shall at Contractor's expense obtain the required permits, give all notice and comply with all laws, ordinances, codes, rules, regulations and Owner's policies bearing on the conduct of the Work under this Agreement. If the Contractor observes that the drawings and specifications are at variance therewith, Contractor shall promptly notify the Owner in writing. If the Contractor performs any Work knowing (or under circumstances in which Contractor ought to have known) it to be contrary to such laws, ordinances, codes, rules and regulations. Contractor shall bear all cost arising therefrom. This Agreement and the relationship of the parties shall be construed under the laws of the state of North Carolina. Contractor shall not employ any individuals to provide services to the Owner who are not authorized by federal law to work in the United States. Contractor represents and warrants that it is aware of and in compliance with the Immigration Reform and Control Act and North Carolina law (Article 2 of Chapter 64 of the North Carolina General Statutes) requiring use of the E-Verify system for employers who employ twenty-five (25) or more employees and that it is and will remain in compliance with these laws at all times while providing services pursuant to this Agreement. Contractor certifies that as of the date of this Agreement, Contractor is not listed on the Final Divestment List created by the North Carolina State Treasurer pursuant to N.C. Gen. Stat. § 147-86.58.

10. Safety Requirements. The Contractor shall be responsible for the Work area and the construction of the Work and provide all the necessary protections as required by laws, rules, regulations or ordinances governing such conditions and as required by the Owner. He shall be responsible for any damage Contractor or Contractor's employees, agents, suppliers or subcontractors cause to the Owner's property or that of others on the job and shall promptly repair any such damage. The Contractor shall clearly mark or post signs warning of hazards existing, and shall barricade excavations and similar hazards. Contractor shall maintain all necessary protective devices and signs throughout the progress of the Work.

11. Warranties. The Contractor guarantees and warrants to the Owner all Work as follows: that all materials and equipment furnished under this Agreement will be new and the best of its respective kind unless otherwise specified; that all Work will be of good quality in accordance with the industry standards; that the Work will be free of omissions and poor quality, defective material or workmanship; that the Work, including but not limited to, mechanical and electrical devices and equipment, shall be fit and fully usable for its intended and specified purpose and shall operate satisfactorily with ordinary care; that the products or materials incorporated in the Work will not contain asbestos; and that all subcontractors, agents or employees of Contractor will be fully qualified, possess any requisite licenses, and otherwise be legally entitled to perform the services provided. If, within one year (two years for painting) after the date of completion of the Work or designated portion thereof or within one year after acceptance by the Owner of designated equipment or within such longer period of time as may be prescribed by law or by the terms of any applicable special warranty required by this Agreement, any of the Work is found to be defective, not in accordance with this Agreement, or not in accordance with the guarantees and warranties specified in this Agreement, the Contractor shall correct it within five (5) working days or such other period as mutually agreed, after receipt of a written notice from the Owner to do so. For items which remain incomplete or uncorrected on the date of Substantial Completion, the one-year warranty shall begin on the date of Final Completion of the Work.

12. Termination for Convenience. The Owner may terminate this Agreement at any time in its complete discretion upon ten (10) days written notice. In the event of a termination for convenience, all finished or unfinished work and materials pursuant to this Agreement shall be turned over to the Owner and become its property. If the Agreement is terminated by the Owner in accordance with this section, the Owner shall only be responsible for paying Contractor for Work performed and accepted and materials delivered to the site as of the date of termination. In the event of a termination for convenience by Owner, Contractor's warranty shall still apply to all portions of the Work and all equipment installed by Contractor prior to termination.

13. Lunsford Act/Criminal Background Checks. Contractor acknowledges that G.S. § 14-208.18 prohibits anyone required to register as a sex offender under Article 27A of Chapter 14 of the General Statutes from knowingly being on the premises of any school. Contractor

shall provide certification, on the form attached as Exhibit D, that it has conducted sexual offender registry checks and criminal background checks on each of its owners, employees, agents and subcontractors who will engage in any service on or delivery of goods to Owner's property (sex offender checks can be conducted at no cost at *http://www.nsopw.gov/*). Contractor shall not assign or allow any individual to deliver goods or provide services on Owner's property if said individual appears on any of the listed sex offender registries or who has ever had any of the following criminal convictions, or similar criminal convictions, without receiving prior written permission from Owner, which Owner may withhold in its reasonable discretion: murder, rape, sexual offense, sexual assault, statutory rape, indecent liberties with a minor, child abuse, kidnapping, abduction, manufacture, sale or delivery of controlled substances, assault with a deadly weapon, assault inflicting serious bodily injury, manslaughter, trafficking or exploitation of minors or felony level burglary, robbery, embezzlement, theft or larceny.

14. Anti-Nepotism. Contractor warrants that, to the best of its knowledge and in the exercise of due diligence, none of its corporate officers, directors, or trustees and none of its employees who will directly provide services under this Agreement are immediate family members of any member of the Owner's Board of Education or of any principal or central office staff administrator employed by such Board. For purposes of this provision, "immediate family" means spouse, parent, child, brother, sister, grandparent, or grandchild, and includes step, half, and in-law relationships. Should Contractor become aware of any family relationship covered by this provision or should such a family relationship arise at any time during the term of this Agreement, Contractor shall immediately disclose the family relationship in writing to the Superintendent of the Schools. Unless formally waived by the Owner, the existence of a family relationship covered by this Agreement is grounds for immediate termination by Owner without further financial liability to Contractor.

15. Entire Agreement. All of the representations and obligations of the parties are contained herein, and no modification, waiver or amendment of this Agreement or of any of its conditions or provisions shall be binding upon a party unless in writing signed by both parties. The waiver by any party of a breach of any provision of this Agreement shall not operate or be construed as a waiver of any subsequent breach of that provision by the same party, or of any other provision or condition of the Agreement. If any section, subsection, term or provision of this Agreement or the application thereof to any party or circumstance shall, to any extent, be invalid or unenforceable, the remainder of said section, subsection, term or provision of the Agreement or the application of the same to parties or circumstances other than those to which it was held invalid or unenforceable, shall not be affected thereby and each remaining section, subsection, term or provision of this Agreement shall be valid or enforceable to the fullest extent permitted by law.

16. Risk of Loss. Contractor shall bear the risk of loss in the event that any of the Work is stolen, lost damaged or destroyed prior to Final Completion of the Work and acceptance by Owner, unless caused by the intentional or reckless acts of Owner or Owner's authorized agents. If any of the Work is stolen, lost, damaged, or destroyed prior to Final Completion of the Work and acceptance by the Owner, due to any reason except the intentional or reckless acts of Owner or Owner's authorized agents, Contractor shall bear the full cost of repairing or replacing all such Work, including all equipment and materials.

17. Interpretation of Agreement. Contractor and Owner acknowledge that the Agreement shall not be construed against Owner due to the fact that it may have been drafted by Owner. For purposes of construing this Agreement, both Contractor and Owner shall be considered to have jointly drafted the Agreement.

18. Taxes. The Contractor shall pay all sales, consumer, use and other similar taxes for the Work or portions thereof provided by the Contractor which are legally enacted at the time bids are received, whether or not yet effective. The Contractor shall indemnify and hold the Owner harmless from any claims arising out of the Contractor's failure to pay all required taxes, including claims by the county for its inability to recover taxes that were not properly paid to the State of North Carolina by the Contractor. With each payment request the Contractor shall submit to the Owner a completed Contractor's Sales Tax Report, attached hereto as Exhibit G.

19. Substantial Completion Liquidated Damages. Should the Contractor fail to substantially complete the Work on or before the date stipulated for Substantial Completion (or such later date as may result from extension of time granted by Owner), he shall pay the Owner or the Owner may deduct and retain from the contract balance **$ 250.00** per day for each consecutive calendar day that terms of the Contract remain unfulfilled beyond the date allowed by the Contract, which sum is agreed upon as a reasonable and proper measure of damages which the Owner will sustain per day by failure of the Contractor to complete work within time as stipulated; it being recognized by the Owner and the Contractor that the injury to the Owner which could result from a failure of the Contractor to complete on schedule is uncertain and cannot be computed exactly. In no way shall costs for liquidated damages be construed as a penalty on the Contractor.

20. Notice. All notices shall be in writing and shall be deemed submitted if mailed or emailed to the representatives as listed below at the respective addresses:

The Owner's Representative:	**The Contractor's Representative:**
(Insert name/ email address of NHCS PM)	**(Insert name/ email address of Contractor Rep)**

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

IN WITNESS WHEREOF, the Owner has caused this Agreement to be signed and the Contractor has caused this Agreement to be signed by a person with the authority to enter this Agreement, as hereinafter attested, all as of the day and year first above written.

NEW HANOVER COUNTY BOARD OF EDUCATION	**NAME OF CONTRACTOR**
_____	_____
_____	_____
Director, Facility Planning and Construction	(Insert title)

This instrument has been preaudited in the manner required by the School Budget and Fiscal Control Act.

Finance Officer _____ Date _____

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Exhibit A

Project Bid/ Proposal

(Reference contractor's bid / proposal here and attach a copy. Also include lists of any accepted alternates, allowances, unit prices, etc.)

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Exhibit B

Scope of Work

The scope of work for this project is based on the following:

(insert list of documents, plans, specifications, and addenda, and include dates for all)

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Exhibit C

Project Schedule

Notice to Proceed: Contract Activities	February 8, 2021
Notice to Proceed: Construction Activities on Site	April 1, 2021, 2:00 p.m.
Substantial Completion:	April 12, 2021, 10:00 a.m.
Final Completion:	April 26, 2021

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Exhibit D

Sexual Offender Registry and Criminal Background Check Certification Form

Check the appropriate box to indicate the type of check:
□ Initial
□ Supplemental
□ Annual

I, _____ (insert name), _____ (insert title) of _____ (insert company name) hereby certify that I have performed all of the required sexual offender registry and criminal background checks required under this Agreement for all contractual personnel (employees, agents, ownership personnel, or contractors) who may be used to deliver goods or provide services under this Agreement, including the North Carolina Sex Offender and Public Protection Registration Program, the North Carolina Sexually Violent Predator Registration Program, and the National Sex Offender Registry. I further certify that none of the individuals listed below appears on any of the above-named registries or has any criminal conviction listed in the Agreement, and that I will not assign any individual to deliver goods or perform services under this Agreement if said individual appears on any of the sex offender registries or has any criminal conviction listed in the Agreement, without the prior written permission of Owner . I agree to maintain all records and documents associated with these registry and criminal background checks, and that I will provide such records and documents to the Owner upon request. I specifically acknowledge that the Owner retains the right to audit these records to ensure compliance with this section at any time in the Owner's sole discretion. I acknowledge that I am required to perform these checks and provide this certification form before any work is performed under the Agreement (initial check), any time additional contractual personnel may perform work under the Agreement (supplemental check), and at each anniversary date of the Agreement (annual check).

	Contractual Personnel Names	**Job Title**
1.	_____	_____
2.	_____	_____
3.	_____	_____
4.	_____	_____
5.	_____	_____

(attach additional page(s) if needed)

I attest that the forgoing information is true and accurate to the best of my knowledge.

_____ (print name) _____ (signature)

_____ (title) _____ (date)

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Exhibit E

NEW HANOVER COUNTY SCHOOLS
ALLOWANCE EXPENDITURE AUTHORIZATION (AEA)

OWNER
ARCHITECT
CONTRACTOR

PO #:

PROJECT:
Wrightsboro Building 500
Kitchen and Dining HVAC
2716 Castle Hayne Road
Wilmington, NC 28401

AEA NO.:

DATE:

NHCS PROJECT NO: 21-9230

CONTRACTOR:
(Name & Address)

CONTRACT DATED:

CONTRACT FOR: Mechanical

Original Contract Allowance Amount(s): $5,000.00

Current Contract Allowance Amount(s): $5,000.00

(Attach Work Change Proposal Request(s) and associated documentation)

CPR 1- xxxxx
CPR 2- xxxxx

A. Description of Contract Allowance utilized for this Authorization:	**Unforeseen Work**
B. Original Contract Allowance amount:	$
C. Contract Allowance Expenditures previously authorized:	$
D. Contract Allowance will be [increased][decreased] by this Authorization:	$
E. Contract Allowance balance including this Authorization	$

Approval Recommended:	Owner Approval:	Contractor Acceptance:
ENGINEER: Cheatham & Assoc., P.A.	**OWNER:** New Hanover County Schools	**CONTRACTOR:**
ADDRESS: 3412 Enterprise Drive Wilmington, NC 28401	**ADDRESS:** 6410 Carolina Beach Road Wilmington, NC 28412	**ADDRESS:**
BY: (Signature)	**BY:** Leanne N. Lawrence (Signature)	**BY:** (Signature)
DATE:	**DATE:**	**DATE:**

Note: The Allowance Expenditure Authorization is not a Change Order and does not modify Contract Sum or contract time. Upon signature by all parties, this document becomes immediately effective.

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EXHIBIT F
CHANGE PROPOSAL FORM

Project:	Wrightsboro Building 500 HVAC Kitchen and Dining Replacement	**Proposal #:**	
Contract:	21-9230-1	**Project #:**	21-9230
Contractor:		**Contractor #:**	

Description of change:

					SUBTOTALS
Materials	(Attach list with Qty, Item, Unit $, Unit mh, Total mh, OT mh, Total $)				
1	Total Direct Cost of Materials			**$0.00**	
2	Overhead & Profit on Item 1.			**$0.00**	
	(15% maximum, includes small tools & consumables)				
3	Sales Tax			**$0.00**	
4	Shipping & Transportation			**$0.00**	**$0.00**
Labor					
5	Total Manhours:	**0** MH @	**$0.00** /hr.	**$0.00**	
6	Overhead & Profit on Item 5.			**$0.00**	
	(15% maximum on straight labor cost, not premium portion)				
	(O & P includes supervisor's time)				
7	Payroll Taxes & Insurance	**39.0%**		**$0.00**	**$0.00**
	(on item 5 only)				
Equipment Rental	(Include quotes)				
8	Equipment Rental			**$0.00**	
9	Overhead & Profit on Item 8.			**$0.00**	**$0.00**
	(8% maximum)				
Subcontractors	(Include quotes with material & equipment backup)				
10	Subcontractors			**$0.00**	
11	Overhead & Profit on Item 10.			**$0.00**	**$0.00**
	(8% maximum)				

		Subtotal of Proposal	**$0.00**
Bonds/ Insurance	**2%**		**$0.00**
		TOTAL OF CHANGE PROPOSAL	**$0.00**

Time Extension Requests: ____ day(s) Schedule Activity # Affected: _____

The Contractor agrees to perform the work outlined in this change proposal for the amount specified above and in accordance with the Contract documents if the work is authorized by the Owner.

Contractor's Signature: _____ _____ **Date:** _____

Approval Recommended by Design Consultant: _____ _____ **Date:** _____

Owner's Representative Approval: _____ _____ **Date:** _____

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EXHIBIT G

CONTRACTOR'S SALES TAX REPORT
N.C. STATE & LOCAL SALES TAXES PAID

OWNER: _____ **PROJECT:** _____

CONTRACTOR: _____ **FOR PERIOD:** _____

ADDRESS: _____ **TO:** _____

VENDOR NAME	ADDRESS	MATERIAL PURCHASED	INVOICE NUMBER	INVOICE DATE	INVOICE AMOUNT	N.C. TAX	COUNTY TAX	NAME OF COUNTY
				Totals				

I hereby certify that, during the period stated above, North Carolina sales and use taxes were paid as listed above, with respect to building materials, supplies, fixtures, and equipment which have become a part of, or annexed to, a building or structure erected, altered or repaired for the New Hanover County Schools, and the vendors from whom the property was purchased, the dates, numbers and amounts of the invoices covering the purchases, and the North Carolina sales and use taxes paid thereon. Also include the cost of property withdrawn from warehouse stock and North Carolina sales or use taxes paid thereon.

By:_____ **Title:** _____

Sworn to and Subscribed before me, this _____ day of _____, 20___.

_____, Notary. My Commission Expires: _____

Form revised 8/1/18

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Exhibit H

E-VERIFY AFFIDAVIT

STATE OF _____

COUNTY OF _____

I, _____ (the individual attesting below), being duly authorized by and on behalf of _____ (hereinafter "Employer") after first being duly sworn hereby swears or affirms as follows:

1. Employer understands that E-Verify is the federal E-Verify program operated by the United States Department of Homeland Security and other federal agencies, or any successor or equivalent program used to verify the work authorization of newly hired employees pursuant to federal law in accordance with NCGS §64-25(5).
2. Employer understands that Employers Must Use E-Verify. Each employer, after hiring an employee to work in the United States, shall verify the work authorization of the employee through E-Verify in accordance with NCGS §64-26(a).
3. Employer is a person, business entity, or other organization that transacts business in this State and that employs 25 or more employees in this State. (Mark "Yes" or "No")
   a. YES _____
   b. NO _____
4. Employer's subcontractors will comply with E-Verify, and Employer will ensure compliance with E-Verify by any and all subcontractors subsequently hired by Employer.

This _____ day of _____, 20_____.

_____
Signature of Affiant

Print or Type Name: _____

State of _____

County of _____

Signed and sworn to (or affirmed) before me, this the _____ day of _____, 20_____.

My Commission Expires: _____

_____
Notary Public

Seal

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SECTION IV

MINORITY BUSINESS PARTICIPATION

It is the policy of the Owner to encourage the use of minority businesses in all school construction contracts and to have a verifiable goal of ten percent (10%) participation by minority businesses in the total value of the work. It is the intent of this policy that the Owner, as awarding authority for school construction projects, and all Contractors and Subcontractors performing the construction contracts awarded shall cooperate and in good faith do all things legal, proper, and reasonable to achieve the verifiable goal of ten percent (10%) participation. The Bidder shall make a good faith effort to utilize minority businesses per the requirements of Section I – Information to Bidders, Article I-8.

N.C. Division of Purchasing and Contract's Office for Historically Underutilized Businesses maintains a list of registered companies. Searches can be completed at https://www.ips.state.nc.us/vendor/searchvendor.aspx?t=h. Additionally, the N.C. Interactive Purchasing System is a free online Internet service for companies to do business with the state. The web address is http://www.ips.state.nc.us/ . Questions for the NC office of Historically Underutilized Businesses or IPS should be directed to the help desk (984) 236-0130 or email huboffice.doa@doa.nc.gov .

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SECTION V

MISCELLANEOUS FORMS

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AFFIDAVIT E

MBE DOCUMENTATION FOR CONTRACT PAYMENTS

Prime Contractor/Architect: _____

Address & Phone: _____

Project Name: _____

SCO Project ID: _____

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	* TYPE OF MBE	AMOUNT PAID THIS MONTH (With This Pay App)	TOTAL PAYMENTS TO DATE	TOTAL AMOUNT COMMITTED

*Minority categories: Black (B), Hispanic (H), Asian American (AA), American Indian (AI), White Female (WF), Socially and Economically Disadvantaged (SED)

Approved/Certified By:

_____ _____

Name Title

_____ _____

Date Signature

SUBMIT WITH EACH PAY REQUEST - FINAL PAYMENT - FINAL REPORT

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New Hanover County Schools
Engaging Students, Achieving Excellence

2020-2021 Traditional Calendar

Approved 6/16/20

July 2020

S	M	T	W	T	F	S
			1	2	3	4
5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30	31	

August 2020

S	M	T	W	T	F	S
						1
2	3	4	5	6	7	8
9	10	11	12	13	14	15
16	17	18	19	20	21	22
23/30	24/31	25	26	27	28	29

September 2020

S	M	T	W	T	F	S
		1	2	3	4	5
6	7	8	9	10	11	12
13	14	15	16	17	(18)	19
20	21	22	23	24	25	26
27	28	29	30			

October 2020

S	M	T	W	T	F	S
				1	2	3
4	5	6	7	{8}	9	10
11	12	13	14	15	16	17
18	19	20	21	22	23	24
25	26	27	28	29	30	31

November 2020

S	M	T	W	T	F	S
1	2	3	4	5	6	7
8	9	10	11	12	(13)	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30					

December 2020

S	M	T	W	T	F	S
		1	2	3	4	5
6	7	8	9	10	11	12
13	14	15	16	17	18	19
20	21	22	23	24	25	26
27	28	29	30	31		

JULY
3.....July 4th Holiday

AUGUST
10-12.....Designated Teacher Workdays
13-14.....Undesignated Teacher Workdays
17.....First Day of School
17-19.....Staggered Enrollment

SEPTEMBER
7.....Labor Day
18.....Interim Reports

OCTOBER
2.....End of Grading Period
5.....Designated Teacher Workday
8.....Report Cards

NOVEMBER
3.....Election Day/ Undesignated Teacher Workday
11.....Veterans Day Holiday
13.....Interim Reports
25.....Vacation Day
26-27.....Thanksgiving Holidays

DECEMBER
17.....End of The Grading Period
18.....Designated Teacher Workday
21-22.....Undesignated Teacher Workdays
23.....Vacation Day
24-28.....Christmas Holidays
29-31.....Vacation Days

JANUARY
1.....New Year's Day Holiday
4-8.....Remote Learning Days
13.....Report Cards
18.....Martin Luther King, Jr. Holiday

FEBRUARY
5.....Interim Reports

MARCH
4.....End of The Grading Period
5.....Designated Teacher Workday
10.....Report Cards

APRIL
2.....Good Friday Holiday
5-9.....Spring Break
23.....Interim Reports

May
27.Last Day&Half Day for Students/End of Grading Period
28.....Designated Teacher Workday
29.....High School Graduation
31.....Memorial Day Holiday

JUNE
1-2.....Designated Teacher Workdays
3-4.....Undesignated Teacher Workdays
9.....Report Cards Mailed

First/Last Day of School · Undesignated Teacher Workday · Designated Teacher Workday · Holiday
Vacation Day · RLD · Half Day for Students · ( ) Interim Reports · Staggered Enrollment · { } Report Cards

January 2021

S	M	T	W	T	F	S
					1	2
3	4	5	6	7	8	9
10	11	12	{13}	14	15	16
17	18	19	20	21	22	23
24/31	25	26	27	28	29	30

February 2021

S	M	T	W	T	F	S
	1	2	3	4	(5)	6
7	8	9	10	11	12	13
14	15	16	17	18	19	20
21	22	23	24	25	26	27
28						

March 2021

S	M	T	W	T	F	S
	1	2	3	4	5	6
7	8	9	{10}	11	12	13
14	15	16	17	18	19	20
21	22	23	24	25	26	27
28	29	30	31			

April 2021

S	M	T	W	T	F	S
				1	2	3
4	5	6	7	8	9	10
11	12	13	14	15	16	17
18	19	20	21	22	(23)	24
25	26	27	28	29	30	

May 2021

S	M	T	W	T	F	S
						1
2	3	4	5	6	7	8
9	10	11	12	13	14	15
16	17	18	19	20	21	22
23/30	24/31	25	26	27	28	29

June 2021

S	M	T	W	T	F	S
		1	2	3	4	5
6	7	8	{9}	10	11	12
13	14	15	16	17	18	19
20	21	22	23	24	25	26
27	28	29	30			

New Hanover County Schools
IMPORTANT CONTACTS

PRE-K CENTERS

Howe Pre-K Center.....251-6195
Johnson Pre-K Center 251-6155
CRA @ Mosley Pre-K Center.....251-6161

ELEMENTARY

Alderman..... 350-2031
Anderson..... 798-3311
Bellamy 350-2039
Blair..... 350-2045
Bradley Creek 350-2051
Carolina Beach..... 458-4340
Castle Hayne..... 602-4970
Codington (Year-Round)790-2236
College Park..... 350-2058
CRECC 350-7860
Eaton (Year-Round)..... 397-1544
Forest Hills 251-6190
Freeman(Year-Round).. 251-6011
Gregory 251-6185
Holly Tree..... 790-2250
Lake Forest Academy ... 772-2515
Murrayville..... 790-5067
Ogden 686-6464
Parsley..... 790-2355
Pine Valley 350-2121
Porters Neck.....251-2975
Snipes (Year-Round) 251-6175
Sunset Park (Year-Round)815-6948
Williams..... 350-2150
Winter Park 350-2159
Wrightsboro..... 815-6909
Wrightsville Beach..... 256-3171

MIDDLE SCHOOLS

Holly Shelter 602-4046
International School at Gregory....251-6185
JC Roe Center.....395-4472
Lake Forest Academy.....772-2515
Murray 790-2363
Myrtle Grove 350-2100
Noble 350-2112
Roland-Grise 350-2136
Trask.....350-2142
Williston 815-6906

HIGH SCHOOLS

Ashley.....790-2360
CRA @ Mosley PLC.....251-6161
Hoggard 350-2072
Isaac Bear Early College 350-1387
JC Roe Center.....395-4472
Laney 350-2089
NHHS.....251-6100
SEA-Tech.....530-6300
Wilmington Early College.....362-7789

BOARD OF EDUCATION

Stefanie Adams, Chairman
David L. Wortman, Vice-Chair
Nelson Beaulieu
Lisa Estep
Judy Justice
Jeannette S. Nichols
Bill Rivenbark
Administrative Asst. to the Board 254-4280

NHCS CENTRAL OFFICE CONTACTS

Central Office Main Switchboard 254-4200
Board of Education..... 254-4280
Superintendent's Office..... 254-4219
Human Resources 254-4232
Instruction & Accountability 254-4314
Arts Education 254-4237
Career Technical 254-4241
Family Life 254-4300
Hispanic Liaisons 254-4202
Pre-K..... 254-4390
Operations..... 254-4243
Public Relations 254-4245
NHCS-TV..... 254-4180
Special Education-Related Services . 254-4454
Student Support Services..... 254-4207
Athletics 254-4207
Counselors..... 254-4346
Driver's Education..... 254-4292
Safe & Drug Free Schools 251-6161
Student Enrollment 251-2929
Transcripts 254-4234
Transportation (Bus Routes) 254-4080
School Nurses.....798-6900

CENTRAL OFFICE LOCATIONS

Administration Building
6410 Carolina Beach Road
Wilmington, NC 28412
(910) 254-4200
Dale K. Spencer Building
1802 South 15th Street
Wilmington, NC 28401
(910) 254-4179
Carolina Beach Road Operations Complex
2814 Carolina Beach Road
Wilmington, NC 28412
(910) 254-4288

COMMUNITY CONTACTS

Amigos International.....341-0007
Brigade Boys & Girls Club.....791-4282
CFCC..... 362-7000
Cape Fear Museum..... 798-4370
Community Advancement Through Mentoring 231-9530
Community Boys & Girls Club..... 762-1252
Communities In Schools..... 343-1901
Kids Making It.....763-6001
NHC Council of PTAs.....264-0547
NHC Social Services.....798-3400
NHC Health Dept..... 798-6500
NHC Libraries—Main..... 798-6300
Carolina Beach.....798-6380
Pine Valley..... 798-6390
Northeast..... 798-6370
New Hanover Health Network..... 343-7000
Smart Start.....815-3731
Southeastern Center Mental Health 251-6440
The Carousel Center (Child Advocacy Center).....254-9898
UNCW.....962-3000
United Way.....798-3900
Voces Latinas..... 762-1870
Wilmington Health Access for Teens.....790-9949
YMCA.....251-9622
YWCA.....799-6820
Other Contacts

_____
_____

The mission of New Hanover County Schools, in collaboration with our parents and the community, is to strive to provide children with an opportunity for a superior education in a safe and positive learning environment where they are prepared with the skills to succeed.

New Hanover County Schools

Engaging Students, Achieving Excellence

SCHOOL CLOSINGS

School Closings: Closings and/or delays are posted at www.nhcs.net and announced by Connect5 calls, local TV and radio stations.

For more information about NHCS, log onto the web
www.NHCS.net

No School for Pre-K Students on Traditional Half Days
Staff Development Day:

Early Dismissal for Students:
Elementary @ 12:00 noon & Secondary @ 1:00 p.m

CLOSE-OUT DOCUMENT CHECKLIST

Project: Wrightsboro Building 500 Kitchen and Dining HVAC Replacement

Project Number: 21-9230

Contractor: _____

Substantial Completion Date: _____

Note: When all of the following close-out documents have been completed and received, this checklist should be completed Copies of the documents or the originals, as indicated by the asterisks, should be attached and the checklist should accompany the final application for payment. The checklist with attachmentsd will be filed in the project's "F" file following approval of the final application for payment.

√ COMPLETE	RESPONSIBILITY	DOCUMENTATION	**Responsibility: S = School System, A = Architect, C = Contractor** **Documentation: * = Original Document to be attached ** Copy of the Cover Document attached**
	S	**	Fully executed Contract
	S	**	Fully executed Certificate of Substantial Completion with attached punchlist
	A/S	**	Fully Executed Final Change Order (i.e. includes allowance, liquidated damages, deductions for work done by others, etc.
	A/S	*	Final AEA with allowance balances zeroed out (may be attached with final change order)
	A/C	**	Final approved Application for Payment
	C	*	Consent of Surety to Final Payment
	C	*	Contractor's Affidavit of Release of Liens (properly signed and notarized)
	C	*	Contractor's Affidavit of Payment of Debts and Claims (properly signed and notarized)
	C	*	Properly executed Release of Liens by Subcontractor's and/or vendors (if applicable for those who have had problems with payments, etc.)
	C	*	Certificate of Occupancy from proper municipality
	C	*	Contractor's One-Year Warranty (notarized)
	C	**	Warranty summary sheet and original warranties for specific items (originals are included in Operation and Maintenance Manuals)
	C	*	Certification letter from Contractor stating that no asbestos containing materials were used on the project
	A	*	Certification letter from Architect or Engineer stating that no asbestos containing materials were specified on the project (per EPA regulations)
	S	**	Transmittal indicating copy of asbestos certification letters have been forwarded to New Hanover County Schools Facility Planning & Construction Dept. Asbestos File.
	A	*	Architect's and MEP Engineer's certification letter stating that the all punchlist items are complete, the work is per contract requirements, and recommending final payment be made to the Contractor
	A	*	Architect's or Engineer's letter regarding liquidated damages (if none, so state)
	S	*	Transmital indicating keys have been given to NHCS (should be signed by person receiving keys)
	C	**	Final lists of MBE firms used on the project with final contract amounts & percentage of the total prime contract for each
	C	**	Final lists of Subcontractors with names, addresses, and phone numbers including emergency numbers (originals are included in the Operations and Maintenance Manuals)
	C	**	Transmittal from Contractor indicating electronic copies of all approved submittals have been forwarded to New Hanover County Schools Facility Planning & Construction Dept.
	A/C	*	Record drawings received and cover letter from A/E stating they have been received and are complete and accurate as possible
	A/C	*	Operations and Maintenance Manuals received and a cover letter from A/E stating that they have been reviewed and are complete
	S	**	Transmittal indicating Record Drawings, Operations and Maintenance Manuals have been been distributed to Maintenance and School.
	A/C	*	Certified testing and balance report for HVAC system has been received and a cover letter from engineer stating that it has been reviewed and approved

_____ _____

Project Manager's Signature Date

File # : _____

FINAL PAYMENT FOR BOTH THE ARCHITECT/ ENGINEER AND CONTRACTOR TO BE WITHHELD UNTIL ALL DOCUMENTS FROM BOTH PARTIES ARE RECEIVED

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SECTION 010100 - GENERAL REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and other Division-1 Specifications Sections, apply to this Section.

B. The "Contract Documents," as defined in the General Conditions, include "the Drawings." Although Drawings are grouped and identified by classification of the Work, Contractors shall be responsible for reviewing all the Contract Documents and incorporating their Work as specified herein and as indicated on the Contract Documents. Although the majority of the Drawings are "to scale," Contractors are directed to use indicated dimensions for determining material quantities and for other reasons. No additional moneys will be allowed due to Contractors using "scaling instruments" to determine material quantities or for other reasons.

1.2 WORK UNDER CONTRACT

A. The intent of this Section is to indicate the Work required by the Contractor and to provide information regarding the duties, responsibilities, and cooperation required by the Contractor, with similar requirements for the subcontractors and suppliers.

B. Where walls are damaged from Contractor’s work, the Contractor shall touch up paint to match existing finish. Contact Owner for exact color and manufacturer of paint to be used.

1.3 SINGLE PRIME BASE BIDS

A. Base Bid: Includes all Work and includes the requirements of Divisions 01 through 32. Under a single prime contract, references herein to "each contractor" shall refer to the Contractor.

1.4 ADMINISTRATIVE RESPONSIBILITIES OF PRIME CONTRACTORS

A. Contractor shall have and maintain, without lapse, appropriate licenses to satisfy state and local requirements.

B. The Contractor shall be responsible for the maintenance of the Construction Schedule and the supervision of every phase of the Work.

C. Contractor shall read the Specifications and Drawings for his subcontractors and familiarize himself with their requirements and responsibilities to enable the required coordination and supervision. This responsibility also includes relaying of information contained in Addenda and Negotiations that affect the Work.

D. Contractor shall also familiarize himself with other items to be incorporated into the Work including equipment and Work by the Owner.

E. Contractor shall be responsible for demolition and disposal of existing items relative to his Contract.

1.5 LABOR AND MATERIALS

A. Unless otherwise specifically noted, provide and pay for labor, materials, equipment, tools, construction equipment and machinery, transportation, and other facilities and services necessary for the proper execution and completion of the Work, whether temporary or permanent and whether or not incorporated or to be incorporated in the Work.

B. Contractor shall enforce strict discipline and good order among his employees or other persons carrying out Work of his Contract and shall not permit employment of unfit person or persons or anyone not skilled in the task assigned to them.

1.6 CUTTING AND PATCHING

A. The Contractor shall be responsible for cutting, fitting, and patching that may be required to complete his Work. Contractor shall use core drilling wherever possible.

B. Contractor shall use appropriate trades people (Electricians for electrical, Mechanical for HVAC, Painters for painting, etc.) for the type of work required.

C. Cutting or restoring work performed by the Contractor which is condemned by the Engineer shall have such correction or restoration work performed when directed by the Engineer. The cost of such Work shall be borne by the Contractor.

D. Contractor shall do no cutting that may impair the strength of the building or its components. No holes except for small screws or bolts may be drilled in the beams or other structural members for the purpose of supporting or attaching Work without obtaining prior approval from the Engineer.

1. Where cutting of structural supports is required, the Contractor requiring said cut shall be responsible for providing temporary and permanent structural support needed to carry unsupported loads.

E. Work shall be done in a neat manner by mechanics skilled in their trades, and the final Work shall be subject to approval by the Engineer and Owner.

1.7 VERIFICATIONS OF EXISTING DIMENSIONS

A. When verification of existing dimensions is required, the Contractor shall be responsible for the procurement of the field information.

1.8 ASBESTOS STATEMENT

A. The Contractor shall submit a written affidavit stating that none of the materials used in the work of the contract contains asbestos prior to application for Final Payment. This statement shall be signed by the same individual who signed the Agreement between the Owner and the Contractor; this signature shall be notarized. Refer to copy of required Certificate following this Section. A statement shall be issued for each work site.

1.9 AS-BUILT RECORD DRAWINGS

A. The Contractor shall keep a complete copy of the drawings and specifications for the project at the Project Site solely for the purpose of recording, as a matter of record, each change or revision made during the construction period. Also, affix to appropriate sheet/page Addendum and Negotiated changes.

B. These record drawings shall be kept intact in the field office of the Contractor. Notations on these Contract Document Record Drawings shall be made neatly and legibly in waterproof colored pencil at the time each change is made.

C. Upon Substantial Completion of the work, the Contractor shall transmit the record set of Contract Documents to the Engineer along with a typed list of each change or revision made during construction of the project. This list shall include change order numbers, authorization dates, and other information relevant to each change. Record Drawings and Contractor's Certificate of Accuracy must be received and approved prior to issuance of Final Payment. Refer to copy Certificate following this section.

1.10 OPERATION AND MAINTENANCE INSTRUCTIONS

A. The Contractor shall meet with Owner and Engineer to confirm specific requirements prior to any submittal.

B. The Contractor shall provide complete operating and maintenance information and instructions for equipment and systems provided under the Contract. These manuals shall be bound in loose-leaf binders containing labels that include the name of the Project, the name of the Contractor, the address of the Contractor, and the Contractor's phone number.

C. The manuals shall be tabbed and indexed, and include information and instruction for each item that will require adjustment, servicing, or attention for its proper operation. The instruction shall give the information that is necessary for the Owner to operate the equipment safely and perform routine maintenance. The instructions shall include a complete maintenance schedule for each item listing suggested maintenance procedure and the interval of time at which each procedure should be repeated. The instructions shall be written in simple, non-technical language.

1.11 PROTECTION OF FINISHED SURFACES

A. The Contractor responsible for installation of items of work with surfaces which will be exposed in the finished work shall be responsible for protection of such finished surfaces during the Construction period. No change in the Contract Sum will be authorized for repair or replacement of material or equipment damaged during the Construction work phase. The Owner will not accept or pay for materials that are damaged at the time of Substantial Completion.

B. Prior to starting demolition or construction work the Contractor shall photograph or otherwise record to mutual satisfaction with the Owner, the existing adjacent areas and their finishes. The Contractor shall restore such areas to their original condition (as documented by the photographs or other record) prior to application for Final Payment.

1.12 SAFETY

A. The Contractor shall note that the Owner or Engineer may request and schedule evaluation of temporary facilities and safety procedures by representatives of State and Federal Agencies responsible for enforcement of applicable safety regulations without prior notice.

1.13 STORAGE & STAGING AREA REPAIR

A. The Contractor shall photograph paved (also includes walks and curbs) and grassed areas that are to be used for storage of construction material and for construction staging. The Contractor shall restore such areas to their original condition (as documented by the photographs) prior to application for Final Payment.

1.14 CLEANING

A. Contractor is responsible for clean up associated with all work. Refer to Section 015600 for specific requirements.

1.15 WASTE DISPOSAL

A. Waste Disposal: Do not burn waste materials. Burning on the project site is not permitted. Do not bury debris or excess materials on the Owner's property. Do not discharge volatile, harmful, or dangerous materials into drainage systems. Remove waste materials from the site and dispose of lawfully. Comply with regulations of authorities having jurisdiction.

PART 2 - PRODUCTS

2.1 MATERIALS

A. General: Comply with requirements specified in other Sections.

B. In-Place Materials: Use materials identical to in-lace materials. For exposed surfaces, use materials that visually match in-lace adjacent surfaces to the fullest extent possible.

1. If identical materials are unavailable or cannot be used, use materials that, when installed, will match the visual and functional performance of in-place materials.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine surfaces to be cut and patched and conditions under which cutting and patching are to be performed.

1. Compatibility: Before patching, verify compatibility with and suitability of substrates, including compatibility with in-place finishes or primers.
2. Proceed with installation only after unsafe or unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Temporary Support: Provide temporary support of Work to be cut.

B. Protection: Protect in-place construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of Project that might be exposed during cutting and patching operations.

C. Adjoining Areas: Avoid interference with use of adjoining areas or interruption of free passage to adjoining areas.

D. Existing Intercom Systems: Where existing services/systems are required to be removed, relocated, or abandoned, bypass such services/systems before cutting to prevent interruption to occupied areas.

3.3 PERFORMANCE

A. General: Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time, and complete without delay.

1. Cut in-place construction to provide for installation of other components or performance of other construction, and subsequently patch as required to restore surfaces to their original condition.

B. Cutting: Cut in-place construction by sawing, drilling, breaking, chipping, grinding, and similar operations, including excavation, using methods at least likely to damage elements retained or adjoining construction. If possible, review proposed procedures with original installer; comply with original installer's written recommendations.

1. In general, use hand or small power tools designed for sawing and grinding, not hammering and chopping. Cut holes and slots as small as possible, neatly to size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
2. Finished Surfaces: Cut or drill from the exposed or finished side into concealed surfaces.
3. Concrete Masonry: Cut using a cutting machine, such as an abrasive saw or a diamond-core drill.
4. Electrical Conduit: Cut off conduit in walls or partitions to be removed. Cap and seal remaining portion of conduit to prevent entrance of moisture or other foreign matter after cutting.
5. Proceed with patching after construction operations requiring cutting are complete.

C. Patching: Patch construction by filling, repairing, refinishing, closing up, and similar operations following performance of other Work. Patch with durable seams that are as invisible as possible. Provide materials and comply with installation requirements specified in other Sections.

1. Inspection: Where feasible, test and inspect patched areas after completion to demonstrate integrity of installation.
2. Exposed Finishes: Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will eliminate evidence of patching and refinishing.
3. Floors and Walls: Where walls or partitions that are removed extend one finished area into another, patch and repair floor and wall surfaces in the new space. Provide an even surface of uniform finish, color, texture, and appearance. Remove in-place floor and wall coverings and replace with new materials, if necessary, to achieve uniform color and appearance.
4. Ceilings: Patch, repair, or rehang in-place ceilings as necessary to provide an even-plane surface of uniform appearance.
5. Exterior Building Enclosure: Patch components in a manner that restores enclosure to a weathertight condition.

D. Cleaning: Clean areas and spaces where cutting and patching are performed. Completely remove paint, mortar, oils, putty, and similar materials.

END OF SECTION 010100

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CERTIFICATE OF NON-USE OF ASBESTOS CONTAINING PRODUCTS

Date: _____

Project: _____

Address: _____

_____

_____

I hereby certify that to the best of my knowledge and actions the products and materials incorporated into the above indicated project are free of asbestos and asbestos containing materials.

Company: _____
(Name of Firm or Corporation making certification)

Represented By: _____
(Person authorized to sign

Ownership: _____ Title _____
(Proprietorship or Partnership) (Owner/Partner/Pres./V.Pres)

Address: _____
_____
_____
_____

License No. _____

Federal I.D. No. _____

ATTEST:

By: _____

Title _____
(Corp. Sec. or Ass't Sec. only)

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CERTIFICATE OF ACCURACY

Date: _____

Project: _____

Address: _____

_____

_____

I hereby certify that to the best of my knowledge and actions the Record/As Built Drawings for the above indicated project are complete and accurate.

Company: _____
(Name of Firm or Corporation making certification)

Represented By: _____
(Person authorized to sign

Ownership: _____ Title _____
(Proprietorship or Partnership) (Owner/Partner/Pres./V.Pres)

Address: _____
_____
_____
_____

License No. _____

Federal I.D. No. _____

ATTEST:

By: _____

Title _____
(Corp. Sec. or Ass't Sec. only)

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SECTION 012100 – ALLOWANCES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The provisions of the General Conditions, Supplementary Conditions, and other Sections included under Division 1, General Requirements, are included as a part of this Section as though bound herein.

B. Designate in Pay Requests and Schedule of Values separate item for cost allowances.

1.2 ALLOWANCES FOR WORK

A. Provide Work under allowance only as directed by Engineer.

1.3 SELECTION OF PRODUCT/MATERIAL

A. Engineer's Duties:

1. Consult with Contractor in consideration of product/material and suppliers.
2. Make selection, designate product/material to be used.
3. Notify Contractor in writing, designating:
   a. Product, size, color, and texture.
   b. Supplier.
   c. Cost, delivered at site.

B. Contractor's Duties:

1. Assist Engineer in determining qualified suppliers.
2. Obtain proposals from suppliers when requested by Engineer.
3. Make appropriate recommendations for consideration by Engineer.
4. Notify Engineer in writing, of effect anticipated by selection of product or supplier under consideration on:
   a. Construction Schedule.
   b. Contract Sum.
5. On notification of selection enter into purchase agreement with designated supplier.
6. Arrange for delivery and unloading.
7. Promptly inspect product for damage or defects.
8. Submit claims for transportation damage.

1.4 ADJUSTMENT OF CASH ALLOWANCES

A. Unused amounts of moneys included under allowances shall be credited to the Owner by deduct change order prior to approval of Final Application for Payment.

PART 2 - PRODUCTS: (NOT APPLICABLE)

PART 3 - EXECUTION:

3.1 RENOVATION/UNFORESEENS ALLOWANCE

A. Renovation/Unforeseens Allowance for those items and Work hidden, undetectable, or unforeseen and not visible from pre-bid, on-site observation, or not shown, called-for, or reasonably implied in the Contract Documents and which is in compliance with N.C. Building Code and New Hanover County Schools requirements. Refer to Schedule at end of section.

3.2 SCHEDULE OF ALLOWANCES:

A. Allowances for Work: Bid shall include an Allowance of $5,000.00 for unforeseen conditions. Allowance shall include all overhead and profit.

END OF SECTION 012100

SECTION 012300 - ALTERNATES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes administrative and procedural requirements for alternates.

1.3 DEFINITIONS

A. Alternate: An amount proposed by bidders and stated on the Form of Proposal for certain work defined in the bidding requirements that may be added to or deducted from the base bid amount if Owner decides to accept a corresponding change either in the amount of construction to be completed or in the products, materials, equipment, systems, or installation methods described in the Contract Documents.

1. Alternates described in this Section are part of the Work only if enumerated in the Agreement.
2. The cost or credit for each alternate is the net addition to or deduction from the Contract Sum to incorporate alternate into the Work. No other adjustments are made to the Contract Sum.

1.4 PROCEDURES

A. Coordination: Revise or adjust affected adjacent work as necessary to completely integrate work of the alternate into Project.

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

B. Notification: Immediately following award of the Contract, notify each party involved, in writing, of the status of each alternate. Indicate if alternates have been accepted, rejected, or deferred for later consideration. Include a complete description of negotiated revisions to alternates.

C. Execute accepted alternates under the same conditions as other work of the Contract.

D. Schedule: A schedule of alternates is included at the end of this Section. Specification Sections referenced in schedule contain requirements for materials necessary to achieve the work described under each alternate.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 SCHEDULE OF ALTERNATES

A. Alternate No. 1: Provide cleaning of interior of ductwork, etc. associated with AHU#17 and AHU#18 as indicated on the drawings and per Section 230130 Existing HVAC Air Distribution System Cleaning.

B. Alternate No. 2: Provide replacement of exterior safety switch disconnects as indicated on Drawing E-101.

END OF SECTION 012300

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SECTION 013300 – SUBMITTALS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section specifies administrative and procedural requirements for submittals required for performance of the Work, including:

- Sub List
- Construction Schedules
- Schedule of Values
- Use of Site Plan
- Shop Drawings
- Product Data

B. Administrative Submittals: Refer to other Division-1 Sections and other Contract Documents for additional requirements for administrative submittals.

1.3 SUBMITTAL PROCEDURES

A. The Contractor shall meet with Owner and Engineer to confirm specific requirements prior to any submittal.

B. Transmit submittals directly to the Engineer:

C. Submittals not properly prepared, reviewed and approved by the Contractor, identifying project, product, purpose etc. shall be returned without review and will require proper resubmittal. Do not submit products for review that are not specified.

D. Submittal Period: Prepare a submittal schedule indicating when submittals shall be made and required dates of return if critical to the progress of the work. Coordinate submittals with progress schedule. Send all submittals to the Engineer within (10) calendar days of the Notice-To-Proceed. Should any item require more than (10) days for submittal, the Contractor shall notify the Engineer in writing, and indicate a reasonable "latest date" for the submittal to be in the Engineer's office for review. Prioritizing of submittals and other special handling shall be coordinated with the Engineer. A submittal progress schedule prepared by the Contractor is required to be submitted prior to first payment request; payment will not be approved without schedule.

E. If submittals have not been received within the submittal period defined above and the Contractor has not notified the Engineer as described above, the Contractor shall provide one of the brands specified. No alternate Manufacturers will be considered for review. If the number of submittals not received within the submittal period is significant or their nature deemed of specific importance, the Engineer may recommend that the Owner suspend or delay payment to the remiss Contractor until such time as the required submittals have been received.

F. The above does not relieve the Contractor from responsibility to provide all required shop drawings, samples, and product data.

G. Coordination: Coordinate transmittal of different types of submittals for related elements of the Work so processing will not be delayed by the need to review submittals concurrently for coordination.

1. The Engineer reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.
2. Allow 30 calendar days for initial review. Allow additional time if processing must be delayed to permit coordination with subsequent submittals. The Engineer will promptly advise the Contractor when a submittal being processed must be delayed for coordination. Exceptions may be made for fast track type projects, based upon progress and submittal schedule data.
3. Allow sufficient time for reprocessing each submittal.
4. No extension of Contract Time, increase in cost, change in materials, or change in colors will be authorized because of failure to transmit submittals to the Engineer sufficiently in advance of the Work to permit material purchase and installation according to the construction schedule.

H. Submittal Transmittal: Package each submittal appropriately for transmittal and handling.

Transmit each submittal from Contractor to Engineer using an approved transmittal form. Submittals received from sources other than the Contractor will be returned without action.

1. On the transmittal, record relevant information and requests for data. On the form, or separate sheet, record deviations from Contract Document requirements, including minor variations and limitations**.** Include Contractor's certification that information complies with Contract Document requirements.

1.4 LIST OF SUBCONTRACTORS, SUPPLIERS, AND MANUFACTURERS

A. The contractor shall submit to the Engineer, a complete list of subcontractors, suppliers, and manufacturers furnishing or installing materials and products specified on this Project within 10 working days after the award of contract. The list shall be complete with names, street addresses, city, state, and zip code.

1. Include names of subcontractors, suppliers, and manufacturers from the required subcontractor, supplier, and manufacturer list, provided within 24 hours of bid.
2. Subcontractors, suppliers, and manufacturers on the list provided prior to award shall not be changed on list provided after award of contract and subcontractors, suppliers, and manufacturers on both lists shall not be changed without notification of the Engineer and approval of the Owner.
3. The list of subcontractors, suppliers, and manufacturers furnishing or installing materials and products specified on this Project prepared by the Contractor is required to be submitted prior to submitting the Contractors first payment request, payment will not be approved without this list.

B. In addition to the names of subcontractors, suppliers, and manufacturers, the Contractor shall be aware of the required dates that shop drawings and samples are to be submitted for approval and the critical date for delivery.

C. Dates submitted for shop drawings and samples shall be realistic and be coordinated with the Progress Schedule for critical dates that affect the progress of construction.

1.5 CONSTRUCTION SCHEDULES

A. The Contractor shall prepare and submit to the Engineer for review 4 copies of an estimated schedule of construction for the entire Work. Schedule shall be submitted within 14 calendar days after the award of the Contract.

1. A Construction schedule prepared by the Contractor is required to be submitted prior to first payment request; payment will not be approved without this schedule.

2. The Contractor may request permission from the Engineer to provide a mobilization construction schedule as partial compliance, with the complete schedule to be provided at an agreed upon later time, this would allow for approval and payment of Construction startup "Soft Costs".

B. The Progress Schedule shall be a manpower loaded, activity schedule, (CMP, Premavera or well-defined and approved bar chart type) prepared on an approved form.

C. Content of Progress Schedule shall be coordinated with the Contractor's Schedule of Values and List of Shop Drawings and Samples. Provide a complete sequence of construction by activity for each item of work.

D. Progress Schedule shall be regularly reviewed at the progress meetings and updated as required. Date for time of completion shall remain unchanged unless revised by change order and the requirements of the General and Supplementary Conditions.

E. The Contractor shall keep a copy of the original Progress Schedule along with a copy of the last approved Progress Schedule.

F. Failure to Make Adequate Progress: If a Contractor fails to make progress which, in the opinion of the Engineer, is not adequate to assure timely completion of the Project, the Engineer, in his sole discretion may, in addition to other remedies:

1. Require the Contractor to utilize additional manpower, equipment, or materials;
2. Require the Contractor to utilize overtime on certain activities;
3. Withhold certification for progress payments in whole or in part according to the provisions of the General and Supplementary Conditions.

1.6 SCHEDULE OF VALUES

A. Contractor shall prepare and submit to the Engineer a Schedule of Values for review within 7 days after notice is given to proceed with Work.

B. The Schedule of Values shall consist of a complete breakdown of the Contractor's contract sum showing the various items of the Work, divided so as to facilitate the approval of payments to the Contractor for Work completed.

C. In addition to and conjunctive with the division of various items of work (labor and materials separated), the breakdown shall separate remodeling/renovation work from new construction work. Additional separations shall be by individual buildings, as determined by Engineer. Completion of punchlist items shall also be listed as a line item on the schedule of values. The Schedule of Values shall be prepared on AIA Document G702 and G703, Continuation Sheet, showing the breakdown of items of Work and supported by such data to substantiate its correctness as the Engineer may require.

D. The contract breakdown shall be the same form as that to be used in submitting request for payments as covered by the General and Supplementary Conditions. Each item of Work shall have indicated a separate cost for labor and material. This schedule when reviewed by the Engineer and Owner shall be used as the basis of approving payments along with establishing percentages of Work complete.

1.7 SHOP DRAWINGS

A. Submit newly prepared information, drawn to accurate scale. Highlight, encircle, or otherwise indicate deviations from the Contract Documents**.** Do not reproduce Contract Documents or copy standard information as the basis of Shop Drawings. Standard information prepared without specific reference to the Project is not considered Shop Drawings.

B. Shop Drawings include fabrication and installation drawings, setting diagrams, schedules, patterns, templates and similar drawings. Include the following information:

- Dimensions.
- Identification of products and materials included.
- Compliance with specified standards.
- Notation of coordination requirements.
- Notation of dimensions established by field measurement.

1.8 PRODUCT DATA

A. Collect Product Data into a single submittal for each element of construction or system. Product Data includes information such as manufacturer's installation instructions, catalog cuts, color charts, roughing-in diagrams and templates, standard wiring diagrams and performance curves. Where Product Data must be specially prepared because standard data is not suitable for use, submit as "Shop Drawings."

1. Mark each copy to show applicable choices and options. Where Product Data includes information on several products, some of which are not required, mark copies to indicate the applicable information. Include the following information:

   - Manufacturer's printed recommendations.
   - Compliance with recognized trade association standards.
   - Compliance with recognized testing agency standards.
   - Application of testing agency labels and seals.
   - Notation of dimensions verified by field measurement.
   - Notation of coordination requirements.

2. Do not submit Product Data until compliance with requirements of the Contract Documents has been confirmed.

1.9 SUBMITTALS

A. Electronic Submittals: Identify and incorporate information in each electronic submittal file as follows:

1. Assemble complete submittal package for a single Specification Section into a file incorporating submittal requirements.

   a. Mark each submittal to show which products and options are applicable.
   b. Shop Drawings shall be on sheets at least 8-1/2 by 11 inches, but no larger than 30 by 42 inches.
   c. Review each submittal and check for coordination with other Work of the Contract and for compliance with the Contract Documents. Note corrections and field dimensions. Mark with approval stamp before submitting to Engineer.

2. Name file with submittal number or other unique identifier, including revision identifier.

   a. File name shall use Specification Section number followed by a decimal point and then a sequential number (e.g., 260500.01). Resubmittals shall include an alphabetic suffix after another decimal point (e.g., 260500.01.A).

3. Transmittal Form for Electronic Submittals: Use a form containing the following information:

   a. Project name.
   b. Date.
   c. Name and address of Engineer.
   d. Name of Contractor.
   e. Name of firm or entity that prepared submittal.
   f. Specification Section number and title.

g. Indication of full or partial submittal.
h. Transmittal number.
i. Submittal and transmittal distribution record.
j. Other necessary identification.
k. Remarks.

4. Submit electronic submittals via email as PDF electronic files.

B. Distribution:Furnish copies of final submittal to installers, applicable subcontractors, suppliers, manufacturers, fabricators, and others required for performance of construction activities. Show distribution on transmittal forms.

1. Do not proceed with installation until an applicable copy of Product Data is in the installer's possession.
2. Do not permit use of unmarked copies of Product Data in connection with construction.

1.10 ENGINEER'S ACTION

A. Except for submittals for record, information or similar purposes, where action and return is required or requested, the Engineer will review each submittal, mark to indicate action taken, and return promptly.

B. Action Stamp: The Engineer will stamp each submittal with a uniform, self-explanatory action stamp. The stamp will be appropriately marked, as follows, to indicate the action taken:

1. Where submittals are marked "**No Exceptions Taken**" that part of the Work covered by the submittal may proceed provided it complies with requirements of the Contract Documents; final acceptance will depend upon that compliance.
2. When submittals are marked "**Note Markings - Confirm**" that part of the Work covered by the submittal may proceed provided it complies with notations or corrections on the submittal and requirements of the Contract Documents; final acceptance will depend on that compliance.
3. When submittal is marked "**Note Markings - Resubmit**", that part of the Work covered by the submittal may proceed provided it complies with notations or corrections on the submittal and requirements of the Contract Documents; final acceptance will depend on that compliance. Revise or prepare a new submittal in accordance with the notations; resubmit without delay for proper project documentation.
4. When submittal is marked "**Rejected - Resubmit**," do not proceed with that part of the Work covered by the submittal, including purchasing, fabrication, delivery, or other activity. Revise or prepare a new submittal in accordance with the notations; resubmit without delay. Repeat if necessary to obtain a different action mark.
5. Do not permit submittals marked “Note Markings - Resubmit or Rejected - Resubmit" to be used at the Project site, or elsewhere where Work is in progress.

PART 2 - PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

END OF SECTION 013300

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SECTION 015010 – CONSTRUCTION FACILITIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 DEFINITIONS

A. The term "Contractor" used herein shall be defined as the person or entity, named on the face of the signed "Standard Form of Agreement Between Owner and Contractor".

1.3 DESCRIPTION OF REQUIREMENTS

A. General: Contractor shall include the costs of the facilities described below in the Base Bid.

1. Plug-in electric power cords and extension cords, and supplementary plug-in task lighting and special lighting necessary to complete its own work.
2. Collection and disposal of its own waste material on a weekly basis.
3. Temporary generators needed to power equipment employed in completion of the Contract which cannot operate from a 120 volt electrical service.
4. Safety lighting required to complete construction of the project in compliance with safety lighting requirements described in the N.C. Occupational Safety and Health Standards for the Construction Industry, Section 1926.56 and ANSI Standard 811.1 (1965).
5. Temporary fire protection.

1.4 QUALITY ASSURANCE

A. Regulations: The Contractor shall comply with state and local laws and regulations governing construction in the installation and maintenance of construction facilities.

B. The Contractor is hereby notified that the Owner may request inspection of construction facilities by agencies responsible for enforcement of construction safety laws and regulations without prior notice.

PART 2 - PRODUCTS

2.1 MATERIALS AND EQUIPMENT

A. Electrical Power Cords: Use only grounded GFCI extension cords; use "hard-service" cords where exposed to abrasion and traffic. Use single lengths or waterproof connectors to connect separate lengths, if single lengths will not reach work areas.

PART 3 - EXECUTION

3.1 CONSTRUCTION FACILITIES INSTALLATION:

A. Contractor may use Owner’s/Building’s electricity, water, and restrooms.

B. Temporary Fire Protection:

1. The Contractor shall install and maintain temporary fire protection facilities of the types needed to adequately protect against reasonably predictable and controllable fire losses during the entire construction period.

END OF SECTION 015010

SECTION 015600 – CONSTRUCTION CLEANING

PART 1 - GENERAL

1.1 RELATED WORK

A. The Work of this Section shall be included as a part of the Contract Documents of the Contractor on this Project.

1.2 SUMMARY

A. The Contractor shall act on behalf of the Owner pertaining to the clean-up responsibilities that are a part of each Contractor's Work. Article 4.18, "Cleaning-Up," included in the General Conditions and the statement concerning clean-up which is included in each Contractor's Scope of Work, will serve as the required 7 day notice called for in Paragraph 6.3 of the General Conditions.

1.3 DAILY CLEANING

A. Contractor shall remove his rubbish and debris from the construction site to guard against fire and safety hazards as well as to provide a more efficient construction operation. If this cleaning is not performed to the satisfaction of the Owner and the Engineer, it will be performed for the Contractor at his expense.

1.4 ROUTINE CLEANING

A. Each day, and more often if necessary, Contractor shall cleanup work areas, including a broom cleaning of appropriate surfaces. The trades shall remove their rubbish and debris from the building site to the rubbish collection location promptly upon its accumulation. The Contractor shall provide a suitable location on the site with a sufficient quantity of rubbish bins, and shall be responsible for the removal of rubbish from the site. If this cleaning is not performed to the satisfaction of the Owner and the Engineer, it will be performed for the Contractor at his expense.

1.5 FINAL CLEANING

A. Contractor shall perform an overall cleanup of the entire site, including a broom cleaning and dusting of appropriate surfaces. The trades shall remove their rubbish and debris from the building and site to the rubbish collection location.

B. If this cleaning is not performed to the satisfaction of the Owner and the Engineer, it will be performed by another Contractor at the Contractor’s expense.

1.6 RUBBISH CONTAINER(s)

A. The Contractor shall provide dumpster type rubbish container(s) sized adequate for the Project waste, debris, and rubbish for the life of the Project, or may dispose of debris promptly by hauling from the site daily.

B. Dispose of container(s) contents weekly or at more frequent intervals if required by inadequate container capacity.

1.7 CLEANING SAFETY REQUIREMENTS

A. Comply with authorities having jurisdiction and AGC recommendations. Submit and make available MSDS information on each cleaning product on the project site.

B. Hazards Control

1. Store volatile wastes in covered metal containers, and remove from premises daily.
2. Prevent accumulation of wastes which create hazardous conditions.
3. Provide adequate ventilation during use of volatile or noxious substances.

C. Conduct cleaning and disposal operations to comply with local ordinances and anti-pollution laws.

1. Do not burn or bury rubbish and waste materials on project site.
2. Do not dispose of volatile wastes such as mineral spirits, oil, or paint thinner in storm or sanitary drains.
3. Do not dispose of wastes into streams or waterways.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Use only cleaning materials recommended by manufacturer of surface to be cleaned.

B. Use cleaning materials only on surfaces recommended by cleaning material manufacturer.

PART 3 - EXECUTION

3.1 DAILY CLEANING

A. Contractor shall execute cleaning to ensure that building, grounds, and public properties are maintained free from accumulations of waste materials and rubbish.

B. Daily, during progress of work, clean site and public properties and dispose of waste materials, debris, and rubbish in dumpster type rubbish container provided under this Section.

C. Schedule cleaning operations so that dust and other contaminants resulting from cleaning process will not fall on wet, newly painted surfaces.

3.2 ROUTINE CLEANING

A. Employ experienced workmen for cleaning.

B. Remove dirt, mud, and other foreign materials from sight exposed interior and exterior surfaces.

C. Weekly, or at more frequent intervals, if work activities justify same, perform the following cleaning. This includes all dirt, dust, and debris not identifiable as part of a Contract. Broom clean floor and paved surfaces; rake clean other surfaces of ground.

D. Maintain cleaning throughout the life of the Project.

E. Should the Contractor fail in the performance of this Work, the Owner may perform such Work in accordance with Article 2 of the General Conditions.

3.3 FINAL CLEANING

A. Contractor shall perform his respective final clean-up and shall leave the Work of the complete Project in clean, neat condition.

B. The following are examples, but not by way of limitation, of cleaning levels required:

1. Remove labels which are not required as permanent labels.
2. Wipe surfaces of mechanical and electrical equipment clean and remove excess lubrication and other substances.
3. Clean concrete floors in unoccupied spaces broom clean.
4. Clean project site (yard and grounds), including landscape development areas of litter and foreign substances. Sweep paved areas to a broom-clean condition; remove stains, petro-chemical spills, and other foreign deposits. Rake grounds, which are neither planted nor paved, to a smooth, even textured surface.

END OF SECTION 015600

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SECTION 016000 – PRODUCTS

PART 1 - GENERAL

1.1 SUMMARY

A. The Work of this Section shall be included as a part of the Contract Documents of this Project.

B. It is the intent of the Specifications and Drawings to accomplish a complete and first-grade installation executed by competent and experienced workmen.

C. The Contractor is cautioned that work or equipment installed without approval is subject to condemnation, removal, and subsequent replacement with an approved item without extra remuneration.

PART 2 - PRODUCTS

2.1 PRODUCT STANDARDS AND QUALITY - SUBSTITUTIONS

A. The Contract is based on the materials, equipment, and methods described in the Contract Documents.

B. Where in the Drawings and Specifications certain products, manufacturer's trade names, or catalog numbers are given, it is done for the expressed purpose of establishing a basis of quality, durability, and efficiency of design in harmony with the work outlined and is not intended for the purpose of limiting competition.

C. Do not substitute products or equipment unless such substitution has been specifically approved for this Work by the Engineer.

D. Where the phrase "or equal" or "or equal as approved by the Engineer" occurs in the Contract Documents, do not assume that products or equipment will be approved as equal by the Engineer unless the item has been specifically approved for this Work by the Engineer. The decision of the Engineer shall be final.

E. Availability of Specified Items:

1. Verify prior to bidding that specified items will be available in time for installation during orderly and timely progress of the work.

2. In the event specified item or items will not be so available, so notify the Engineer prior to receipt of bids.

3. Costs of delays because of non-availability of specified items, when such delays could have been avoided by the Contractor, will be back charged as necessary and shall not be borne by the Owner.

F. When requesting a substitution the Contractor shall provide all necessary documentation.

2.2 MANUFACTURER’S DIRECTIONS

A. Manufactured products shall be applied, installed, connected, erected, used, cleaned, and conditioned in accordance with the manufacturer's printed directions, unless herein specified to the contrary. Where manufacturer's printed directions are available and where reference is made to manufacturer's directions in the Specifications, the Contractor shall submit 2 copies of such directions to the Engineer prior to the beginning of Work covered thereby.

B. Where specific installation instructions are not part of these Specifications and Drawings, equipment shall be installed in strict accordance with instructions from the respective manufacturers. Where installation instructions included in these Specifications or Drawings are at a variance with instructions furnished by the equipment manufacturer, the Contractor shall make written request for clarification from the Engineer.

C. In accepting or assenting to the use of apparatus or material, or make, or arrangement thereof, the Engineer in no way waives the requirements of these Specifications or the warranty embodied therein.

2.3 WARRANTIES

A. Specific warranties or bonds called for in the Contract Documents, in addition to that falling under the general warranty as set forth in General Conditions, shall be furnished in accordance with the requirements of the Specifications.

B. The Contractor shall and does hereby agree to warrant for a period of one year, or for longer periods, where so provided in the Specifications, as evidenced by the date of Substantial Completion issued by the Engineer, products installed under the Contract to be of good quality in every respect and to remain so for periods described herein.

C. Nothing herein intends or implies that the warranty shall apply to Work which has been abused or neglected or improperly maintained by the Owner or his successor in interest.

D. Where service on products is required under this Article, it shall be promptly provided when notified by the Owner and no additional charge shall be made, unless it can be established that the defect or malfunctioning was caused by abuse or accidental damage not to be expected under conditions of ordinary wear and tear.

E. The manufacturer and supplier expressly warrants that each item of equipment furnished by him and installed in this Project is suitable for the application shown and specified in the Contract Documents and includes features, accessories, and performing characteristics listed in the manufacturer's catalog in force on the date bids are requested for the Work. This warranty is intended as an assurance by the manufacturer that his equipment is not being misapplied and is fit and sufficient for the service intended.

1. This warranty is in addition to and not in limitation of other warranties or remedies required by law or by the Contract Documents. It shall be the responsibility of the Contractor for the particular equipment to obtain this warranty in writing.

F. In case the Contractor fails to do Work so ordered, the Owner may have work done and charge the cost thereof against monies retained as provided for in the Agreement and, if said retained monies shall be insufficient to pay such cost or if no money is available, the Contractor and his Sureties shall agree to pay to the Owner the cost of such Work.

2.4 MATERIAL DELIVERY AND RESPONSIBILITIES

A. The Contractor shall be responsible for materials he orders for delivery to the job site. Responsibility includes, but is not limited to, receiving, unloading, storing, protecting, and setting in place; ready for final connections.

B. The Contractor shall insure that products are delivered to the Project in accordance with the Construction Schedule of the Project. In determining date of delivery, sufficient time shall be allowed for shop drawings and sample approvals, including the possibility of having to resubmit improperly prepared submittals or products other than those specified and the necessary fabrication or procurement time along with the delivery method and distance involved.

2.5 PROTECTION

A. The Contractor shall protect building elements and products subject to damage. Should workmen or other persons employed or commissioned by the Contractor be responsible for damage, the entire cost of repairing said damage shall be assumed by the Contractor.

B. Should damage be done by a person or persons not employed or commissioned by the Contractor, the Contractor shall make repairs and charge the cost to the guilty person or persons. The Contractor shall be responsible for collecting such charges.

C. The Contractor shall protect its products prior to installation and final acceptance. Storage shall be dry, clean, and safe. Materials or equipment damaged, deteriorated, rusted or defaced due to improper storage, shall be repaired, refinished, or replaced, as required by the Engineer. Products lost through theft or mishandling shall be replaced by the Contractor without cost to the Owner.

2.6 ACCPETANCE OF EQUIPMENT

A. The Owner will not accept the start of the warranty period on equipment until Substantial Completion is issued.

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 016000

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SECTION 017719 – PROJECT CLOSEOUT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The Work of this Section shall be included as a part of the Contract Documents on this Project.

B. Refer to the General and Supplementary Conditions of the Contract for Substantial Completion and final payment.

1.2 SUMMARY

A. Closeout is hereby defined to include general requirements near end of Contract Time in preparation for final acceptance, final payment, normal termination of contract, occupancy by Owner, and similar actions evidencing completion of the Work. Time of closeout is directly related to "Substantial Completion."

1.3 PREREQUISITES TO FINAL INSPECTION

A. General: Prior to requesting Engineer inspection for certification of Substantial Completion (for either entire Work or portions thereof), complete the following and list known exceptions in request:

1. Submit specific warranties, workmanship/maintenance bonds, agreements, final certifications, and similar documents.
2. Deliver tools, spare parts, extra stocks of materials, and similar physical items to Owner.
3. Complete instruction of Owner's maintenance personnel.
4. Complete final cleaning up requirements.

1.4 PREREQUISITES TO FINAL PAYMENT

A. General: Prior to requesting Engineer final inspection for certification of final payment, complete the following:

1. Submit final payment request.
2. Submit copy of Engineer final punchlist of itemized work to be completed or corrected, stating that each item has been completed or otherwise resolved for acceptance.
3. Submit record drawings, maintenance manuals, and similar final record information.
4. Certification of code compliance.
5. Submit certification stating that no materials containing asbestos were incorporated into the Work. Copy and use form provided, following Section 010100.
6. Electronic (.pdf) copies of all final approved submittals.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 PUNCHLIST

A. Prior to the Engineer's preparation of a Project Punchlist, Contractor shall prepare and keep his own punchlist on the job for use by his employees and subcontractors and for use by the Engineer to facilitate completion of the Work.

B. The Contractor's inspection shall be as thorough as possible, in accordance with his desire to provide first-class workmanship and maintain good reputation and shall include Work under his Contract, including that of his subcontractors.

C. The Engineer shall observe the Work, providing Work on the Contractor's punchlist has been completed, and prepare the Project Punchlist for use by the Contractor to expedite proper completion of the Work.

3.2 WARRANTY - CORRECTION OF WORK

A. Prior to the expiration of the one year warranty period, the Engineer will check to see if additional Work by the Contractor is needed to make good on the warranties. An itemized list will be furnished to the Contractor for corrective or replacement work.

B. This Work shall be completed immediately by the Contractor after receiving notification.

3.3 “PROJECT-RECORD” DRAWINGS

A. The Contractor shall update "Project-Record" Drawings on separate prints set aside especially for this purpose on the job. Drawings shall incorporate changes made in the Work during the construction period. Such changes shall be indicated at the time they occur.

B. Maintain 1 copy of Drawings, Specifications, addenda, approved shop drawings, change orders, field orders, other contract modifications, and other approved documents submitted by the Contractor, in compliance with various Sections of the Specifications.

C. Each of these project record documents shall be clearly marked "Project-Record Copy"; maintained in good condition; available for observation by the Engineer; and shall not be used for construction purposes. Mark up the document to show:

1. Significant changes and selections made during the construction process.

D. Furnish to the Engineer, with the Record Documents, a completed signed copy(s) of the “Certificate of Accuracy” covering work performed under contract. Copy and use form provided, following Section 010100.

3.4 MAINTENANCE MANUALS

A. The Contractor shall meet with Owner and Engineer to confirm specific requirements prior to any submittal.

B. Prior to Substantial Completion, Contractor shall submit to the Engineer one copy of a rough draft for a comprehensive Maintenance Manual presenting complete directions and recommendations for the proper care and maintenance of visible surfaces for items which he has provided.

C. Upon Engineer's approval and prior to issuance of final payments, Contractor shall submit 2 corrected and completed copies of maintenance manuals to the Engineer.

D. Finished manuals shall be loose-leaf type with hardboard covers and titled tabs identifying each particular portion or item of the Work.

E. For each titled item, manual must provide the names, addresses, and phone numbers of the following parties:

1. Contractor/installer
2. Manufacturer
3. Nearest dealer/supplier
4. Nearest agency capable of supplying parts and service

F. For each manual label on front cover or spine shall indicate the following information:

1. Project name and address
2. Owner's name
3. Name and address of Engineer
4. Name and address of Contractor
5. Date of submission

3.5 CLEANING OF WORK: Refer to Section 015600.

END OF SECTION 017719

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SECTION 024119 – SELECTIVE DEMOLITION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Demolition and removal of selected portions of building or structure as indicated on Drawings.

1.2 DEFINITIONS

A. Remove: Detach items from existing construction and legally dispose of them off-site unless indicated to be removed and salvaged or removed and reinstalled.

B. Existing to Remain: Existing items of construction not to be permanently removed and not otherwise indicated to be removed, removed and salvaged, or removed and reinstalled.

1.3 MATERIALS OWNERSHIP

A. Unless otherwise indicated, demolition waste becomes property of Contractor.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Arrange selective demolition schedule so as not to interfere with Owner's operations.

B. Pre-demolition Conference: Conduct conference at Project site.

1. Inspect and discuss condition of construction to be selectively demolished.
2. Review structural load limitations of existing structure.
3. Review and finalize selective demolition schedule and verify availability of materials, personnel, equipment, and facilities needed to make progress and avoid delays.
4. Review requirements of Work performed by other trades that rely on substrates exposed by selective demolition operations.
5. Review areas where existing construction is to remain and requires protection.

1.5 INFORMATIONAL SUBMITTALS

A. Proposed Protection Measures: Submit report, including drawings, that indicates measures proposed for protecting individuals and property, for dust control, and for noise control. Indicate proposed locations and construction of barriers.

B. Schedule of Selective Demolition Activities: Indicate the following:

1. Detailed sequence of selective demolition and removal Work, with starting and ending dates for each activity. Ensure Owner's on-site operations are uninterrupted.
2. Interruption of utility services. Indicate how long utility services will be interrupted.
3. Coordination for shutoff, capping, and continuation of utility services.
4. Coordination of Owner's continuing occupancy of portions of existing building and of Owner's partial occupancy of completed Work.

C. Pre-Demolition Photographs or Video: Submit before Work begins. Indicate existing conditions of adjoining construction and site improvements, including finish surfaces, that might be misconstrued as damage caused by selective demolition operations

D. Warranties: Documentation indicating existing warranties are still in effect after completion of selective demolition.

1.6 CLOSEOUT SUBMITTALS

A. Inventory: Submit list of items that have been removed and salvaged.

1.7 FIELD CONDITIONS

A. Owner will occupy portions of building immediately adjacent to selective demolition area. Conduct selective demolition so Owner's operations will not be disrupted.

B. Conditions existing at time of inspection for bidding purpose will be maintained by Owner as far as practical. Before selective demolition, coordinate items to be removed by Owner.

C. Notify Architect of discrepancies between existing conditions and Drawings before proceeding with selective demolition.

D. Hazardous Materials: It is not expected hazardous materials will be encountered in Work.

1. Hazardous materials will be removed by Owner before start of Work.
2. If suspected hazardous materials are encountered, do not disturb; immediately notify Architect and Owner. Hazardous materials will be removed by Owner under separate contract.

E. Storage or sale of removed items or materials on-site is not permitted.

F. Utility Service: Maintain existing utilities indicated to remain in service and protect them against damage during selective demolition operations.

1. Maintain fire-protection facilities in service during selective demolition operations.

1.8 WARRANTY

A. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during selective demolition, by methods and with materials so as not to void existing warranties. Notify warrantor before proceeding.

B. Notify warrantor on completion of selective demolition, and obtain documentation verifying existing system has been inspected and warranty remains in effect. Submit documentation at Project closeout.

PART 2 - PRODUCTS

2.1 PERFORMANCE CRITERIA

A. Regulatory Requirements: Comply with governing EPA notification regulations before beginning selective demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.

B. Standards: Comply with ANSI/ASSE A10.6 and NFPA 241.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify utilities have been disconnected and capped before starting selective demolition operations.

B. If available, review record documents of existing construction provided by Owner. Owner does not guarantee existing conditions are same as those indicated in record documents.

C. Verify that hazardous materials have been remediated before proceeding with building demolition operations.

D. Survey of Existing Conditions: Record existing conditions by use of measured drawings, preconstruction photographs, or preconstruction videotapes.

1. Inventory and record condition of items to be removed and salvaged. Provide photographs or video of conditions that might be misconstrued as damage caused by salvage operations.

3.2 UTILITY SERVICES AND MECHANICAL/ELECTRICAL SYSTEMS

A. Existing Services/Systems to Remain: Maintain services/systems indicated to remain and protect them against damage.

B. Existing Services/Systems to Be Removed, Relocated, or Abandoned: Locate, identify, disconnect, and seal or cap off indicated utility services and mechanical/electrical systems serving areas to be selectively demolished.

1. Owner will arrange to shut off indicated services/systems when requested by Contractor.
2. Arrange to shut off indicated utilities with utility companies.
3. If services/systems are required to be removed, relocated, or abandoned, provide temporary services/systems that bypass area of selective demolition and maintain continuity of services/systems to other parts of building.
4. Disconnect, demolish, and remove fire-suppression systems, plumbing, and HVAC systems, equipment, and components indicated to be removed.
    a. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
    b. Piping to Be Abandoned in Place: Drain piping and cap or plug piping with same or compatible piping material.
    c. Equipment to Be Removed: Disconnect and cap services and remove equipment.
    d. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make equipment operational.
    e. Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to Owner.
    f. Ducts to Be Removed: Remove portion of ducts indicated to be removed and plug remaining ducts with same or compatible ductwork material.
    g. Ducts to Be Abandoned in Place: Cap or plug ducts with same or compatible ductwork material.

3.3 PROTECTION

A. Temporary Protection: Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.

1. Provide protection to ensure safe passage of people around selective demolition area and to and from occupied portions of building.
2. Provide temporary weather protection, during interval between selective demolition of existing construction on exterior surfaces and new construction, to prevent water leakage and damage to structure and interior areas.
3. Protect walls, ceilings, floors, and other existing finish Work to remain or that are exposed during selective demolition operations.
4. Cover and protect furniture, furnishings, and equipment that have not been removed.

B. Temporary Shoring: Provide and maintain shoring, bracing, and structural supports as required to preserve stability and prevent movement, settlement, or collapse of construction and finishes to remain, and to prevent unexpected or uncontrolled movement or collapse of construction being demolished.

1. Strengthen or add new supports when required during progress of selective demolition.

C. Remove temporary barricades and protections where hazards no longer exist.

3.4 SELECTIVE DEMOLITION, GENERAL

A. General: Demolish and remove existing construction only to extent required by new construction and as indicated. Use methods required to complete Work within limitations of governing regulations and as follows:

1. Proceed with selective demolition systematically, from higher to lower level. Complete selective demolition operations above each floor or tier before disturbing supporting members on next lower level.
2. Neatly cut openings and holes plumb, square, and true to dimensions required. Use cutting methods least likely to damage construction to remain or adjoining construction. Use hand tools or small power tools designed for sawing or grinding, not hammering and chopping, to minimize disturbance of adjacent surfaces. Temporarily cover openings to remain.
3. Cut or drill from exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.
4. Do not use cutting torches until Work area is cleared of flammable materials. At concealed spaces, such as duct and pipe interiors, verify condition and contents of hidden space before starting flame-cutting operations. Maintain fire watch and portable fire suppression devices during flame-cutting operations.
5. Maintain fire watch during and for at least two hours after flame-cutting operations.
6. Maintain adequate ventilation when using cutting torches.
7. Remove decayed, vermin-infested, or otherwise dangerous or unsuitable materials and promptly dispose of off-site.
8. Remove structural framing members and lower to ground by method suitable to avoid free fall and to prevent ground impact or dust generation.
9. Locate selective demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.
10. Dispose of demolished items and materials promptly.

B. Existing Items to Remain: Protect construction indicated to remain against damage and soiling during selective demolition. When permitted by Architect, items may be removed to suitable, protected storage location during selective demolition, cleaned, and reinstalled in their original locations after selective demolition operations are complete.

3.5 SELECTIVE DEMOLITION PROCEDURES FOR SPECIFIC MATERIALS

A. Adhere to OSHA’s Respirable Crystalline Silica Standard for Construction (29 CFR 1926.1153).

B. Concrete: Demolish in small sections. Using power-driven saw, cut concrete to depth of at least 3/4 inch at junctures with construction to remain. Dislodge concrete from reinforcement at perimeter of areas being demolished, cut reinforcement, and then remove remainder of concrete. Neatly trim openings to dimensions indicated.

C. Masonry: Demolish in small sections. Cut masonry at junctures with construction to remain, using power-driven saw, and then remove masonry between saw cuts.

D. Existing Finishes: Where finish materials are scheduled to replace existing finish materials, ensure removal of existing finishes is complete, including adhesives and other materials that would be detrimental to installation of new finish materials.

3.6 DISPOSAL OF DEMOLISHED MATERIALS

A. Remove demolition waste materials from Project site and dispose of them in an EPA-approved construction and demolition waste landfill acceptable to authorities having jurisdiction.

1. Do not allow demolished materials to accumulate on-site.
2. Remove and transport debris in manner that will prevent spillage on adjacent surfaces and areas.

B. Burning: Do not burn demolished materials.

3.7 CLEANING

A. Clean adjacent structures and improvements of dust, dirt, and debris caused by selective demolition operations. Return adjacent areas to condition existing before selective demolition operations began.

END OF SECTION 024119

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SECTION 033000 - MISCELLANEOUS CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes cast-in-place concrete, including reinforcement, concrete materials, mixture design, placement procedures, and finishes.

B. Related Sections:

1. Division 31 Section "Earthwork" for drainage fill under slabs-on-grade.

1.3 SUBMITTALS

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

B. Other Action Submittal:

1. Design Mixtures: For each concrete mixture.

1.5 QUALITY ASSURANCE

A. Ready-Mix-Concrete Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94 requirements for production facilities and equipment.

B. Comply with the following sections of ACI 301 , unless modified by requirements in the Contract Documents:

1. "General Requirements."
2. "Formwork and Formwork Accessories."
3. "Reinforcement and Reinforcement Supports."
4. "Concrete Mixtures."
5. "Handling, Placing, and Constructing."
6. "Lightweight Concrete."

C. Comply with ACI 117, "Specifications for Tolerances for Concrete Construction and Materials."

PART 2 - PRODUCTS

2.1 FORMWORK

A. Furnish formwork and formwork accessories according to ACI 301.

2.2 STEEL REINFORCEMENT

A. Recycled Content: Provide steel reinforcement with an average recycled content of steel products so that postconsumer recycled content plus one-half of preconsumer recycled content is not less than 25 percent.

B. Reinforcing Bars: ASTM A 615, Grade 60, deformed.

C. Plain-Steel Wire: ASTM A 82, as drawn.

D. Plain-Steel Welded Wire Reinforcement: ASTM A 185, fabricated from as-drawn steel wire into flat sheets.

E. Deformed-Steel Welded Wire Reinforcement: ASTM A 497, flat sheet.

2.3 CONCRETE MATERIALS

A. Cementitious Material: Use the following cementitious materials, of the same type, brand, and source throughout Project:

1. Portland Cement: ASTM C 150, Type I.

a. Fly Ash: Not permitted.

B. Normal-Weight Aggregate: ASTM C 33, graded, 1-1/2-inch nominal maximum aggregate size.

C. Water: ASTM C 94/C 94M.

2.4 ADMIXTURES

A. Air-Entraining Admixture: ASTM C 260.

B. Chemical Admixtures: Provide admixtures certified by manufacturer to be compatible with other admixtures and that will not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride.

1. Water-Reducing Admixture: ASTM C 494, Type A.
2. Retarding Admixture: ASTM C 494, Type B.
3. Water-Reducing and Retarding Admixture: ASTM C 494, Type D.
4. High-Range, Water-Reducing Admixture: ASTM C 494, Type F.
5. High-Range, Water-Reducing and Retarding Admixture: ASTM C 494, Type G.
6. Plasticizing and Retarding Admixture: ASTM C 1017, Type II.

2.5 RELATED MATERIALS

A. Vapor Retarder: Polyethylene sheet, ASTM D 4397, not less than 10 mils thick; or plastic sheet, ASTM E 1745, Class C.

B. Joint-Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber, or ASTM D 1752, cork or self-expanding cork.

2.6 CURING MATERIALS

A. Evaporation Retarder: Waterborne, monomolecular film forming; manufactured for application to fresh concrete.

B. Absorptive Cover: AASHTO M 182, Class 3, burlap cloth or cotton mats.

C. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.

D. Water: Potable.

E. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B.

2.7 CONCRETE MIXTURES

A. Comply with ACI 301 requirements for concrete mixtures.

B. Normal-Weight Concrete: Prepare design mixes, proportioned according to ACI 301, as follows:

1. Minimum Compressive Strength: 3000 psi at 28 days.
2. Maximum Water-Cementitious Materials Ratio: 0.45.
3. Slump Limit: 4 inches, plus or minus 1 inch.
4. Air Content: Maintain within range permitted by ACI 301. Do not allow air content of trowel-finished floor slabs to exceed 3 percent.

2.8 CONCRETE MIXING

A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94, and furnish batch ticket information.

1. When air temperature is above 90 deg F, reduce mixing and delivery time to 60 minutes.

B. Project-Site Mixing: Measure, batch, and mix concrete materials and concrete according to ASTM C 94/C 94M. Mix concrete materials in appropriate drum-type batch machine mixer.

1. For mixer capacity of 1 cu. yd. or smaller, continue mixing at least 1-1/2 minutes, but not more than 5 minutes after ingredients are in mixer, before any part of batch is released.
2. For mixer capacity larger than 1 cu. yd., increase mixing time by 15 seconds for each additional 1 cu. yd.
3. Provide batch ticket for each batch discharged and used in the Work, indicating Project identification name and number, date, mix type, mix time, quantity, and amount of water added. Record approximate location of final deposit in structure.

PART 3 - EXECUTION

3.1 FORMWORK

A. Design, construct, erect, brace, and maintain formwork according to ACI 301.

3.2 EMBEDDED ITEMS

A. Place and secure anchorage devices and other embedded items required for adjoining work attached to or supported by cast-in-place concrete. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.

3.3 VAPOR RETARDERS

A. Install, protect, and repair vapor retarders according to ASTM E 1643; place sheets in position with longest dimension parallel with direction of pour.

1. Lap joints 6 inches and seal with manufacturer's recommended adhesive or joint tape.

3.4 STEEL REINFORCEMENT

B. Comply with CRSI's "Manual of Standard Practice" for fabricating, placing, and supporting reinforcement.

1. Do not cut or puncture vapor retarder. Repair damage and reseal vapor retarder before placing concrete.

3.5 JOINTS

A. General: Construct joints true to line with faces perpendicular to surface plane of concrete.

B. Construction Joints: Locate and install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Architect.

C. Contraction Joints: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of concrete thickness, as follows:

1. Grooved Joints: Form contraction joints after initial floating by grooving and finishing each edge of joint with groover tool to a radius of 1/8 inch. Repeat grooving of contraction joints after applying surface finishes. Eliminate groover marks on concrete surfaces.

D. Isolation Joints: Install joint-filler strips at junctions with slabs-on-grade and vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.

1. Extend joint fillers full width and depth of joint, terminating flush with finished concrete surface, unless otherwise indicated.

3.6 CONCRETE PLACEMENT

A. Comply with ACI 301 for placing concrete.

B. Before test sampling and placing concrete, water may be added at Project site, subject to limitations of ACI 301.

C. Do not add water to concrete during delivery, at Project site, or during placement.

D. Consolidate concrete with mechanical vibrating equipment.

3.7 FINISHING FORMED SURFACES

A. Smooth-Formed Finish: As-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch tie holes and defective areas. Remove fins and other projections exceeding 1/8 inch.

1. Apply to concrete surfaces exposed to public view, to receive a rubbed finish, or to be covered with a coating or covering material applied directly to concrete.

B. Rubbed Finish: Apply the following rubbed finish, defined in ACI 301, to smooth-formed finished as-cast concrete where indicated:

1. Smooth-rubbed finish.
2. Grout-cleaned finish.
3. Cork-floated finish.

C. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces, unless otherwise indicated.

3.8 CONCRETE PROTECTING AND CURING

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and with ACI 301 for hot-weather protection during curing.

B. Evaporation Retarder: Apply evaporation retarder to concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.

C. Begin curing after finishing concrete but not before free water has disappeared from concrete surface.

D. Curing Methods: Cure formed and unformed concrete for at least seven days by one or a combination of the following methods:

1. Moisture Curing: Keep surfaces continuously moist for not less than seven days with the following materials:

a. Water.
b. Continuous water-fog spray.
c. Absorptive cover, water saturated and kept continuously wet. Cover concrete surfaces and edges with 12-inch lap over adjacent absorptive covers.

2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches, and sealed by waterproof tape or adhesive. Cure for not less than seven days. Immediately repair any holes or tears during curing period using cover material and waterproof tape.

3. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period.

3.9 FIELD QUALITY CONTROL

A. Testing Agency: Owner may engage a qualified testing agency to perform tests and inspections.

B. Tests: Perform according to ACI 301.

1. Testing Frequency: One composite sample shall be obtained for each day's pour of each concrete mix exceeding 5 cu. yd. but less than 25 cu. yd., plus one set for each additional 50 cu. yd. or fraction thereof.

3.10 REPAIRS

A. Remove and replace concrete that does not comply with requirements in this Section.

END OF SECTION 033000

SECTION 055000 - METAL FABRICATIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

B. Section shall supplement and not supersede specifications indicated on the S-series drawings.

1.2 SUMMARY

A. Section Includes:

1. Steel framing and supports for mechanical and electrical equipment.
2. Steel framing and supports for applications where framing and supports are not specified in other Sections.

1.3 COORDINATION

A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written instructions to ensure that shop primers and topcoats are compatible with one another.

B. Coordinate installation of metal fabrications that are anchored to or that receive other work. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

1.4 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel in accordance with the following:

1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."

1.5 FIELD CONDITIONS

A. Field Measurements: Verify actual locations of walls, floor slabs, decks, and other construction contiguous with metal fabrications by field measurements before fabrication.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes acting on exterior metal fabrications by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects.

1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

2.2 METALS

A. Metal Surfaces, General: Provide materials with smooth, flat surfaces unless otherwise indicated. For metal fabrications exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.

B. Steel Plates, Shapes, and Bars: ASTM A36/A36M.

C. Cast Iron: Either gray iron, ASTM A48/A48M, or malleable iron, ASTM A47/A47M, unless otherwise indicated.

2.3 FASTENERS

A. General: Unless otherwise indicated, provide Type 304 stainless steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B633 or ASTM F1941/F1941M, Class Fe/Zn 5, at exterior walls. Select fasteners for type, grade, and class required.

B. Steel Bolts and Nuts: Regular hexagon-head bolts, ASTM A307, Grade A; with hex nuts, ASTM A563; and, where indicated, flat washers.

C. High-Strength Bolts, Nuts, and Washers: ASTM F3125/F3125M, Grade A325, Type 3, heavy-hex steel structural bolts; ASTM A563, Grade DH3, heavy-hex carbon-steel nuts; and where indicated, flat washers.

D. Stainless Steel Bolts and Nuts: Regular hexagon-head annealed stainless steel bolts, ASTM F593; with hex nuts, ASTM F594; and, where indicated, flat washers; Alloy Group 1.

2.4 MISCELLANEOUS MATERIALS

A. Universal Shop Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI#79 and compatible with topcoat.

1. Use primer containing pigments that make it easily distinguishable from zinc-rich primer.

B. Epoxy Zinc-Rich Primer: Complying with MPI#20 and compatible with topcoat.

C. Shop Primer for Galvanized Steel: Primer formulated for exterior use over zinc-coated metal and compatible with finish paint systems indicated.

D. Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 and compatible with paints specified to be used over it.

E. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D1187/D1187M.

F. Shrinkage-Resistant Grout: Factory-packaged, nonmetallic, nonstaining, noncorrosive, nongaseous grout complying with ASTM C1107/C1107M. Provide grout specifically recommended by manufacturer for interior and exterior applications.

2.5 FABRICATION, GENERAL

A. Shop Assembly: Preassemble items in the shop to greatest extent possible. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.

B. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.

C. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.

D. Form exposed work with accurate angles and surfaces and straight edges.

E. Weld corners and seams continuously to comply with the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

F. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners or welds where possible. Where exposed fasteners are required, use Phillips flat-head (countersunk) fasteners unless otherwise indicated. Locate joints where least conspicuous.

G. Fabricate seams and other connections that are exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.

H. Cut, reinforce, drill, and tap metal fabrications as indicated to receive finish hardware, screws, and similar items.

I. Provide for anchorage of type indicated; coordinate with supporting structure. Space anchoring devices to secure metal fabrications rigidly in place and to support indicated loads.

2.6 MISCELLANEOUS FRAMING AND SUPPORTS

A. General: Provide steel framing and supports not specified in other Sections as needed to complete the Work.

B. Fabricate units from steel shapes, plates, and bars of welded construction unless otherwise indicated. Fabricate to sizes, shapes, and profiles indicated and as necessary to receive adjacent construction.

C. Galvanize miscellaneous framing and supports where indicated.

D. Prime miscellaneous framing and supports with primer appropriate for installed locations.

2.7 MISCELLANEOUS STEEL TRIM

A. Unless otherwise indicated, fabricate units from steel shapes, plates, and bars of profiles shown with continuously welded joints and smooth exposed edges. Miter corners and use concealed field splices where possible.

B. Provide cutouts, fittings, and anchorages as needed to coordinate assembly and installation with other work.

1. Provide with integrally welded steel strap anchors for embedding in concrete or masonry construction.

C. Galvanize and prime exterior miscellaneous steel trim.

D. Prime miscellaneous steel trim with primer appropriate for installed locations.

2.8 GENERAL FINISH REQUIREMENTS

A. Finish metal fabrications after assembly.

B. Finish exposed surfaces to remove tool and die marks and stretch lines, and to blend into surrounding surface.

2.9 STEEL AND IRON FINISHES

A. Galvanizing: Hot-dip galvanize items as indicated to comply with ASTM A153/A153M for steel and iron hardware and with ASTM A123/A123M for other steel and iron products.

1. Do not quench or apply post galvanizing treatments that might interfere with paint adhesion.

B. Preparation for Shop Priming Galvanized Items: After galvanizing, thoroughly clean galvanized surfaces of grease, dirt, oil, flux, and other foreign matter, and treat with metallic phosphate process.

C. Shop prime iron and steel items not indicated to be galvanized unless they are to be embedded in concrete, sprayed-on fireproofing, or masonry, or unless otherwise indicated.

1. Shop prime with universal shop primer unless zinc-rich primer is indicated.

D. Preparation for Shop Priming: Prepare surfaces to comply with requirements indicated below:

1. Exterior Items: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
2. Items Indicated to Receive Zinc-Rich Primer: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
3. Items Indicated to Receive Universal Primers: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
4. Other Steel Items: SSPC-SP 3, "Power Tool Cleaning."
5. Galvanized-Steel Items: SSPC-SP 16, "Brush-off Blast Cleaning of Coated and Uncoated Galvanized Steel, Stainless Steels, and Non-Ferrous Metals."

E. Shop Priming: Apply shop primer to comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.

1. Stripe paint corners, crevices, bolts, welds, and sharp edges.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal fabrications. Set metal fabrications accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.

B. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.

C. Field Welding: Comply with the following requirements:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

D. Fastening to In-Place Construction: Provide anchorage devices and fasteners where metal fabrications are required to be fastened to in-place construction. Provide threaded fasteners for use with concrete and masonry inserts, toggle bolts, through bolts, lag screws, wood screws, and other connectors.

E. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.

3.2 INSTALLATION OF MISCELLANEOUS FRAMING AND SUPPORTS

A. General: Install framing and supports to comply with requirements of items being supported, including manufacturers' written instructions.

3.3 REPAIRS

A. Touchup Painting:

1. Immediately after erection, clean field welds, bolted connections, and abraded areas. Paint uncoated and abraded areas with same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.

    a. Apply by brush or spray to provide a minimum 2.0-mil dry film thickness.

2. Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint are specified in Section 099123 "Interior Painting."

B. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A780/A780M.

END OF SECTION 055000

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SECTION 230130 - EXISTING HVAC AIR DISTRIBUTION SYSTEM CLEANING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes cleaning existing HVAC supply air, return air, and outside air ducts, plenums, and system components as indicated on the drawings. Cleaning of existing exhaust air ducts and system components are not included in the project.

B. Related Requirements:

1. Section 230500 "Heating and Air Conditioning".

1.3 DEFINITIONS

A. ACAC: American Council for Accredited Certification.

B. AIHA-LAP: American Industrial Hygiene Association Lab Accreditation Program

C. ASCS: Air systems cleaning specialist.

D. CESB: Council of Engineering and Scientific Specialty Boards.

E. EMLAP: Environmental Microbiology Laboratory Accreditation Program.

F. IEP: Indoor Environmental Professional.

G. IICRC: Institute of Inspection, Cleaning, and Restoration Certification.

H. NADCA: National Air Duct Cleaners Association.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data:

1. For an ASCS.
2. For an IEP.

B. Field Quality-Control Reports:

1. Project's existing conditions.
2. Evaluations and recommendations, including cleanliness verification.
3. Strategies and procedures plan.

1.5 CLOSEOUT SUBMITTALS

A. Post-Project report.

1.6 QUALITY ASSURANCE

A. ASCS Qualifications: A certified member of NADCA.

1. Certification: Employ an ASCS certified by NADCA on a full-time basis.
2. Supervisor Qualifications: Certified as an ASCS by NADCA.

B. IEP Qualifications: CMI who is certified by ACAC and accredited by CESB.

C. UL Compliance: Comply with UL 181 and UL 181A for fibrous-glass ducts.

PART 2 - PRODUCTS

2.1 NOT USED

PART 3 - EXECUTION

3.1 PREPARATION

A. Inspect HVAC air-distribution equipment, ducts, plenums, and system components to determine appropriate methods, tools, and equipment required for performance of the Work.

B. Perform "Project Evaluation and Recommendation" according to NADCA ACR.

C. Cleaning Plan: Prepare a written plan for air-distribution system cleaning that includes strategies and step-by-step procedures. At a minimum, include the following:

1. Supervisor contact information.
2. Work schedule, including location, times, and impact on occupied areas.
3. Methods and materials planned for each HVAC component type.
4. Required support from other trades.
5. Equipment and material storage requirements.
6. Exhaust equipment setup locations.

D. Existing Conditions Report: Prepare a written report that documents existing conditions of the systems and equipment. Include documentation of existing conditions, including inspection results, photo images, laboratory results, and interpretations of the laboratory results by an IEP.

1. Prepare written report listing conditions detrimental to performance of the Work.

E. Proceed with work only after conditions detrimental to performance of the Work have been corrected.

F. Use new and existing service openings, as required for proper cleaning, at various points of the HVAC system for physical and mechanical entry and for inspection.

G. Service Openings in HVAC Systems shall be in accordance with Access Doors in Section 230500.

H. Mark the position of manual volume dampers and air-directional mechanical devices inside the system prior to cleaning.

3.2 CLEANING

A. Comply with NADCA ACR, including items identified as "recommended," "advised," and "suggested."

B. Perform electrical lockout and tagout according to Owner's standards or authorities having jurisdiction.

C. Remove non-adhered substances and deposits from within the HVAC system.

D. Systems and Components to Be Cleaned:

1. Air devices for supply, return, and exhaust air including existing registers, grilles, and diffusers.
2. Ductwork:
    a. Supply air ducts, including turning vanes and reheat coils, to the air-handling unit.
    b. Return air ducts to the air-handling unit.
    c. Outside air ducts to the air-handling unit.
    d. Transfer ducts.
3. Casings.

E. Collect debris removed during cleaning. Ensure that debris is not dispersed outside the HVAC system during the cleaning process.

F. Particulate Collection:

1. For particulate collection equipment, include adequate filtration to contain debris removed. Locate equipment downwind and away from all air intakes and other points of entry into the building.
2. HEPA filtration with 99.97 percent collection efficiency for particles sized 0.3 micrometer or larger shall be used where the particulate collection equipment is exhausting inside the building,

G. Control odors and mist vapors during the cleaning and restoration process.

H. Protect new ductwork, new air devices, new HVAC units and their coils, etc. during the cleaning process. Deenergize equipment during the cleaning process. Any new work found to be dirty as a part of the cleaning process shall be cleaned in accordance with this Section.

I. Mark the position of manual volume dampers and air-directional mechanical devices inside the system prior to cleaning. Restore them to their marked position on completion of cleaning.

J. System components shall be cleaned so that all HVAC system components are visibly clean. On completion, all components must be returned to those settings recorded just prior to cleaning operations.

K. Clean non-adhered substance deposits according to NADCA ACR.

L. Air-Distribution Systems:

1. Create service openings using duct access doors in the HVAC system as necessary to accommodate cleaning.
2. Mechanically clean air-distribution systems specified to remove all visible contaminants, so that the systems are capable of passing the HVAC System Cleanliness Tests (see NADCA ACR).

M. Debris removed from the HVAC system shall be disposed of according to applicable Federal, state, and local requirements.

N. Mechanical Cleaning Methodology:

1. Source-Removal Cleaning Methods: The HVAC system shall be cleaned using source-removal mechanical cleaning methods designed to extract contaminants from within the HVAC system and to safely remove these contaminants from the facility. No cleaning method, or combination of methods, shall be used that could potentially damage components of the HVAC system or negatively alter the integrity of the system.

    a. Use continuously operating vacuum-collection devices to keep each section being cleaned under negative pressure.
    b. Cleaning methods that require mechanical agitation devices to dislodge debris that is adhered to interior surfaces of HVAC system components shall be equipped to safely remove these devices. Cleaning methods shall not damage the integrity of HVAC system components or damage porous surface materials, such as duct and plenum liners.

2. Cleaning Mineral-Fiber Insulation Components:

    a. Fibrous-glass thermal or acoustical insulation elements present in equipment or ductwork shall be thoroughly cleaned with HEPA vacuuming equipment while the HVAC system is under constant negative pressure and shall not be permitted to get wet according to NADCA ACR.
    b. Cleaning methods used shall not cause damage to fibrous-glass components and will render the system capable of passing the HVAC System Cleanliness Tests (see NADCA ACR).
    c. Fibrous materials that become wet shall be discarded and replaced.

3.3 CLEANLINESS VERIFICATION

A. Verify cleanliness according to NADCA ACR, "Verification of HVAC System Cleanliness" Section.

B. Verify HVAC system cleanliness after mechanical cleaning.

C. Surface-Cleaning Verification: Perform visual inspection for cleanliness. If no contaminants are evident through visual inspection, the HVAC system shall be considered clean. If visible contaminants are evident through visual inspection, those portions of the system where contaminants are visible shall be re-cleaned and subjected to re-inspection for cleanliness.

D. Prepare a written cleanliness verification report. At a minimum, include the following:

1. Written documentation of the success of the cleaning.
2. Site inspection reports, initialed by supervisor, including notation on areas of inspection, as verified through visual inspection.
3. Surface comparison test results if required.
4. Gravimetric analysis (nonporous surfaces only).
5. System areas found to be damaged.

3.4 RESTORATION

A. Restore and repair HVAC air-distribution equipment, ducts, plenums, and components according to NADCA ACR, "Restoration and Repair of Mechanical Systems" Section.

B. Replace fibrous-glass materials that cannot be restored by cleaning or resurfacing. Comply with requirements in Section 230500 for "Metal Ducts" and "Nonmetal Ducts."

C. Replace damaged insulation according to Section 230500.

D. Ensure that closures do not hinder or alter airflow.

E. New closure materials, including insulation, shall match opened materials and shall have removable closure panels fitted with gaskets and fasteners.

F. Restore manual volume dampers and air-directional mechanical devices inside the system to their marked position on completion of cleaning.

3.5 PROJECT CLOSEOUT

A. Post-Project Report:

1. Post-cleaning laboratory results if any.
2. Post-cleaning photo images.
3. Post-cleaning verification summary.

B. Drawings:

1. Deviations of existing system from Owner's record drawings.
2. Location of service openings.

END OF SECTION 230130

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SECTION 230500 - HEATING AND AIR CONDITIONING

230501 GENERAL

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

B. The Heating and Air Conditioning Contractor shall cooperate with the contractors of other trades and shall install his work as fast as the progress of the balance of the work will permit.

C. The Heating and Air Conditioning Contractor shall install all work in accordance with the requirements of the latest edition of the North Carolina State Building Code. Codes to be a part of these specifications: North Carolina State Building Code, National Fire Protection Association Codes Section 70, 90A, 91, and other applicable sections.

D. Inspection by local authorities will be required.

E. The drawings accompanying these specifications indicate diagrammatically the general location of the ducts, piping, and equipment and do not show all offsets, supports, fittings, bolts, connections, etc., required for a complete system. While the drawings are to be followed as closely as possible, if it is found necessary to change the location of same to accommodate the conditions at the building, such changes shall be made without additional cost to the Owner, and as directed by the Engineer. Any detail which is omitted, and which is necessary for the proper operation of any system included under the contract, shall be supplied and installed by the Heating and Air Conditioning Contractor without extra cost to the Owner. All pipes and ducts shall be run as high as possible to maintain ceiling and head clearance. All equipment shall be installed in such a manner as to allow proper maintenance access.

F. Equipment and Materials shall be delivered to the site and stored in original containers, suitably sheltered from the elements, but readily accessible for inspection by the Engineer until installed. All items subject to moisture damage shall be stored in dry spaces.

G. Conditions shall be checked at the building before placing orders for apparatus and such apparatus shall be of such dimensions as to fit the spaces allotted. The Heating and Air Conditioning Contractor shall not scale mechanical plans, but rather refer to architectural plans for dimensions.

H. All debris resulting from heating and air conditioning work shall be removed from the premises daily or as directed by the Engineer. Trash and rubbish shall not be allowed to accumulate either within or outside the building. Materials and debris, which in the opinion of the Engineer cannot practicably be removed from the site the same day, may be temporarily stacked or stored in a designated location on the site as directed by the Engineer.

I. Guards shall be provided for all moving equipment, motor couplings, pump shafts, belt drives and similar exposed reciprocating or rotating components.

J. All HVAC and refrigeration equipment shall be labeled in accordance with Section 301 of the North Carolina Mechanical Code and as required by the Authority having jurisdiction. Labeling shall be a permanent factory-applied nameplate affixed to the equipment on which shall appear in legible lettering, the manufacturer’s name or trademark, the model, serial number, and the seal or mark of the testing agency.

230502 SCOPE

A. The Heating and Air Conditioning Contractor shall provide labor and materials required for a complete system ready for operation as shown on the drawings and hereinafter specified. This includes all equipment, ductwork, necessary plumbing, and all other services necessary whether they are specifically mentioned herein or not. The entire installation shall be installed in a first-class, neat, professional manner to the satisfaction of the Engineer and shall conform to all applicable codes and laws.

230503 DEMOLITION

A. General Requirements: The work includes the demolition or removal of all construction indicated, specified, or necessary to accomplish the work under this contract. All items not to be reused shall become the property of the Heating and Air Conditioning Contractor. The drawings define the scope of work, but it is not intended that all items of demolition work be specifically indicated. After carefully reviewing the drawings and specifications to determine intent, and prior to bidding, the Heating and Air Conditioning Contractor shall visit the site and determine the extent of demolition work required to properly complete the work under his contract.

B. Protection of Materials and Work: Before beginning any cutting or demolition work, the Heating and Air Conditioning Contractor shall carefully survey the existing work and examine the drawings and specifications to determine the extent of work required. The Heating and Air Conditioning Contractor shall take all necessary precautions to insure against damage to existing work to remain in place, to be reused, or to remain the property of the Owner, and any damage to such work shall be repaired or replaced at no additional cost to the Owner.

C. The Contractor shall notify the Owner immediately in the event that any asbestos is encountered during demolition.

D. Refrigerant in Demolitioned Equipment: Recover all refrigerant in approved refrigerant containers and in compliance with section 608 of the EPA Clean Air Act. Removal must be conducted under supervision of an EPA certified technician.

230504 SHOP DRAWINGS AND SUBMITTAL DATA

A. The Heating and Air Conditioning Contractor shall submit within 10 days after award of the contract a list of materials and the manufacturer to be used on this project. He shall submit within thirty days after award of the contract at least five copies of submittal data in written form for the Engineer's use in approving materials and equipment. One copy will be returned. If the Heating and Air Conditioning Contractor desires the return of more than one copy, additional copies shall be provided to the Engineer at the time of the original submission. It is requested that all submittal data be sent to the Architect at one time. Unless special consideration is given, none of the submittal data will be checked until it has all been received by the Architect. Where called for, the Heating and Air Conditioning Contractor shall submit five sets of shop drawings showing the detailed arrangement or connections that are shown schematically on the drawings. Data certified for the specified project and indicated manufacturer, type, or size, capacity, etc., shall be submitted for the following equipment items:

1. Split System Air Conditioning Units
2. Controls with Complete Diagram
3. Manual and Motorized Dampers
4. Access Doors
5. Insulation
6. Flexible Hoses
7. Water Treatment
8. Testing and Balancing

230505 APPROVED EQUAL EQUIPMENT, ETC.

A. Manufacturers listed are to establish a standard of quality and not intended to limit the selection to these manufacturers. All materials and equipment which are essential and have not been specified or shown shall be new and of the highest grade and quality, free from defect or other imperfections. It should be understood that where the word "provide" is used, it is intended that the Heating and Air Conditioning Contractor shall purchase and install all materials required. Approval of equipment will not relieve the Contractor of compliance with the specifications even if such approval is made in writing, unless the attention of the Engineer is called to the non-complying features by letter accompanying the submittal data.

Approval of submittal data by the Engineer shall not be construed as a complete check of approval of detailed dimensions, weights, gauges, and similar details with the proposed articles. The conformance with the necessary coordination between the various other contractors and suppliers shall be solely the responsibility of the Heating and Air Conditioning Contractor.

230506 SPLIT SYSTEM AIR CONDITIONING UNITS

A. Air handling unit section shall be UL labeled draw-thru design complete with centrifugal fans, condensate drain pan, refrigerant coil, insulated cabinet, and filter frame. The cooling coil shall be dual circuit where indicated with non-ferrous tubes mechanically bonded to plate fins. The fan section shall have direct or belt driven forward-curved fans with variable speed adjustment. The cabinets shall be internally insulated and shall be constructed of 16-gauge galvanized steel with baked enamel finish.

B. Where indicated on the drawings, units shall include integral hot water heating coil. Heating coils shall be two-row hot water type with copper tubes and aluminum fins by the unit manufacturer installed in casing that matches the air handling unit's cabinet in the reheat position at the unit's discharge.

C. Air handling unit sections shall include frames for 2" thick filters and factory supplied fixed filter blockoffs to prevent air bypass around filters. Filters shall be 2" thick UL Class 1 pleated panels with Minimum Efficiency Reporting Value of MERV 8 per ASHRAE Standard 52.2-1999. Contractor shall supply complete sets of filters to protect his equipment during construction, another change of filters at completion, and leave two additional complete sets of filters at the project for the next change.

D. Outdoor section shall be UL labeled and AHRI rated and certified with its air handling unit and bear the AHRI seal. The fans shall be permanently lubricated, direct drive, propeller type. The compressors shall be hermetic using R-410A refrigerant with suction and discharge stop valves, crankcase heaters, automatically reversible oil pump, oil filter, internal thermostat, and controls for low ambient temperature operation. The unit controls shall include compressor staging where dual compressor units are provided, a high and low pressurestat of the automatic reset type, a positive acting five minute timer to prevent short cycling and a motor starting and protecting equipment. Units shall be furnished with coil guards.

E. Refrigerant piping systems shall be sized, pitched, and furnished with all specialties as recommended by the unit manufacturer to accommodate refrigerant piping lengths. Specialties shall include suction line accumulators, liquid line solenoid valves, thermal expansion valves, refrigerant sight glass, removable core filter drier, and any other item deemed necessary or recommended by the unit manufacturer.

F. See Article 230526 GUARANTEE for description of compressor warranty requirements.

G. Indoor and outdoor sections shall be by the same manufacturer and shall be Trane, Carrier, JCI/York, or approved equal.

230507 CONTROLS

A. See Sections 230913 and 230923.

230508 MANUAL AND MOTORIZED DAMPERS

A. Manual and Motorized dampers shall be low leakage type provided in the duct systems as indicated on the drawings in accordance with NFPA Standard No. 90A and shall conform to NFPA Standard No. 90A for materials and workmanship. Blades shall have extruded vinyl double edge seals. Jambs shall have flexible metal compression type seals. Maximum damper leakage at 1.0 in w.g. shall be 10 cfm/sf of damper area for motorized dampers. For manual dampers, maximum damper leakage at 1.0 in w.g. shall be 40 cfm/sf of damper area for dampers smaller than 24 inches in either dimension and shall be 20 cfm/sf for larger manual dampers. Leakage ratings shall be when tested in accordance with AMCA Standard 500. The dampers shall have electric operators and shall be normally closed. Wiring to operators shall be by the

Heating and Air Conditioning Contractor. To facilitate service access and insulation installation, manual damper handles shall be lock on quadrant type on 2" stand-off brackets. Handles shall be spray painted red. Dampers shall be installed according to the manufacturer's recommendations. Dampers shall be Ruskin, Pottorff, Prefco, Air Balance, United Enertech, or approved equal.

230509 ACCESS DOORS

A. Access doors shall be provided for access to new or existing motor operated dampers and duct mounted smoke detectors, and to facilitate duct cleaning.

B. Duct mounted access doors shall be constructed of No. 22 US gauge zinc-coated sheet steel and shall be gasketed, air tight and provided with not less than two (2) cam-type latches. Doors shall be square and shall be 12" x 12" or two inches less than the height of the duct. Doors shall be two-piece with 1" rigid insulation between the metal sides. Doors shall have engraved plastic laminated labels with 1/2" tall letters indicating item accessed through door.

C. Provide 3/4" diameter red dot on ceiling grid below all duct access doors.

230510 ELECTRICAL

A. Electrical circuit sizes are based on capacities of the drawings and it shall be the responsibility of Heating and Air Conditioning Contractor to change any and all electrical work in order to fit mechanical equipment. Heating and Air Conditioning Contractor shall coordinate with Electrical Contractor to assure that all units and controls are properly connected and shall check wiring prior to starting units. Any damage to units resulting from improper wiring or connections shall be the responsibility of Heating and Air Conditioning Contractor. Flexible electrical conduits shall be 18 inches in length maximum. All electrical work shall be installed in accordance with Codes having jurisdiction and the Electrical Division, Division 26, of these specifications.

230511 DUCTWORK

A. Mechanical drawings are schematic only and do not show all offsets etc. required. Heating and Air Conditioning Contractor shall familiarize himself with the complete contract documents and site conditions before fabricating ductwork. Any changes to ductwork found necessary to accommodate the conditions at the building shall be made without additional cost to the Owner, and as directed by the Engineer.

B. During construction, interior of ductwork shall be protected. All open ends of new or existing ductwork shall be covered with self-adhesive 3 mil polyethylene film.

C. Ductwork shall be of galvanized steel with standard gauges and construction in accordance with the recommendations of SMACNA HVAC Duct Construction Standards, Metal and Flexible, Third Addition, 2005 for appropriate pressure class. Elbows shall be long radius type or have airfoil turning vanes with 1-1/8" spacing and rail support system in all 90º square throat elbows. Ductwork shall be cross broken on all sides and shall be supported at both ends of each joint and at 10'-0" intervals maximum with galvanized angles supported by galvanized threaded rods of sizes and spacing in accordance with SMACNA. Ductwork to be exposed shall be constructed in a first class, neat, professional manner and exposed ductwork with excessive hammer marks shall be replaced. Round supply takeoffs from trunk ducts shall be made with factory 45º entry branch rectangular to round type fittings. Provide dampers in takeoff fittings where indicated on drawings. Damper handles shall be lock on quadrant type on 2" stand-off brackets. Handles shall be spray painted red. Splitter dampers shall be provided where indicated with adjustment quadrant locking device and shall be constructed of two thicknesses of 24-gauge-galvanized steel. All dimensions on the drawings are free inside dimensions. All components of the air distribution system shall be mechanically fastened with at least three equally spaced sheet metal screws with screws not more than on 12" centers. All duct joints shall be sealed in accordance with SMACNA Seal Class A

before insulation is applied. All sealants shall meet the provisions of UL181. Sealant shall be Sonolastic NP1.

230512 PIPING

A. The Heating and Air Conditioning Contractor shall furnish all piping and supports necessary to provide a complete system as shown or intended by the plans and specifications. All piping shall be inspected, tested, and approved before being insulated or concealed. Piping 2" and smaller shall be welded or have screwed fittings with extra heavy nipples, unless otherwise noted. Piping 2-1/2" and larger shall have welded fittings of the same material and weight as the piping in which they are installed. Pipe shall be clean, run generally parallel to the building and have all open ends closed with iron caps at all times. Eccentric reducers shall be used in horizontal runs and concentric reducers in vertical runs. All piping and fittings shall have manufacturer's identification and ASTM designation incorporated thereon.

B. Hot Water System Piping: Standard weight Schedule 40 black steel in accordance with ASTM Specification A-53 and Schedule 40 fittings. Piping 2" and smaller may be Type L copper with joints soldered with 95-5 solder. Piping shall have dielectric union or bronze ball valve at connection to ferrous pipe.

C. Drain Pan Condensate Piping: To match existing, Schedule 40 PVC with solvent cemented joints. Drain pan condensate piping shall have a minimum slope of 1/4" per linear foot and be of size at least as large as unit condensate connection.

D. Refrigerant Piping: Capped and dehydrated Type "L" hard drawn copper with wrought fittings. All joints shall be brazed with silver brazing alloys according to manufacturer's published recommendations.

E. Welding material and labor shall be in accordance with welding procedures of the American Standards Code for Pressure Piping ASA B31.9. Welders shall be fully qualified in above specified procedure, tested, and so certified by an approved Welding Bureau of Locally Recognized Testing Authority. Welding shall be electric arc or oxyacetylene welding method as approved using electrodes and rods that comply with ASTM specifications.

F. Swing joints or loops shall be provided wherever necessary to allow for expansion of piping. Broken piping or fittings shall be removed and replaced at the Heating and Air Conditioning Contractor's expense.

230513 PIPE HANGERS

A. All piping shall be neatly and securely supported by hangers from fire resistance rated structural elements of the building spaced in the following manner:

1. Steel Piping 1-1/4" and smaller - 7'-0" O.C.
2. Steel Piping 1-1/2" and larger - 10'-0" O.C.
3. Copper Piping 1-1/4" and smaller - 6'-0" O.C.
4. Copper Piping 1-1/2" and larger - 10'-0" O.C.
5. PVC Piping - 4'-0" O.C.
6. Provide 2 hangers at each change in direction.

B. Hangers shall be the Clevis type as manufactured by Modern Fig. 590, B-Line Fig. B 3100, or Grinnell Fig. 260 complete with hanger rods of size to conform to the type of hanger and pipe supported. Hangers shall be attached to the building by beam clamps or bolted to bar joist. At hangers provide 16" long 16 gauge galvanized sheet metal protection saddle three times the nominal pipe diameter. Under no condition shall hangers be connected directly to insulated pipe. Saddles shall be Modern Type A, B-Line Fig. B 3151, or Grinnell Fig. 167.

C. Hangers for vertical piping shall be riser clamp design as manufactured by Modern Fig. 500, B-Line Fig. B3373 or Grinnell Fig. 261. Riser clamps shall be installed on top of each floor penetration.

230514 INSULATION

A. All piping and ductwork shall be inspected and tested before insulation is applied. All insulation shall meet UL 723 and ASTM-E84 flame spread and smoke developed requirements of 25/50 and shall comply with NFPA 90A and the latest edition of the NC Building Code. Insulation shall be Certainteed, Owen Corning, Knauf, and Johns-Manville.

B. All new air conditioning supply, return, relief/exhaust, and outside air ducts shall be externally insulated with 2" thick 1 lb. density foil scrim kraft jacketed insulation. Adhere insulation to duct with fire retardant adhesive in sufficient quantities to prevent sagging. Ducts with a width over 30" shall be further secured on all sides with mechanical fasteners on 18" maximum centers. Insulation shall be butted with facing overlapping all joints at least 2" and sealed with fire retardant vapor barrier adhesive. Tape all joints, breaks, punctures, and any penetrations with SMACNA foil faced kraft duct tape.

C. Where externally insulated ductwork is supported by angles, provide 6” long x duct width x 1-1/2” thick 6.0 pound density board insulation on bottom of duct at hanger support. External duct insulation shall be continuous around ductwork and board insulation at duct hanger. On round ducts, duct hanger shall be outside duct insulation.

D. All new heating hot water supply and return piping fittings, valves, elbows, etc., shall be insulated with 4 lb. density snap on type glass fiber pipe insulation in molded sections with factory applied all service jacket. Provide high density insulation inserts at all pipe hangers. Seams shall be closely butted together and secured by self-sealing or pasting the all service lap. Fittings insulation shall be milled pre-fabricated of same material and thickness as on adjacent pipe. Fittings shall have factory preformed PVC jacket covers. Insulation thickness shall be as shown in the schedule on the drawings.

E. New air handling unit drain pan condensate piping on interior, pumped condensate piping, and all new refrigerant piping shall be insulated with tubular closed cell elastomeric insulation with all joints butted and cemented tight. Insulation shall have two coats of exterior protective coating on all insulation exposed on exterior. Insulation on make-up water piping and interior condensate piping shall be 1” thick. Insulation on refrigerant piping shall be 1-1/2” thick.

230515 SPECIALTIES

A. Air vents shall be provided at all points on the piping systems where required to eliminate air from the new system. The air vents shall be manual or high capacity automatic type as indicated and manufactured by Bell and Gossett, Hoffman or Armstrong.

B. Floor, wall and ceiling plates or escutcheons of size to fit pipe covering shall be installed where pipes pass thru finished areas and shall be chromium plated spring type as manufactured by Kenney, Connecticut Stamping and Bending Company, Dearborne or approved equal.

C. Unions or flanges shall be provided throughout the piping system to facilitate the removal and servicing of all valves, equipment, items, etc.

D. Pressure and temperature taps shall be 1/4" NPT fitting to receive either a temperature or pressure probe 1/8" OD. Fitting will be solid brass with two valve cores of Nordel (Max 275°F) at 500 PSI, fitted with a color-coded cap strap with gasket. No readout kits to be included.

E. Flexible Hoses shall be stainless steel outer braid and polymer inner core with swivel connectors on one end. Hoses shall be flame retardant per UL 723 and ASTM-E84 and rated to 300 psi.

230516 VIBRATION ISOLATION

A. Pad type isolators shall be 3/4" thick bridge bearing quality neoprene ribbed or waffled on both sides. Pads shall be selected for a maximum durometer of 50 and designed for 15% deflection. Where required, steel load-spreading plates shall be incorporated between the equipment and the neoprene pad.

B. Flexible duct connections, both at inlet and discharge of units, shall be made of 30 oz. workinglass fiber coated with neoprene, sewn together at edges and joints. These flexible connections shall withstand the operating air-pressure, shall not permit air leakage, and shall not transmit vibration.

230517 OPENINGS

A. The Heating and Air Conditioning Contractor shall furnish all blockouts, sleeves, and openings required for his work. Pipe sleeves, where firestop penetration system allows, shall be standard weight black steel pipe and shall be provided where pipes pass through walls and floor. Sleeves through walls shall butt flush with the wall finish and shall be of sufficient size to permit passage of pipe covering through the area where pipe is installed. Sleeves through floors shall extend 3/4" above the finished floor and sealed watertight. Any penetrations of ducts through floor shall be curbed 3" high x 6" wide with concrete. Specifically inform the General Contractor as to the correct size and location of openings and sleeves to insure that they shall be cast in their proper location. Sleeves and duct opening frames shall be furnished and installed by the Heating and Air Conditioning Contractor. Failure to indicate such openings in time to avoid delaying the General Contractor shall result in the Heating and Air Conditioning Contractor providing all cutting and repairing at his own expense. Repairing shall include sealing tight around pipe sleeves and duct frames in a neat and professional manner and in accordance with the "Cutting and Patching" section of this specification.

B. All penetrations in rated floors, firewalls and any other rated separations shall be protected using a through-penetration firestopping method with an "F" rating equivalent to the rating of the membrane being penetrated for particular piping materials used and membrane construction type. Floor penetrations shall additionally have a "T" rating equivalent to the rating of the floor being penetrated. Through-penetration firestop systems shall be installed and tested in accordance with ASTM E814 or UL 1479.

230518 NAMEPLATES

A. All new split systems shall be furnished with engraved plastic laminated labels permanently attached to the equipment. Lettering shall be ½" tall. Label shall include equipment number, area served, final acceptance date, number and size of filters, number and size of belts, and capacities. Final Acceptance/Substantial Completion date shall be on a separate label so as to allow equipment nameplates to be installed prior to final acceptance.

B. Provide engraved plastic laminated or plastic tape label on ceiling grid below air handling units located above ceilings. Label text shall match the piece of equipment's identifier/symbol noted on the drawings.

C. Provide laminated master list of all new HVAC equipment with filter sizes and quantities with listing matching the symbol on the drawings. List shall include location by room number. Install list on wall in Mechanical Room 530.

230519 CUTTING AND PATCHING

A. The Heating and Air Conditioning Contractor shall do all cutting and patching necessary to install all equipment as required under his contract in accordance with the General Conditions of these specifications and shall re-establish all finishes where cutting and patching occur to their original condition. All cutting of the structure, where unavoidable, must be approved by the Engineer and be done by the General Contractor, but shall be paid for by the Heating and Air Conditioning Contractor.

230520 WATER TREATMENT

A. Flushing of new hot water piping and equipment shall be by the Heating and Air Conditioning Contractor. Flushing shall be coordinated with New Hanover County School's Chemical Treatment Contractor. Chemical cleaning and treatment including chemicals will be by New Hanover County School's Chemical Treatment Contractor as contracted directly by New Hanover County Schools.

230521 PIPING PRESSURE TESTING

A. The Heating and Air Conditioning Contractor shall make the following tests before the systems are insulated or covered by construction. The systems shall have no decrease in pressure during the test periods. All system components shall be protected from test pressures that exceed manufacturer's design limits.

B. Notify Architect, Engineer, and Commissioning Authority 48 hours in advance of all tests.

C. Heating and Air Conditioning Contractor shall provide written report of each test.

D. New, renovated, or reused refrigerant piping shall be tested in accordance with Chapter 11 of the North Carolina Mechanical Code and split system unit manufacturer's recommendations.

E. New condensate piping shall be tested by applying a hydrostatic pressure of 100-psig for a period of two hours.

F. New hot water piping shall be tested by applying a hydrostatic pressure of 1.5 times system's working pressure or 100-PSIG, whichever is greater but not exceeding the maximum pressure rating for any component in the system under test, for a period of four (4) hours.

G. No caulking of joints shall be permitted. Any joint found to leak under this test shall be broken, remade, and a new test applied. Welded joint pinhole leaks shall be repaired by welding; however, welds that show numerous pinholes shall be replaced.

230522 TESTING AND BALANCING

A. Testing and balancing of the new or renovated portions of the heating, ventilating, and air conditioning systems shall be performed by an AABC certified Test and Balance Company as a subcontractor to the Heating and Air Conditioning Contractor. All instruments used shall be accurately calibrated and in good working order. The tests shall be in strict accordance to the Standards of AABC. Test and Balance Contractor shall submit TAB plan to the Engineer and Commissioning Authority for their review and approval prior to starting any TAB work.

B. Air balance and testing shall not begin until the systems have been installed in full working order and shown to be operating satisfactory on both heating and cooling. The Contractor shall place all heating, ventilating, and air conditioning systems into full operation and shall continue operation of the system until balancing is completed. All operational cost shall be borne by the Heating and Air Conditioning Contractor. The Architect and Engineer shall be given three weeks advance notice of when tests are to be made.

C. Upon completion of the heating, ventilating, and air conditioning systems, the Test and Balance Contractor shall compile the test data and submit four copies of the completed test data to the Engineer for evaluation and approval. At final inspection and prior to final commissioning verification, Heating and Air Conditioning Contractor shall have a copy of test and balance report and all necessary personnel and equipment to facilitate spot-checking of test and balance data by the Engineer or his representative. Final payment to the Contractor shall be withheld until the complete test and balance data has been approved.

D. Testing Procedure (AIR):

1. Test and adjust air handling unit fan's RPM and CFM to design requirements. Record all data.
2. Test and record motor full load amperes on all motors.
3. Adjust all main supply, exhaust, return, relief, and outside air ducts to proper design CFM when air handling systems are in normal operating mode, DCV mode, and in outside air economizer mode. Record exhaust, relief, and outside air data.
4. Test and adjust each diffuser, grille, and register for supply, exhaust, or return systems to within 10% of design requirements. Record all data.
5. All adjustments to air diffusing devices where possible shall be made in trunk or run out dampers, not at diffuser volume control.
6. Exhaust fans shall be tested and balanced for the requirement as shown on the plans. Record all data.
7. The Heating and Air Conditioning Contractor shall make any changes in the pulleys, belts, filters, dampers, or valves necessary or as recommended by the Engineer for correct balance at no additional cost to the Owner.

E. Testing Procedure (Water):

1. All air systems shall be balanced prior to water balance.
2. Notify Architect, Engineer, and NHCS 48 hours in advance of water balancing so that NHCS Technician has the opportunity to witness.
3. Open all valves to full open position.
4. Clean all strainers.
5. Set mixing valves to full coil flow.
6. Check expansion/compression tanks to determine that they are not air bound.
7. Check all air vents at high points of water systems to insure their installation and operation.
8. Check and record coil inlet water temperature and air temperature drops or rises across coils for full cooling and full heating.
9. Test and adjust each fluid balancing item to within 10% of design requirements. Record all data.

230523 INSTRUCTIONS/TRAINING

A. The Heating and Air Conditioning Contractor shall give an instruction and training period in the operation of the apparatus to the persons who will be in charge of the system.

230524 MAINTENANCE DATA

A. For all new or renovated items requiring maintenance, the Heating and Air Conditioning Contractor shall furnish two weeks prior to Final Acceptance and deliver to the Owner's representative on the job multiple copies of complete data as prepared by the manufacturer covering the details of operation and maintenance and complete parts list for all equipment specified. Each copy of the maintenance data shall be assembled into a 3-ring hardback binder with indexing and label on cover and spine. Data shall include:

1. Index with page numbers.
2. List of all subcontractors and suppliers with names, addresses, and phone numbers.
3. Contractor's certificate of Final Acceptance.
4. Copy of all warranties.
5. Equipment model numbers, etc. indicated and referenced with the same mark as shown on equipment on the drawings.
6. Filter schedules of sizes and quantities for all equipment requiring filters referenced by mark on the drawings.
7. Equipment summary showing all capacities and ratings.
8. Certified test and balance report.
9. Start-up and test reports for equipment.
10. Complete start-up, operation, and shut-down procedures for each system.

11. Lubrication schedules and types of lubricates.
12. All submittal data and shop drawings, unless included in a separate manual.

230525 RECORD DRAWINGS

A. Heating and Air Conditioning Contractor shall maintain "during the course of the work" a set of specifications and drawings marked up to show the work as installed, **including a minimum of two dimensions to indicate locations and elevations of buried work**. Upon completion of the work, return this set of drawings to the Architect/Engineer.

230526 GUARANTEE

A. The Heating and Air Conditioning Contractor shall guarantee the new or renovated heating and air conditioning systems subject to the General Conditions of these specifications, except refrigeration compressors in split system air conditioning units shall have a four-year extended warranty for the compressors only. Labor, freight, refrigerant and other required parts shall be provided or paid for by the Owner.

END OF SECTION 230500

SECTION 230913 - INSTRUMENTATION AND CONTROL DEVICES FOR HVAC

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

B. Section 230923, which specifies the DDC system that utilizes sensors, devices, actuators, and final control elements specified in this section.

1.2 SUBMITTALS

A. General: Submittals shall demonstrate compliance with technical requirements by reference to each subsection of this specification. Where a submitted item does not **comply fully** with each and every requirement of the Specifications, the submittal shall clearly indicate such deviations. Identification requirements for non-complying features of items are very specific.

B. Manufacturer's Data: Submit manufacturer's technical product data and installation instructions for all components including the following to demonstrate compliance with the contract documents:

1. Catalog cut sheets of all equipment used. This includes, but is not limited to sensors, actuators, valves, and dampers.
2. Catalog cut sheets of air measuring stations used for the volumetric control system. Include as a separate volumetric control section velocity transmitters, static pressure transmitters, and flow chart for sequence of operation.
3. Control air supply components, and sizing computations for compressors, receivers and main air piping.

C. Operation and Maintenance (O/M) Manuals: O/M manuals shall include the following, at a minimum, elements:

1. General description and specifications for all sensors and final control elements.
2. Complete troubleshooting procedures and guidelines for all sensors and final control elements.
3. Documentation of all required maintenance and repair/replacement procedures.

PART 2 - PRODUCTS

2.1 ELECTRONIC SENSORS

A. General: Provide all remote sensors and instrumentation as required for the control system. All sensors shall have accuracies as stated hereinafter. Electronic sensors shall include integral transmitter and provide input analog input signal as either 4-20 mA or 0-10 VDC over the full range specified below.

B. Sensor Accuracy and Range: Each sensor, as hereinafter specified, shall have accuracy and range as follows:

Sensed/Measured Variable	Sensor Characteristics Required	
	Measurement Accuracy	**Range**
Space Temperature	±1°F	+50°F- +85°F
Outside Air Temperature	±2°F	-30°F- +130°F
Relative Humidity (indoor air)	±5% RH	20% - 80% RH
Relative Humidity (outdoor air)	±2% RH	10% - 95% RH
Ducted Air Temperature	±1°F	+40°F- +140°F
Water Temperature		
- Chilled Water	±1°F	+20°F- +70°F
- Hot Water	±1°F	+50°F- +250°F

1. Temperature Sensors:
2. Space Sensors: Existing to be reused.
3. Duct- or Plenum-Mounted Dry Bulb Sensors:

    a. Sensors located within AHUs or ductwork/plenums attached thereto and used as part of a temperature control sequence shall be RTD type averaging sensors with integral transmitter and a sensing element incorporated in a copper capillary with a minimum length to provide 1 ft of capillary per square foot of airflow area. Where the airflow area exceeds 20 sf, provide multiple sensors and average inputs from sensors as AI point.

    b. Sensors located within BCUs, FCUs, or TUs or in ductwork/plenums attached thereto and used only for temperature monitoring, shall be one of the two following types, as applicable:

        1) When airflow area is 2 sf or less, provide probe type 10k ohm NTC, Type II or Type III, thermistor sensor with all metal enclosure that includes mounting bracket with insulation stand-offs, as required. Probe shall be ¼" diameter, stainless steel construction, and have length sufficient to monitor at least 60% of the dimension in the plane of installation.
        2) When airflow area exceeds 2 sf, provide averaging type 10k ohm NTC, Type II or Type III, thermistor sensor with all metal enclosure that includes mounting bracket with insulation stand-offs, as required. Capillary shall be of sufficient length to provide 1 ft of capillary per square foot of airflow area and capillary brackets shall be included.
        3) Where airflow area exceeds 20 sf, provide multiple sensors wired in a series-parallel configuration in accordance with the manufacturer's recommendations to provide multiple average inputs from sensors as AI point.

C. Indoor Air Relative Humidity Sensors: Analog type with polymer element for comfort conditions monitoring and platinum element for critical areas including laboratories, hospital procedure rooms, etc. Space sensors shall have blank covers and no humidity display and no setpoint adjustment unless specifically indicated on the drawings. Duct sensors shall meet the requirements specified below for outdoor relative humidity sensors.

D. Motor Status Sensor: Status of pumps and fans shall be proven by adjustable current sensing relays. Provide user adjustable time delays (10 seconds default) to prevent false alarms during starting/stopping of motor.

E. Flow status of pumps and fans, 1/2 hp and larger, shall be proven by adjustable current sensing relays. Provide software resident time delays to prevent false alarms during starting/stopping, including printout and application programs.

2.2 ELECTRIC CONTROLS ELEMENTS

A. Low-Voltage, On-Off Thermostats: NEMA DC 3, 24-V, bimetal-operated, mercury-switch type, with adjustable or fixed anticipation heater, concealed set-point adjustment, 55 to 85 deg F set-point range, and 2 deg F maximum differential.

B. Line-Voltage, On-Off Thermostats: Bimetal-actuated, open contact or bellows-actuated, enclosed, snap-switch or equivalent solid-state type, with heat anticipator; listed for electrical rating; with concealed set-point adjustment, 55 to 85 deg F set-point range, and 2 deg F maximum differential.

1. Electric Heating Thermostats: Equip with off position on dial wired to break ungrounded conductors.

C. Selector Switch: Integral, manual on-off-auto.

D. Remote-Bulb Thermostats: On-off or modulating type, liquid filled to compensate for changes in ambient temperature; with copper capillary and bulb, unless otherwise indicated.

E. Bulbs in water lines with separate wells of same material as bulb.

1. Bulbs in air ducts with flanges and shields.
2. Averaging Elements: Copper tubing with either single- or multiple-unit elements, extended to cover full width of duct or unit; adequately supported.
3. Scale settings and differential settings are clearly visible and adjustable from front of instrument.
4. On-Off Thermostat: With precision snap switches and with electrical ratings required by application.
5. Modulating Thermostats: Construct so complete potentiometer coil and wiper assembly is removable for inspection or replacement without disturbing calibration of instrument.

F. Hydronic Surface-Mounted Thermostat ("Aquastat"): Snap-acting, single-pole, single-throw, auto-reset switch that opens if temperature rises above adjustable high temperature setpoint or falls below adjustable low temperature setpoint, as indicated by the application.

2.3 FINAL CONTROL ELEMENTS AND OPERATORS:

A. Control Dampers:

1. Provide dampers with parallel blades for 2-position control, opposed blades for modulating control.

a. Outdoor Air Dampers: Dampers shall be constructed for coastal environment (salt water) corrosion resistance of Type 316 stainless steel (blades, frame, shafts, and linkage) or aluminium with clear anodized finish (blades and frame) with Type 316 stainless steel shafts and linkage. Dampers shall be rated Leakage Class I at 250-deg F according to ANSI/AMCA 500-D. When flow velocity is less than 2000 fpm, blades may be single thickness or airfoil type. When the flow velocity exceeds 2000 fpm, blades shall be airfoil type.
b. Operating Temperature Range: From minus 40 to plus 250 deg F.
c. Edge Seals: Use inflatable blade edging or replaceable rubber blade seals and spring-loaded stainless-steel side seals, rated for Leakage Class I according to ANSI/AMCA 500-D.

2. Damper Sizing:

a. Two-position dampers shall be sized to match duct or opening size, as applicable.
b. Modulating dampers utilized as part of an airside economizer cycle shall be sized in accordance with ASHRAE *Guideline 16*.

B. Control Valves:

1. Valve bodies shall be designed for not be less than 125 psig working pressure or 150% of the operating pressure, whichever is greater. Class 125 bronze body valves and Class 150 stainless steel valves shall comply with ASTM B16.5. Cast iron components shall meet the requirements of ASTM A126, Class B.
2. Select and size control valves as hereinafter specified and submit complete valve selection list with shop drawings.

C. Hydronic Control Valves:

1. General:

a. **Control valve body, packing, and trim shall be designed to withstand the system static head plus the greater of 150% of the maximum pump head or the pump cut-off head at the maximum temperature and velocity of the controlled medium and have no stem lift and leak-by at close-off.**
b. All valves 1-1/2" NPS and smaller shall be brass or bronze bodied with Type 316 stainless steel internal trim (including seats, seat rings, and valve stems). Non-metallic parts of valves shall be designed for 250-degree F operating temperature. Valves shall be packless construction or equipped with pressure sealed molded packing and backseating ring.

2. Three-Way Modulating Control Valves:

a. Valves shall be of the modulating globe or ball type and have *linear* position vs. flow characteristic; total flow through the valve shall remain constant regardless of the valve stem position.
b. Valve rangeability shall be at least 50:1.

3. Control Valve Sizing:

a. Two-position control: Valves shall be line size. Select valve for minimum wide open pressure drop.
b. Modulating 3-Way Control: Minimum valve pressure drop at full flow shall be the greater of 10 feet of water [4 psig] or the pressure drop through the heat exchanger.
c. Modulating 2-Way Control: Valves shall be sized to operate at no less than 70% available stroke at maximum flow rate. Select control valve C_v to provide control valve authority of at least 0.3 when authority is defined as the pressure drop through the valve at full flow divided by flow through the valve at minimum (0 gpm) flow. Minimum valve pressure drop at full flow shall be the greater of 10 feet of water [4 psig] or the pressure drop through the heat exchanger and piping (including valves, specialties, etc.) serving it.

D. Damper and Valve Operator/Actuators: Unless indicated otherwise on the Drawings, all actuators shall have fail-safe operation via a mechanical, spring-return mechanism. Provide external, manual gear release on non-spring-return actuators.

1. Electronic Damper and Valve Operator/Actuator: Shall be direct-coupled type designed for minimum 60,000 full-stroke cycles at rated torque. For valves, size actuator for torque required for valve tight close off at pressures defined above. For dampers, size actuator for running torque calculated as follows:

a. Parallel-Blade Dampers: 7 inch-lb/sq. ft. of damper.
b. Opposed-Blade Dampers: 5 inch-lb/sq. ft. of damper.
c. Dampers with Face Velocities exceeding 1000 fpm: Increase running torque by 2.0.

2. Couplings shall be V-bolt and V-shaped, with toothed cradle.
3. Provide electronic overload or digital rotation-sensing circuitry.

4. Actuator shall operate with proportional input signal of 2-V to 10-V dc or 4 to 20 mA
5. Rated temperature operating range for actuators shall be -20 deg F to +120 deg F for conventional applications and -20 to +250 deg F for smoke or fire/smoke damper application.
6. Actuator shall have the following operational characteristics:
    a. Actuator full stroke time requirement shall not exceed 12 seconds to open or 5 seconds to close when applied to control smoke dampers or cooling tower bypass valves less than 6" NPS.
    b. Actuator full stroke time requirement shall not exceed 30 seconds to open or close when applied to control cooling tower bypass valves 6" NPS or large size.
7. Electric Two-Position Damper Operator/Actuator: Provide a bi-directional, 120-V operator with spring return, size actuator for running torque calculated as follows:
    a. Parallel-Blade Dampers: 7 inch-lb/sq. ft. of damper.
    b. Opposed-Blade Dampers: 5 inch-lb/sq. ft. of damper.
    c. Dampers with Face Velocities exceeding 1000 fpm: Increase running torque by 2.0.
8. Position Indicator: Actuators shall be provided with a compact, adjustable visual position indicator attached to the actuator. As a damper or valve is cycled, the position indicator shall rotate, causing a cylinder to rotate inside a second cylinder with "display windows." When the damper or valve is open, the word "OPEN" shall be displayed in the two windows located 180° apart. When the damper or valve is closed, the word "CLOSED" shall be displayed. Between the two extremes, the display shall be scaled in degrees (0-90).

PART 3 - EXECUTION

3.1 INSTALLATION

A. Sensors and Controls:

1. Permanently mark terminal blocks for identification. Protect all circuits to avoid interruption of service due to short-circuiting or other conditions. Line-protect all wiring that comes from external sources to the site from lightning and static electricity.

2. Label or code each field wire at each end. Permanently label or code each point of all field terminal strips to show the instrument or item served. Color-code cable with cable diagrams may be used to accomplish cable identification.

B. Temperature Sensors:

1. Install all sensors and instrumentation according to manufacturer's written instructions. Temperature sensor locations shall be readily accessible, permitting quick replacement and servicing of them without special skills and tools.
2. Mount sensors rigidly and adequately for the environment within which the sensor operates.
3. Sensors used in mixing plenum or in air-handling unit hot and cold decks shall be of the averaging of type. Averaging sensors shall be installed in a serpentine manner horizontally across duct. Each bend shall be supported with a capillary clip.
4. Pipe-mounted temperature sensors shall be installed in wells completely filled with thermal conducting material.
5. All wires attached to sensors shall be air sealed in their conduits or in the wall to stop air transmitted from other areas affecting sensor reading.

C. Actuators:

1. Mount damper and valve actuators according to manufacturer's written instructions.

2. Damper actuators shall be located outside of the airstream.
3. Check operation of damper/actuator combination to confirm that actuator modulates damper smoothly throughout stroke to both open and closed position.
4. Check operation of valve/actuator combination to confirm that actuator modulates valve smoothly in both open and closed position.

3.2 FIELD TEST AND INSPECTIONS

A. Upon completion of installation of each sensor or final control element, field inspect and mechanically and electrically test for proper function.

END OF SECTION 230913

SECTION 230923 – DIRECT DIGITAL CONTROL SYSTEM FOR HVAC

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

B. Section 230913, which specifies the requirements for sensors, devices, actuators, and final control elements utilized by the DDC system.

1.2 QUALITY ASSURANCE

A. See 2.1.A for requirements of new controls connecting to existing controls within the building.

B. Single Source Responsibility of Supplier: The controls system vendor shall be responsible for the complete installation and proper operation of the control system. The vendor shall be in the regular and customary business of design, installation and service of computer-based building environmental control systems similar in size and complexity to the system specified. **The vendor shall be the manufacturer of the primary DDC system components**. The vendor must be licensed as an "unlimited electrical contractor" in the state of North Carolina, shall have a factory-certified trainer on staff, and provide 5 day per week technical support. ***Acceptable vendors and DDC systems are limited to the following***:

1. Johnson Controls, Inc. (395 North Green Meadows Drive, Wilmington, NC 28443) "Metasys" architecture.
    a. Exceptions:
        1) Controllers shall have the capability of utilizing any non-proprietary sensor and operator complying with Section 230913.
        2) Use of "adaptive control" algorithms for automatic PID "loop tuning" is prohibited.
2. Schneider Electric (2600 Perimeter Park Drive, Suite 150, Morrisville, NC 27560) "SmartStruxure" architecture.
    a. Exceptions:
        1) Controllers shall have the capability of utilizing any non-proprietary sensor and operator complying with Section 230913.
        2) Use of "adaptive control" algorithms for automatic PID "loop tuning" is prohibited.
        3) "Sensor Link" (S-Link) sensors and communications is prohibited unless specifically approved by NHCS prior to bid.
        4) Seven (7) levels of access security, in lieu of the eight (8) levels hereinafter specified is acceptable.
3. Siemens Building Technologies (215 Southport Drive, Suite 900, Morrisville, NC 27560) "Apogee" architecture with "Desigo CC" workstation software.
    a. Exceptions:
        1) Controllers shall have the capability of utilizing any non-proprietary sensor and operator complying with Section 230913.
        2) Use of "adaptive control" algorithms for automatic PID "loop tuning" is prohibited.
        3) Application of "ATEC" controllers is prohibited.
        4) "User Licences" shall be provided as required for support full system utilization by New Hanover County Schools maintenance and operations staff.

C. Equipment and Materials: Equipment and materials shall be catalogued products of manufacturers regularly engaged in production and installation of HVAC control systems. Products shall be manufacturer's latest standard design and have been tested and proven in actual use.

1.3 GUARANTEE PERIOD SERVICES

A. Maintenance of Control Hardware: The Contractor shall inspect, repair, replace, adjust, and calibrate, as required, the file server/workstation(s), associated peripheral equipment, and control units. The Contractor shall then furnish a report describing the status of the equipment, problem areas (if any) noticed during service work, and description of the corrective actions taken. The report shall clearly certify that all software is functioning correctly.

B. Maintenance of Control Software: The Contractor shall maintain all software. In addition, all factory or sub-vendor upgrades to software shall be added to the systems, when they become available, at no additional cost to the Owner.

C. Service Period: Routine system service shall be provided on a monthly basis for the first six (6) months of the guarantee period and at least every three months during the second six (6) months. Calls for service by the Owner shall be honored within 24 hours and are not to be considered as part of routine maintenance.

D. Service Documentation: A copy of the service report associated with each routine service visit or Owner-initiated service call shall be provided to the Owner and the A-E with 10 days after the date of each service call.

1.4 SUBMITTALS

A. General: Submittals shall demonstrate compliance with technical requirements by reference to each subsection of this specification. Where a submitted item does not **comply fully** with each and every requirement of the Specifications, the submittal shall clearly indicate such deviations.

B. Submittals required by this sub-section, and the required dates for each submittal, shall be finalized at a pre-submittal meeting, to be scheduled within 30 days of the date of the Notice to Proceed, and shall be provided in three phases:

1. Phase I submittals shall consist of DDC engineering shop drawings, including valve and damper schedules with sizing calculations, control system schematics, and sequences of operation, including setpoints, alarm limits, and schedules; product data for all control devices required under Section 230913; DDC system hardware and software as required below; and any other submittals determined during the pre-submittal conference. **Phase I submittals must be submitted and reviewed as early in project schedule as possible to avoid delays in actual installation.**
2. Phase II submittals shall consist of the graphic displays as required below. Phase II submittals are required at least 30 days prior to the date of the Substantial Completion inspection.
3. Phase III submittals shall be the close-out submittals as required below. Phase III submittals are required before the date of Final Completion inspection.

C. Product Data: Include manufacturer's technical literature for each control device. Indicate dimensions, capacities, performance characteristics, electrical characteristics, finishes for materials, and installation and startup instructions for each type of product indicated.

D. DDC System Hardware: Bill of materials of equipment indicating quantity, manufacturer, and model number. Include technical data for operator workstation equipment, interface equipment, control units, transducers/transmitters, sensors, actuators, valves, relays/switches, control panels, and operator interface equipment.

E. DDC System Software:

1. Include technical data for operating system software, operator interface, color graphics, and other third-party applications.
2. List of graphics indicating monitored systems, data (connected and calculated) point addresses, output schedule, and operator notations.

F. Controlled Systems: Instrumentation list with element name, type of device, manufacturer, model number, and product data. Include written description of sequence of operation including schematic diagram.

G. Shop Drawings:

1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
2. Bill of materials of equipment indicating quantity, manufacturer, and model number.
3. Schematic diagrams of each controlled system with control points labeled and control elements graphically shown, with wiring.
4. Details of control panel faces, including controls, instruments, and labeling.
5. Written description of sequences of operation.
6. Schedule of dampers including size, leakage, and flow characteristics.
7. Schedule of valves including flow characteristics.

H. DDC System Hardware:

1. Wiring diagrams for control units with termination numbers.
2. Schematic diagrams and floor plans for field sensors and control hardware.
3. Schematic diagrams for control, communication, and power wiring, showing trunk data conductors and wiring between operator workstation and control unit locations.
4. Scaled drawings showing mounting, routing, and wiring of elements including bases and special construction.

I. Graphic Displays: Include color prints or "screen shots" of each proposed graphic display proposed, complete with clear indication of (1) static components and dynamic components and (2) "on"/"off"/"alarm" condition designation convention.

J. Samples for Initial Selection: For each color available for each type of thermostat, sensor, etc. cover exposed to view with factory-applied color finishes.

K. Data Communications Protocol Certificates: **Certify that each proposed DDC system component complies with ASHRAE Standard 135-2012 and is BACnet Laboratory tested and certified.**

L. Closeout Submittals:

1. Operation and Maintenance Data: Include the following:
    a. Maintenance instructions and lists of spare parts for each type of control device and compressed-air station.
    b. Interconnection wiring diagrams with identified and numbered system components and devices.
    c. Keyboard illustrations and step-by-step procedures indexed for each operator function.
    d. Inspection period, cleaning methods, cleaning materials recommended, and calibration tolerances.
    e. Calibration records and list of set points.
    f. Software and Firmware Operational Documentation. Include the following:
        1) Software operating and upgrade manuals.

2) Program Software Backup: On a magnetic media or compact disc, complete with data files.
3) Device address list.
4) Printout of software application and graphic screens.
5) Software license.

PART 2 - PRODUCTS

2.1 SYSTEM DESCRIPTION

A. **Existing DDC in the building is Johnson Controls N2 system. Connect new equipment to existing DDC BAS control system as indicated on the drawings. Except where noted otherwise on the drawings, project's intent is to reuse existing controllers, sensors, actuators, control wiring, communications wiring, JACE, etc. for a complete and functional system. Where necessary, new work shall be compatible with the existing N2 system and as hereinafter specified.**

B. Provide a peer-to-peer networked, stand-alone, distributed processing global Direct Digital Control (DDC) System utilizing flat communications scheme. DDC system shall be BACnet/IP based, complying with ANSI/ASHRAE Standard 135-2012 protocol, and communicating using ISO 8802-3 (Ethernet) datalink/physical layer protocol.

C. Control system shall consist of sensors, indicators, actuators, final control elements, interface equipment, other apparatus, accessories, and software connected by a Local Area Network (LAN) to distributed processing, standalone control units (CUs) operating in a multiuser, multitasking environment and programmed to control HVAC and other systems, as shown on the Drawings.

D. The system shall include at least one Building Level Control Unit (BLCU) to provide interface to the Owner's file server and network located at the NHCS Maintenance Office and/or to a remote user using a standard Web browser as hereinafter specified.

E. DDC system shall use ANSI/ASHRAE Standard 135-2012 protocol and communicate using ISO 8802-3 (Ethernet) datalink/physical layer protocol. Comply with ANSI/ASHRAE Standard 135-2012 for all controls hardware and software.

2.2 MAINTENANCE OFFICE FILE SERVER AND WORKSTATIONS

A. The Owner maintains a controls systems file server, network, and client workstations located at the NHCS Maintenance Office, 2418 Carolina Beach Road, Wilmington, NC. The DDC system, through a site Building Level Control Unit as hereinafter specified, shall be connected to the Owner's wide area network (WAN) with a compatible communications interface as a client to the Owner's server. Communications between the any operator and the DDC system over the Owner's WAN shall be accomplished through either of the following:

1. PC or laptop workstations directly connected to the WAN.
2. Laptop, notebook, tablet, or other remote device connected to the WAN through a browser-based Internet connection using Barracuda SSL VPN Agent, a Java client that provides secure access to the WAN from remote locations.

B. Access to the Owner's WAN by the DDC system vendor, except via supervised access using Join.me Basic, is ***prohibited***.

C. Via either access method specified above, the following functions shall be provided:

1. Global Data Access: The server shall provide complete access to distributed data defined anywhere in the system.
2. Distributed Control: The server shall provide the ability to execute global control strategies based on control and data objects in any control unit.
3. Server shall include a master clock service for its subsystems and provide time synchronization for all network components.

D. Network Software: Software shall include the following capabilities:

1. I/O capability from any network operator workstation. The system operator interface shall be an easy to use, self-guiding, menu-penetration, windowing approach. Key features that shall be included in the interface are as follows:

a. Full English language data addressing and presentation: BACnet objects/points shall be identified within a particular BACnet device by a 32-bit numeric "object identifier" defined in accordance with ANSI/ASHRAE Standard 135-2012. Each object/point shall also be referenced by individual writable "object name" of 50 characters or less assigned by the Contractor utilizing the following naming convention:

1) Format object/point names in terms of "**FACILITY.SYSTEM.POINT**." "Facility" shall be the name or identifying abbreviation for the facility as provided by the Owner. "System" shall be the name or identifying abbreviation for the HVAC system, subsystem, or component matching **exactly the system, subsystem, and component identifier used within the Contract Documents**. "Point" name abbreviations shall be as follows:

Point Description	**Point Name**
Air Flow	AirFlow
Air Static Pressure	AirSP
Air Velocity Pressure	AirVP
Chilled Water Supply, Return Temperature	CHWSTemp CHWRTemp
Condenser Water Supply, Return Temperature	CDWSTemp CDWRTemp
Control Valve, 2-Way Configuration	CV2W
Control Valve, 3-Way Configuration	CV3W
Differential Temperature	DTemp
Heat Pump Water Loop Supply, Return Temperature	HPWSTemp HPWRTemp
Hot Water Supply, Return Temperature	HWSTemp HWRTemp
Hydronic Differential Pressure	DiffPres
Hydronic or Steam Pressure	Pres
Hydronic Return Temperature	RetTemp
Hydronic Energy (BTU), Chilled Water and Hot Water	CHWBtu HWBtu
Mixed Air Temperature, Humidity, Enthalpy	MATemp MAHum MAEnth
Outdoor Air Temperature, Humidity, Enthalpy	OATemp OAHum OAEnth
Percent Open	PctOpn
Percent Output	PctOpt
Power	kW

Point Description	Point Name
Return Air Temperature, Humidity, Enthalpy	RATemp RAHum RAEnt
Space Temperature, Humidity, Enthalpy	SpaceTemp SpaceHum SPEnth
Speed	RPM
Status, Alarm or Failure	Alarm
Status, Occupied/Unoccupied	Occ or Unocc
Status, On/Off	On or Off
Status, Open/Closed	Open or Closed
Supply Air Temperature	SATemp

2) Where a required point name abbreviation or identifier is not readily show within the Contract Documents, the Contractor shall submit a Request for Information to the A/E.
3) Object/point descriptions used for applications such as graphics, reports, alarms, etc. shall be same as the object/point name as specified above.
4) Engineering units shall be the English ("inch-pound") system.

b. Interactive operation and help messages.
c. Organization of points into logical groups or “systems” and an information penetration scheme that provides quick and simple method for maintenance staff to determine HVAC conditions and problems at any school, as follows:

1) Initial facility information display will be one or more "floor plans" that include basic site information and specific room by room data. Each of these data points are displayed as "hot buttons" so that selecting any data display takes the user to next, more detailed information level. The floor plan display(s) shall provide display of temperature and humidity conditions in each space. Designation of the HVAC unit or system serving each space shall also displayed and selecting that hot button shall take the operator to the detailed system points display for that unit or system.
2) At the HVAC system, subsystem, or component level, a graphical display or "tree structure" structure display may be utilized, as selected by the user. Typically, since all graphical displays tend to be less detailed and slower to respond than tree structure displays, graphics tend to be rarely used by experienced operators (but, graphics play an important role for educating less experienced operators).
3) Site information shall include direct hot button links to primary heating and cooling systems. (For example, selecting "CHWSTemp" shall take the operator immediately to the graphic or tree structure display of the facility chilled water cooling system, while selecting "HWSTemp" shall lead to the facility hot water heating system.)

d. Fill-in-the-blanks programming.
e. On-line data file programming.
f. Multi-level system access for security, as follows:

Level	Access Privileges
1	View only.
2	Same as Level 1, plus acknowledge alarms
3	Same as Level 1, plus allow temporary schedule modifications.
4	Same as Level 2, plus temporary or permanent schedule modifications, establish and view trend logs.
5	Same as Level 4, plus space temperature setpoint adjustment
6	Not assigned.
7	Not assigned.

8	Unlimited.

g. Pictorial representation of data on color graphic terminals with dynamic data.
h. Capability to alternate between graphic and text displays for the same logical group.

2. Automatic system diagnostics; monitor system and report failures of both controlled equipment and control system components.
3. Database creation and support.
4. Automatic and manual database save and restore.
5. Dynamic color graphic displays with multiple screen displays at once.
6. Custom graphics generation and graphics library of HVAC equipment and symbols.
7. Alarm and event processing.
   a. Provide audible, visual, and printed means of alarm indication. The alarm dialog box shall al ways become the top dialog box upon receipt of an alarm irrespective of the foreground application. Alarms assigned for printout shall be routed to the destination printer. In addition, alarms shall be capable of being routed to specified personnel by means of pager or mobile telephone.
   b. User-defined alarm messages shall be generated and delivered in conjunction with the alarm notification.
   c. Alarms shall be routed to the appropriate destination device(s), based on time and other conditions. An alarm shall be able to initiate sequences, print, be logged in the event log, generate custom messages, and automatically display an associated system graphic.
   d. Any object in the system shall be configurable to generate alarms on transition in and out of normal state. The operator shall be able to configure the alarm category, alarm limits, alarm limit differentials, states, al arm message, states and reporting actions for each alarm in the system.
   e. Minimum alarm categories required are notification, maintenance, critical and security.
8. BACnet object and property status and control.
9. Automatic restart of field equipment on restoration of power.
10. Data collection, reports, and logs. Include standard reports for the following:
    a. Current values of all objects.
    b. Current alarm summary.
    c. Disabled objects.
    d. Alarm lockout objects.
    e. Logs:
       1) Retrieve and display default logs, including "all points log", "system points log", "alarm log", etc.
       2) Create, retrieve, and display trend logs, in real time, of historical object data stored in remote CUs.
          a) Maintain trend log files saved to hard disk for subsequent use in spreadsheet or database programs.
          b) Dynamically graph the trend logged object data by creating two-axis (x, y) graphs that simultaneously display values relative to time for up to eight objects in different colors.
          c) It shall be possible to trend log any number of points at least equal to twice the number of connected physical points. Any object in the system (physical or calculated) may be logged.
          d) Once established, trend logs shall continue until deleted by user. Data storage sufficient for at least 30 days shall be provided for each trend log.
    f. Custom report development.
    g. Utility and weather reports.

11. Application editors for controllers and schedules.

2.3 WEB BROWSER CLIENT ACCESS

A. In addition to networked workstation access as specified above, provide access to all data at the facility site and allow a remote user to operate the site control system using any Java-enabled browser (e.g., Firefox, Internet Explorer, Google Chrome, etc.) without requiring proprietary interface and/or configuration. The system shall be capable of supporting multiple clients using a standard Web browser.

B. Web browser shall provide the same view of the system, in terms of graphics, schedules, logs, etc., and provide the same interface methodology as provided by a workstation directly connected to the file server network.

C. Web browser client access shall support the following functions, at a minimum:

1. User log-on identification and password shall be required as hereinbefore specified. If an unauthorized user attempts access, a blank web page shall be displayed. Security using Java authentication and encryption techniques to prevent unauthorized access shall be implemented.
2. Graphical screens developed for direct system access shall be the same screens used for the web browser client. Any animated graphical objects supported by the control system shall be supported by the Web browser interface.
3. HTML/XML programming shall not be required to display system graphics or data on a web page. HTML editing of the web page shall be allowed if the user desires a specific look or format.
4. Real-time values displayed on a web page shall update automatically without requiring a manual "refresh" of the web page.

D. Provide the capability to specify a user's home page as determined by the log-on user identification. Provide the ability to limit a specific user to just the defined home page. From the home page, links to other views or pages in the system shall be possible.

E. *Graphic screens on the web browser client shall support hypertext links to other locations on Internet sites by specifying the Uniform Resource Locator (URL) for the desired link.*

2.4 JOB CONDITIONS (ENVIRONMENTAL CONDITIONS OF OPERATION)

A. LAN hardware shall be designed to operate in ambient conditions of 65 to 90 degrees F at 20 to 80 percent RH, non-condensing.

B. Digital control equipment shall comply with the following:

1. Digital control equipment shall be designed to operate in ambient conditions of 35 to 120 degrees F at a relative humidity of 0 to 95 percent non-condensing.
2. Control units as hereinafter specified shall operate properly with power fluctuations of plus 15 percent to minus 10 percent of nominal supply voltage.

C. Electric and electronic equipment shall be properly mounted and organized in a grounded and Listed NEMA 1 cabinet (panel). Cabinets or enclosures shall protect equipment from dust, liquids or accidental blows.

2.5 DIRECT DIGITAL CONTROL UNITS

A. General: Multiple digital control units (CUs), including at least one site BLCU, shall be provided. ***CUs shall be fully field programmable and the use of firmware-based application specific controllers (ASCs)***

is prohibited. All control functions shall be resident in the CUs, including those involved in facility-wide strategies.

1. **Exception**: When approved by NHCS for a specific application, an ASC may be utilized, provided the ASC programming, including firmware, enables the proposed ASC to fully comply with the specified I/O points and sequence of operation specified in Section 230993 for that application. ***When use of an ASC is desired by the DDC system vendor, product data and other information necessary to evaluate its use shall be submitted at the pre-submittal conference hereinbefore specified.***

B. Control Units: Modular, comprising processor board with programmable, non-volatile, random-access memory; local operator access and display panel; integral interface equipment; and backup power source.

1. Control units shall fully comply with the system architecture and communication requirements specified hereinbefore.
2. Units shall monitor or control each I/O point; process information; execute commands from other control units, devices, and operator stations; and download from or upload to operator workstation or diagnostic terminal unit.
3. Stand-alone mode control functions shall operate regardless of network status. Functions include the following:
   a. Global communications.
   b. Discrete/digital, analog, and pulse I/O.
   c. Monitoring, controlling, or addressing data points.
   d. Software applications, scheduling, and alarm processing.
   e. Testing and developing control algorithms without disrupting field hardware and controlled environment.

C. Building Level Control Unit (BLCU): Provide one or more BLCUs, as required, meeting the general requirements for control units specified above and incorporating communication interface between the control system peer-to-peer network and the Owner's WAN.

D. Control Modes: Control loops shall be able to utilize any of the following control modes:

1. Two position (e.g., on-off, slow-fast)
2. Proportional (P), proportional plus integral (PI), or proportional plus integral plus derivative (PID), applied as follows:

Controlled Variable	**Control Mode**
Space Temperature	P
Mixed Air Temperature	PI
Coil Discharge Temperature	PI (cooling), P (heating)
Hot Water Supply Temperature	P
Airflow	PI (with wide proportional band and fast reset rate) or PID
Fan Static Pressure	PI
Humidity	P (PI throttling range is less than 5%)
Dewpoint Temperature	P (PI throttling range is less than 2 F)

3. For any unlisted application, the control mode shall be as approved by the A-E.

E. I/O Interface: Hardwired inputs and outputs may tie into system through controllers. Protect points so that shorting will cause no damage to controllers.

1. Binary Inputs: Allow monitoring of on-off signals without external power.
2. Pulse Accumulation Inputs: Accept up to 10 pulses per second.
3. Analog Inputs: Allow monitoring of low-voltage (0- to 10-V dc), current (4 to 20 mA), or resistance signals.
4. Binary Outputs: Provide on-off or pulsed low-voltage signal, selectable for normally open or normally closed operation with three-position (on-off-auto) override switches and status lights.
5. Analog Outputs: Provide modulating signal, either low voltage (0- to 10-V dc) or current (4 to 20 mA) with status lights, two-position (auto-manual) switch, and manually adjustable potentiometer.
6. Tri-State Outputs: Provide two coordinated binary outputs for control of three-point, floating-type electronic actuators.
7. Universal I/Os: Provide software selectable binary or analog outputs.

F. Power Supplies: Transformers with Class 2 current-limiting type or overcurrent protection; limit connected loads to 80 percent of rated capacity. DC power supply shall match output current and voltage requirements and be full-wave rectifier type with the following:

1. Output ripple of 5.0 mV maximum peak to peak.
2. Combined 1 percent line and load regulation with 100-mic.sec. response time for 50 percent load changes.
3. Built-in over-voltage and over-current protection and be able to withstand 150 percent overload for at least 3 seconds without failure.

G. Power Line Filtering: Internal or external transient voltage and surge suppression for workstations or controllers with the following:

1. Minimum dielectric strength of 1000 V.
2. Maximum response time of 10 nanoseconds.
3. Minimum transverse-mode noise attenuation of 65 dB.
4. Minimum common-mode noise attenuation of 150 dB at 40 to 100 Hz.

H. Diagnostic Devices:

1. Each CU shall be supplied with connections to which maintenance personnel can connect a portable laptop computer for data display, setpoint modification, and reloading and modification of controller programs.
2. Provide software installed on Owner's laptop computers required to troubleshoot local HVAC equipment operation and control. It shall be possible for the user to completely operate the controller via the laptop and completely exercise all valves and dampers via the laptop, display values in complete engineering units for setting analog control values, reading digital status, setting control parameters, commanding digital loads, and setting analog alarm limits. Full read-write capability shall be provided.

I. Control Functions: All control functions shall execute within the standalone control units via DDC algorithms. The operator shall be able to customize control strategies and sequences of operations defining the appropriate control loop algorithms and choosing the optimum loop parameters. Each CU shall include the following standalone functions:

1. Direct Digital Control algorithms and control sequences are to be CU resident and be capable of standalone operation. All DDC programs shall be custom written as required to meet the performance criteria spelled out in the sequence of operation paragraphs for each controlled mechanical system. PID control mode shall be employed as appropriate to the application and per sequences or operation.
2. Enable/Disable: All CU resident DDC programs shall be capable of being enabled or disabled from any workstation. In the enable mode all DDC loops shall be active and output signals shall be routed to the final control elements. In the disable mode, all DDC loop calculations shall continue but

outputs to actuators shall be suppressed. (When disabled, control outputs shall stay in the same state or position as commanded from the central or until they are manually set to automatic.)

3. Integral Windup Prevention: To eliminate integral windup, all PID programs shall automatically invoke integral windup prevention routines whenever the controlled unit is off, under manual control or under control of a system or time initiated program, or when the controlled unit is in the process or starting or stopping.

J. Default Value Operation: All CU's shall be capable of being programmed to utilize stored default values for assured fail-safe operation of critical processes. Default values shall be invoked upon sensor failure or, if the primary value is normally provided by the central or another CU, by loss of communication between CUs. Individual application software packages shall be structured to assume a fail-safe condition upon loss of input sensors. Loss of an input sensor shall result in output of a sensor-failed message at the central control and command station. Each CU shall have capability for local readouts of all functions.

2.6 APPLICATION SOFTWARE

A. Provide the following programs in addition to control algorithms defined on the drawings:

1. Scheduled Start/Stop: Provide a calendar format for schedules required for annual time-of-day scheduling for equipment operation, trending, logging and reports, etc.

B. Provide the following minimum features:

1. Day-type schedules (Monday, Tuesday, Wednesday, Thursday, Friday, Saturday, Sunday, Holiday, Pre-Holiday day, Vacation day, Special Day, etc., 24 hours per day)
2. Monthly schedules (allow individual assignment of day types to each day of the month).
3. Yearly schedules (allow schedules to be applied on an annual basis and be edited and re-applied to a following year).
4. Temporary override of schedules shall be allowed by operators with access levels as specified above. A temporary override shall (1) extend hours of use of HVAC systems, subsystems, and/or components up to midnight on weekdays and (2) allow use of HVAC systems, subsystems, and/or components during scheduled "off" periods for a maximum of 12 hours. When an override use period terminates, the temporary override time(s) shall be voided and affected HVAC elements shall return to their normal schedules.

C. Optimum Start: Optimum start program shall automatically delay equipment startup based on outdoor temperature, space temperature, and system response to assure that comfort conditions are reached exactly at scheduled occupancy time. The program is to operate in both heating and cooling cycles. An adaptive algorithm is to be employed which automatically adjusts according to past experience. Algorithm shall be tested and updated every day. The program shall automatically assign longer lead times for weekend and holiday shutdowns. Space temperature input is to be the highest value of zones served in the cooling mode and the lowest of zones served in the heating mode. It shall be possible to assign occupancy start times on a per air handler unit basis. Modification of assigned occupancy start times shall be possible via the central operator's terminal.

D. Event Initiated Programs (EIP): Event initiators may be any digital data point in the system, real time values, or any analog alarm limit. The EIPs shall be structured so that one initiator may set and reset the EIP as it goes from normal to off-normal and back to normal, or one initiator may set the program and a second initiator reset the program, or reset may be manual via the console keyboard. Setting an EIP shall cause a series of start or stop commands to assigned loads to be executed to EIP's points. EIP’s shall have priority assignments to allow them to override other programs in the set mode when desired. The operator shall have read-write capability for initiator load and priority assignment.

E. Alarm Initiation and Response:

1. All AI points shall have user-defined upper and/or lower condition limits. If user-defined limits are not defined, ***default limits shall be initially set as follows***:

Space temperature	5ºF below low setpoint of comfort zone or 5ºF above high setpoint of comfort zone
Space humidity	≥70% RH
AHU mixed air low limit	≤38ºF
Cooling coil leaving air	≥60ºF
Heating coil leaving air	≤90ºF
CHW supply	≥48ºF
HW supply	≤120ºF

2. Monitor and display "status" (on/off, high/low, open/closed, etc.) of each DI point. Motor on/off status shall be indicated by current sensing relays with field-adjustable trigger point to provide DI "switch", as hereinafter specified. Monitor and display "position" of an AO point (valve or damper percent open, motor speed percent of full speed, etc.)

3. An alarm shall be initiated whenever any of the following conditions occur:

   a. Any AI point high or low limit alarm setpoint is exceeded.
   b. Any DI status condition does not correspond to the DDC command condition (i.e., damper is closed when occupied/unoccupied schedule requires damper to be open, motor is operated in "hand" rather than "auto" mode, etc.)
   c. Any AI or DI device fails or goes "out of range".
   d. Any AO device fails to respond to DDC command condition.
   e. If any AO control loop continues to cycle its output more than 40% of its range (user adjustable) 3 or more times in any 60 minute internal.
   f. For variable air volume AHUs, if any supply fan or return/relief fan speed AO output signal remains above 95% for more than 8 hours (user adjustable) accumulated per "on" period for 3 or more consecutive "on" periods.
   g. If any AHU coil control valve(s) AO output signal remains above 95% for more than accumulated 8 hours (user adjustable) per "on" period for 3 or more consecutive "on" periods.
   h. If any humidifier valve AO output signal remains above 85% for more than accumulated 8 hours (user adjustable) per "on" period for 3 or more consecutive "on" periods.
   i. During "on" periods, if any cooling coil chilled water return temperature is greater than design for more than 4 hours during which coil chilled water supply temperature was at or below design setpoint temperature.

F. Automatic Restart Programming:

1. When a power failure is detected in any phase, the DDC system shall command all electrical equipment served by the failed power source "off".
2. If the associated CU is powered by normal or emergency power, it may monitor its own power source as an indication of power status.

   a. If the CU is powered by uninterruptible power supply (UPS), or if it is not capable of monitoring its own power for use in sequences, Contractor shall provide at least one voltage transformer (three phase when applicable) for each facility for the DDC system to monitor for power status.

3. When the DDC system detects normal or emergency power has been restored to the failed power source, all equipment served by that source that was commanded "off" shall be automatically restarted. Restart shall be sequenced by the CU network restart program with a 5 second interval between starts to minimize inrush current.

G. Preventive Maintenance Instruction (PMI) programming: A preventive maintenance alarm shall be printed indicating maintenance requirements based on run time. The log shall include all equipment listed in the runtime schedule data base that have reached limit criteria of calendar-date (month-day-year) or high accumulation of totalized run-time (for points with start/stop or run status indication). Each PMI message shall include point descriptions, limit criteria and preventive maintenance instruction assigned to that limit. PMI shall be provided for each component of units such as air handling units. All limit criteria, PMI and reset-to-zero assignments shall be operator programmable, on-line at the keyboard. Stagger initial alarms to distribute maintenance throughout the year. Program initial PM alarms as follows:

1. Fans and pumps, run time 4000 hours
2. Refrigerators/freezers, converters, cooling tower system, water treatment, calendar time 3 months
3. Emergency generator oil samples, calibration of instrumentation and controls, calendar time 12 months
4. All other, calendar time 4 months

H. Additional application control requirements shall be met as required by the DDC control logic diagrams on the Drawings.

2.7 CABLING AND WIRING

A. DDC Cabling: Cabling between buildings shall be fiber optic. Network cabling within buildings shall be shielded twisted pair or fiber optic. Cabling or wiring between control units and I/O point devices shall be as follows:

Application	**Cable/Wire Type and Min. Gauge (AWG)**
Digital Input Wiring	24 gauge, twisted pair
Analog Input Wiring	24 gauge, shielded twisted pair
Digital Output Wiring	24 gauge stranded for 24V 18 gauge stranded for 120V
Analog Output Wiring	24 gauge, twisted pair

B. Data Cable:

1. Twisted shielded cables shall have FFEP insulation in thermoplastic jacket, with #24 AWG stranded conductors, minimum. Shield shall be tinned, soft-copper strands formed into a braid or equivalent foil. Shielding coverage on conductors shall not be less than 100 percent.

2. Multimode fiber optic cables shall be 62.5/125 micron Class Ia Graded Index Multimode Optical Fiber, OFNR, OFNP, Outdoor or Indoor / Outdoor (I/O) NEC Rating, FDDI Compliant.

   a. Coating Diameter: 250 Microns
   b. Core Eccentricity: 7.5% maximum (1.5% typical)
   c. Numerical aperture: .275 plus or minus .015
   d. Attenuation: 3.5 dB/km @ 850 NM / 1.50 dB/km @ 1300 NM
   e. Bandwidth: 160 MHz at 850 NM / 500 MHz @ 1300 NM
   f. Fiber connectors: ST .75 dB maximum insertion loss
   g. Cable bend radius: 10 times diameter

3. Single mode fiber optic cables shall be 8.3/125 micron Class IVa Dispersion-Unshifted Single-mode Optical Fiber, OFNR, OFNP, Outdoor or Indoor / Outdoor (I/O) NEC Rating, FDDI Compliant.

   a. Coating Diameter: 250 Microns
   b. Core Eccentricity: 7.5% maximum
   c. (1.5% typical)
   d. Attenuation: 0.5 dB/km @ 1310 NM/1550 NM
   e. Zero dispersion wavelength 1300 -1320 NM

f. Cable bend radius: 10 times diameter

C. Control and Interlock Wiring: All 24V-120V control and interlock wiring shall comply with the following:

1. Conductors:

a. All wire and conducting components shall be THWN stranded copper.
b. Conductors shall be continuous from device to device and no splices shall be made except within device or junction boxes. ***Wire nuts and crimp slices are prohibited.*** Junction boxes may be utilized where required.
c. Control wiring shall be color-coded in accordance with reviewed submittals.
d. Where conductors pass through a junction box or connect to a device, the conductor and the box shall be tagged to indicate the circuit and/or terminal number shown on the submittal drawings.

2. Raceway: Provide electrical metallic tubing (EMT), minimum 3/4" size. Fittings shall be steel insulated throat compression type. ***Set screw fittings, fittings constructed of alloys of aluminium or fittings of the indenter type are prohibited.*** Flexible metallic raceway may be utilized for the last 24" up to the connection point for devices, sensors, etc.
3. Routing of Raceway: Exposed raceway shall line up work true to adjacent surfaces and be placed in a workmanlike manner. Raceway shall be run at right angles to building lines; this requirement does not apply to raceway located below concrete placed as a part of this project. Raceway shall be sturdily supported and separated in a manner satisfactory to the A/E; raceway shall not be supported by the ceiling grid or ceiling grid support wires. In general, all raceway is to be concealed and routed overhead, below the floor, or in walls except in electrical or mechanical equipment rooms. Raceway in such rooms may be surface mounted.
4. Device Boxes: Device boxes for use in sheetrock or paneled surfaces shall be of galvanized steel, 4 inches square of a depth necessary to contain the intended device(s) and associated conductors. Boxes shall be sized to have no less than the minimum volume as required by the NEC. Boxes must be flush mounted and accommodate device(s) and all wires and connections without crowding. Boxes shall be furnished with a suitable plaster ring of the depth required to match the wall (or ceiling) material. Where the surface material or covering is combustible the front edge of the plaster ring shall be absolutely flush with the surface. Where the wall material is non-combustible, the front of the plaster must be recessed into the wall no further than 3/16 inch. Device boxes for flush mounted use in masonry walls shall be of the concrete tight masonry type sized for the number of device(s) and conductors. In locations where surface mounting of device boxes is permitted on masonry walls, provide 1/2 inch raised cover and suitable plaster ring.
5. Junction Boxes: Junction boxes shall be of galvanized steel of size, type, and shape for intended use and having adequate volume as required by NEC. All junction boxes shall be concealed unless specifically permitted elsewhere in these Specifications or on the Drawings. Boxes must be supported from the building structure without dependence on support of conduit, fixture support wires, ceiling support wires, or similar items.
6. Device and/or Junction Box Wall Penetrations: All wall penetrations at device or equipment locations must be protected in such a manner that the fire rating of the wall is maintained. ***It is the responsibility of the Contractor to assure that fire and smoke integrity of all walls is maintained at all penetration points***.

PART 3 - EXECUTION

3.1 EXISTING DDC SYSTEM/COMPONENTS DEMOLITION

A. If existing DDC system components are required to be removed to provide for installation of new DDC system components, careful attention to demolition and salvage is required. All existing DDC components, including but not limited to controllers, sensors, valve and damper operators, etc. ***shall be removed without damage and turned over to the Owner***.

B. Thermostats and sensors containing mercury shall be disposed in accordance with EPA Resource Conservation and Recovery Act (RCRA). Contractor shall refer to EPA web site for handling procedures for disposal and spill management of projects containing mercury.

C. Remove all abandoned wiring, raceway, and any related items, both exposed and concealed. Where existing raceway is concealed in concrete or masonry, remove wiring as required above and abandon in place. Cut abandoned raceway off ½" into wall, ceiling, or floor to allow patching to completely cover cut off end of raceway.

D. Repair surfaces and finishes to match existing surrounding surfaces or finish in all areas where items are removed. After repairs are made no evidence of previous use of surfaces shall be visible.

E. Provide touch-up painting as required where new items are installed adjacent to existing items to remain.

1. Clean new, damaged, and/or disturbed areas and apply primer, intermediate, and finish coats at each location.
2. Surface preparation and timing of application of successive coats of paint shall be in accordance with paint manufacturer's instructions.
3. Use zinc-rich paint to repair damage to galvanized finishes. Follow written instructions of paint manufacturer.
4. Repair paint finishes for other items, surfaces, or equipment as necessary. Follow written instructions of paint manufacturer.

F. Provide blank cover plates to match device plates used in the adjoining areas where outlet, device, junction, or other boxes are to remain,

3.2 INSTALLATION

A. Provide skilled technicians, properly trained and qualified for the work and directed by experienced engineers.

B. Except for short apparatus connections, run raceway parallel to or at right angles to the building structure. Conceal raceway and tubing in finished spaces. Do not run raceway concealed under insulation or inside ducts. Mount control devices, tubing and raceway located on ducts or apparatus with external insulation on standoff supports to avoid interference with insulation.

C. Run wire connecting devices on or in control cabinets parallel with the sides of the cabinet neatly racked to permit tracing. Rack connections bridging a cabinet door along the hinge side and protect from damage. Provide grommets, sleeves or vinyl tape to protect plastic tubing or wires from sharp edges of panels, raceway, and other items.

D. Cabling and Wiring Installation:

1. All control cabling and interlock wiring shall be installed in raceway.
   Exception: Where Class 2 wiring is located in concealed and accessible locations, including supply or return air plenums, plenum-rated cables complying with NFPA 262 may be installed without raceway, provided that:
2. Circuits meet NFPA 70 Class 2 (current-limited) requirements.
3. All cables shall be UL-listed for the application.
4. **Do not install Class 2 wiring in raceway containing Class 1 wiring.** Boxes and panels containing high voltage (120 V+) may not be used for low voltage wiring except for the purpose of interfacing the two via relays, transformers, etc.
5. Shielded, twisted pair cable shielding shall be grounded at each connection point.
6. Fiber Optic Cable:

a. Route all interior cables in raceway within walls and inaccessible ceiling spaces.
b. Use nylon bushings at top of conduit where stubbed in accessible ceiling spaces.
c. Support all cables using J type hooks where open cable is permitted.
d. Route all fiber optic cable in raceway with innerducts. The innerducts shall contain a pull string, if no fiber is pulled at the time of the installation of the duct.
e. All conduit where fiber optic cable is installed shall be sized to maintain the manufacturer's recommended bend radius of fiber optic cables. As a minimum, conduit shall be provided with long radius elbows.
f. All cables shall be terminated using appropriate termination equipment.
g. Fiber Termination Panels: Provide a rack mountable, modular cabinet capable of terminating up to 24 type ST multimode fiber cables. Panels shall be as manufactured by Ortronics, Amp, Siecor, or Superior.
h. Fiber Optic Testing: Upon completion of the passive optical cable system, the system must be tested to ensure compliance with the design and link loss specifications. The tests include:

1) Power Meter Tests: For building risers, power meter tests are required.
2) End-to-End Attenuation Testing: Tests shall be completed on each fiber span at both operational wavelengths:
   - 850/1310 nm multimode
   - 1550 nm single mode
3) Testing in one direction is required. Link attenuation does not include any active devices or passive devices other than cable, connectors and splices (e.g., link attenuation does not include such devices as optical bypass switches, couplers, repeaters, or optical amplifiers. Test results should be retained for inclusion into the documentation package.
4) Connector loss readings of each completed connector should be recorded using an OTDR at 850 and 1310 nm in one direction.
5) Optical time domain reflectometer (OTDR) signature traces of each terminated fiber should be recorded at 850 nm and 1310 nm for fiber continuity purposes. OTDR testing is mandatory for runs longer than 2 km.
6) Final report shall be compiled which records system configuration, fiber labels, cable routes and "as built" details. Loss measurements with calibrated light source and power meter shall be included. OTDR traces shall also be included when requested in advance.

E. Smoke detectors and/or fan shutdown relays initiated by a fire alarm system shall be integrated into the control system and sequence of operation as indicated and/or required.

3.3 FIELD QUALITY CONTROL

A. Perform the following field tests and inspections and prepare test reports after completion of DDC system installation:

1. After electrical circuitry has been energized, start units to confirm proper unit operation. Remove and replace malfunctioning units and retest.

B. Test and adjust controls and safeties.

1. Test calibration of control units by disconnecting input sensors and stimulating operation with compatible signal generator.
2. Test each control point through its full operating range to verify that safety and operating control set points are as required.
3. Test each control loop to verify stable mode of operation and compliance with sequence of operation.
4. Test each system for compliance with sequence of operation.

5. Test software and hardware interlocks.

C. DDC Verification:

1. Verify that instruments are installed before calibration, testing, and loop or leak checks.
2. Check instruments for proper location and accessibility.
3. Check instrument installation for direction of flow, elevation, orientation, insertion depth, and other applicable considerations.
4. Check instrument tubing for proper fittings, slope, material, and support.
5. Check installation of air supply for each instrument.
6. Check flow instruments. Inspect tag number and line and bore size, and verify that inlet side is identified and that meters are installed correctly.
7. Check temperature instruments and material and length of sensing elements.
8. Check control valves. Verify that they are installed for flow(s) in the correct direction(s).
9. Check DDC system as follows:

   a. Verify that DDC controller power supply is from emergency power supply, if applicable.
   b. Verify that wires at control panels are tagged with their service designation and approved tagging system.

10. Verify that spare I/O capacity has been provided.

    a. Verify that DDC controllers are protected from power supply surges.

11. Replace damaged or malfunctioning controls and equipment and repeat testing procedures.

3.4 CALIBRATION AND ADJUSTMENT

A. General:

1. Make two-point calibration test for both linearity and accuracy for each analog instrument.
2. Calibrate equipment and procedures using manufacturer's written recommendations and instruction manuals. Use test equipment with accuracy at least double that of instrument being calibrated.

B. Control System Inputs and Outputs:

1. Check analog inputs at 50 and 100 percent of span.
2. Check analog outputs using milliampere meter at 50 and 100 percent output.
3. Check digital inputs using jumper wire.

C. Check digital outputs using ohmmeter to test for contact making or breaking.

1. Check resistance temperature inputs at 0 and 100 percent of span using a precision-resistant source.

D. Temperature:

1. Calibrate resistance temperature transmitters at 0 and 100 percent of span using a precision-resistance source.
2. Calibrate temperature switches to make or break contacts.

E. Stroke of valves and dampers: Follow the manufacturer's recommended procedure, so that valve or damper is 0 and 100 percent closed.

F. Provide diagnostic and test instruments for calibration and adjustment of system.

G. Provide written description of procedures and equipment for calibrating each type of instrument. Submit procedures review and approval before initiating startup procedures.

H. Adjust initial pressure, temperature, humidity, etc. setpoints in coordination with TAB sub-contractor.

3.5 HVAC SYSTEMS OPERATION VERIFICATION

A. After installation, calibration, and adjustment of DDC system, the DDC system vendor shall verify the performance of any new DDC components and new HVAC equipment as follows:

1. Verify Final Control Element Functionality: Test each final control element operator to ensure performance in accordance with Section 230913 and the control sequences defined on the Drawings. Test shall include full range of movement, stability through that range, and power and/or control signal failure performance. Operators found to be non-functional in any way shall be replaced.
2. Verify Operator and System Functionality:

a. Verify DDC system command software by issuing commands at the operator's console and via browser interface and observing display, printer output, or HVAC equipment responses. The following software operation shall be verified:

1) Software for checking input commands and issuing error messages. Enter various correct and incorrect commands.
2) System and point addressing check. Enter command to display I/O data. Verify all data points defined on the drawings and/or required by the specifications.
3) Start-stop or enable-disable of HVAC equipment or DDC system control points. Enter commands to start/stop selected HVAC equipment, and to disable and enable selected points.
4) Operator override/automatic mode. Enter command to change selected automatic control under DDC system to manual and vice versa.
5) Display format. Enter commands to display data and graphics on terminal and graphic display. Check display content for adequacy and clarity as specified.
6) Ability to modify, cancel and confirm operator's commands. Verify by entering commands.
7) Set-point adjustment and limiting. Enter commands to adjust set points of controllers and range limits of the controlled media. Verify by display. Also enter commands to adjust set-points outside their range limits. DDC system shall display error messages.
8) System access and access level control. Try to log on to system with both incorrect and correct ID codes. Try to enter different commands with different access level of the operators. The responses of the DDC system shall be as specified.
9) Start/stop equipment. Enter command to start or stop selected equipment. Also reset time to initiate automatic mode. Verify responses by observation of equipment and DDC system display.
10) Change parameter of points. Enter commands to change parameters of selected points such as high and low limit alarms, scale factor, etc. to test the adequacy of software.

b. Verify graphic display of each new HVAC system and component. Confirm that the graphic is in accordance with the design data and reviewed submittals, includes all data points required, displayed data is correct and in the correct format and units, and changes in point conditions or status are accurately updated. Evaluate the refresh rate of data display.

c. Verify report generation (status, profile, energy, etc.) by entering commands to generate reports such as all points, trend, total display of a system, timed display, and other specified reports. Examine the report content for general format, system/point code, time interval of reporting, point status/value/unit, energy amount/rate/unit, status of control and set time (manual or automatic), and other specification required information.

1) Check for proper operation of system status reports, including point status reviews which would include information such as points currently in alarm, points removed from alarm checking, points off of scan, etc.
2) Test alarm reporting by initiating alarm conditions of different points at different alarm

levels in sequence to examine alarm reports. The reports shall show alarm location and device, alarm time, cause of alarm, current status of the point, etc. as required in the specifications. When alarm conditions are removed the printer shall print updated status report. Also verify audible alarm operations in accordance with specification requirements. Then initiate alarm conditions at different levels at the same time to check alarm priority.

d. Trending performance shall be tested by creating trend logs for each control sequence and monitoring the trend reports throughout the period that each control sequence is tested.

3. Test Control Sequences: The test procedures described below do not check the details of the software, rather, they try to verify the final output as indicated by the field equipment. Before testing, each program the required input and output of the program and those listed in the contract specifications shall be compared to make sure that the program covers the specified operations. Verification of HVAC equipment operation (such as equipment status or temperature of space air) may be done by either (1) actual observation of equipment status and test instruments, or (2) obtaining DDC system reports if the accuracy of these reports has been verified previously.

   a. Basic Functional Tests: Through the user interface conduct the following series of tests:

      1) Raise/lower space temperature setpoints in software to verify if the system responds in accordance with design requirements.
      2) Raise/lower AHU discharge temperature setpoints and verify control valve and damper positions.
      3) Initiate a high priority, off-hours alarm and verify that the remote notification procedures are carried out correctly.
      4) Verify that the interface with system safeties allow operation of dampers, etc., if safety conditions are met.
      5) Conduct an emergency start-up after power failure test. Verify that all systems return to automatic control.
      6) Verify DDC system maintains required outside air requirements under low airflow conditions.
      7) Disconnect communication cable to the DDC system and verify if the DDC panel can control the respective system (stand-alone control).
      8) Disconnect a sample of DDC space-temperature sensors and verify control sequence default.
      9) Test HVAC Systems Sequences of Operation: Through the user interface very control of HVAC systems as follows:

         a) Scheduled on/off and occupied/unoccupied control. Verify that input includes start/stop times and days for specified equipment. As applicable, verify that input includes occupied/unoccupied times and days. Verify input for time delays of specified equipment. Check holiday/vacation effect. Log operations for at least three days to confirm that systems and components start and stop in accordance with defined schedules.
         b) Optimum start-stop control. Verify that the required input includes space temperature, outdoor temperature, occupied time and days of the week, and the response time of the air handling equipment, on an individual system by system basis. For each air handler, log space temperature for at least three days to confirm that space is at required temperature by the start of the occupied period.
         c) Occupied-Unoccupied control. Confirm that required input data is provided. To test control, change the setback time from occupied to unoccupied time and confirm that HVAC systems respond to the setback mode. If system is an air-handling system, the outside air damper should close and the fan should cycle to maintain the setback temperature setpoint.

- Change the setback temperature setpoint to 5°F higher than the actual space temperature. The system should operate to increase the space temperature to the new setpoint condition. For air-handlers, the outside air damper should remain closed.

d) Economizer cycle control: If the outdoor air temperature is above the discharge air temperature setpoint, but below the defined 100% outdoor air changeover temperature setpoint, verify that the outside air damper is fully open, the return air damper is fully closed, and that the air-handler discharge air temperature is maintained by modulation of the chilled water control valve.

e) Heating/cooling coil discharge temperature reset: Verify that the required input points are provided and that the coil discharge air temperature setpoint is in accordance with the input conditions and the sequence of operation defined on the control drawings.

3.6 OWNER INSTRUCTION AND TRAINING

A. General: The Contractor is responsible for instructing Owner's personnel, including the following:

1. Instruction in the operation of new HVAC systems, subsystems, and equipment via new DDC system
2. Training in operation, maintenance, and trouble-shooting of new DDC system components.

B. Program Structure: Develop an instruction and training program that includes both classroom instruction and "hands-on" demonstrations.

C. Training Modules: Develop a learning objective and teaching outline for each instruction and training module, taking into consideration the level of proficiency of Owner's maintenance staff. Include a description of specific skills and knowledge that each participant is expected to master.

1. **Exception**: Training is required to be accomplished onsite. However, at the option of NHCS, some of or all the training required below may be accomplished for selected NHCS personnel at the DDC system vendor’s offsite training facility. The cost for offsite training shall be the responsibility of NHCS.
2. For each instruction and training module, include instruction for the following, as applicable to the system, subsystem, equipment, or component:

a. Documentation: Review the following items in detail:

1) Operations manuals.
2) Maintenance manuals.
3) Project record documents.
4) Warranties, bonds, and guarantees.
5) Maintenance service agreements and similar continuing commitments.

b. Emergencies: Include the following, as applicable:

1) Instructions on meaning of warnings, trouble indications, and error messages.
2) Shutdown instructions for each type of emergency.
3) Operating instructions for conditions outside of normal operating limits.
4) Sequences for DDC system.
5) Special operating instructions and procedures.

c. Operations: Include the following, as applicable:

1) Start-up procedures.
2) Equipment or system break-in procedures.
3) Routine and normal operating instructions.

4) Regulation and control procedures.

d. Control sequences:

1) Safety procedures.
2) Normal start-up and shutdown instructions.
3) Operating procedures for emergencies.
4) Operating procedures for system, subsystem, or equipment failure.
5) Required sequences for electric or electronic control systems.
6) Special operating instructions and procedures.

e. Adjustments: Include the following:

1) Alignments.
2) Routine adjustments, tightening, etc.
3) Noise and vibration adjustments.
4) Economy and efficiency adjustments.

f. Maintenance and Repairs: Demonstrate the following:

1) Inspection procedures.
2) Troubleshooting and diagnostic instructions.
3) Test and inspection procedures.
4) Repair instructions.
5) Disassembly; component removal, repair, and replacement; and reassembly instructions.
6) Review of spare parts needed for operation and maintenance.

D. Training Execution:

1. Owner will furnish an instructor to describe Owner's operational philosophy.
2. Owner will furnish Contractor with names and positions of participants to attend instruction and training, not to exceed 10 individuals.
3. Provide instruction at mutually agreed on times scheduled at least four (4) weeks in advance through the A/E. For systems, subsystem, and/or equipment that requires seasonal operation, provide required instruction at start of each season.
4. Conduct training on-site in the completed and fully operational facility in classroom/conference space provided by the Owner and using the actual systems, subsystems, and equipment installed.
5. Conduct training using final operation and maintenance data submittals as the training reference material. If additional training materials are utilized, they shall be incorporated as an appendix to the operation and maintenance data submittals.
6. Provide documentation that Owner instruction and training has taken place. Provide record of dates, topics, and duration of each training session, the names of Owner's staff who participated, and a signed review form by each participant.

END OF SECTION 230923

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SECTION 260000 – ELECTRICAL, BASICS

1.1 RELATED DOCUMENTS

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

1.2 GENERAL

A. Applicable requirements of the Instructions to Bidders and General Conditions of the Contract shall be a part of the Electrical Specifications. The electrical contractor shall examine the general and special conditions before submitting a proposal.

B. The electrical work shall be performed by a licensed electrical contractor.

C. The electrical contractor shall assume total responsibility for any portion of the work provided by his subcontractors.

1.3 CODES AND STANDARDS

A. Building Codes:

1. National Fire Protection Association No. 70, National Electrical Code
2. North Carolina State Building Code, Latest Edition and Revisions (NCSBC)
3. National Electrical Safety Code (NESC)
4. National Bureau of Standards (NBS)
5. Local Codes where applicable

B. Industry Standards:

1. Underwriter's Laboratories, Inc. Standards and approved listings (UL)
2. Electrical Testing Laboratories Standards (ETL)
3. National Electrical Manufacturers Association Standards (NEMA)
4. Insulated Power Cable Engineers Association Standards (IPCEA)
5. American National Standards Institute (ANSI)
6. American Society for Testing Materials Standards (ASTM)
7. Canadian Standards Association (CSA)

1.4 SCOPE OF WORK

A. It is the intent and meaning of the drawings and specifications to call for finished work that has been tested and is ready for operation. The electrical contractor shall take this into consideration and include in his proposal allowance for contingencies that will allow him to provide minor pieces of materials and labor not specifically indicated but required for the job to operate properly. This paragraph is intended to insure a complete job will be provided without requests for minor extras.

1.5 RECORD DRAWINGS

A. A set of drawings covering the electrical contract will be provided to the electrical contractor to mark all changes, modifications, or revisions effected during construction. These field mark-up drawings are to be turned over to the electrical designer.

B. The electrical contractor shall provide photographs of switchboards and panelboards. Photographs shall clearly show equipment designations, manufacturer nameplates, breaker positions, breaker ratings, and directory descriptions.

1.6 APPROVAL OF MATERIALS

A. Construction phase: The CONTRACTOR shall submit his proposal on the specified materials and equipment, or their equivalent, provided the words "or equal" or "or approved equal" follow the named manufacturers. If the above phrases do not appear, the specified manufacturers shall be furnished without substitution. Equivalent shall be interpreted to mean an item of material or equipment, similar to that named and which is suitable for the same use and capable of performing the same functions as that named, the Engineer being the judge of equality.

B. Where no specific material or equipment type is mentioned, any first-class product of a reputable manufacturer may be used provided it conforms to the requirements of the specifications. These materials shall be third party listed or labeled in accordance with the General Statutes of the State (example: UL, ETL, CSA, etc).

1.7 SHOP DRAWINGS AND SUBMITTAL DATA PROCEDURES

A. Unless directed otherwise in the Architectural Specifications, Civil Specifications, or General Provisions and/or Conditions of the Contract, the CONTRACTOR shall submit PDF files of shop drawings, certified prints, literature, and cuts to the Engineer for all major items of equipment and materials for review and approval. It is preferred that all electrical submittals for the project shall be submitted at one and the same time.

B. Product data cut sheets with multiple components, part numbers, etc. shall be clearly marked to identify what is proposed for this project.

C. The CONTRACTOR shall analyze all shop drawings and submittal data and certify that they meet requirements of Contract Drawings and Specifications, prior to delivery to the Engineer. CONTRACTOR Certification shall be in the form of suitable approval stamp placed on each shop drawing submitted for approval.

D. If the Engineer deems submittal data is either incomplete or incorrect, a resubmittal submittal will be required.

E. At least one set of all “approved” shop drawings, certified prints, etc., shall be maintained at the job site and available to representative of the Engineer.

F. Approval by the Engineer of shop drawings for any materials, apparatus, devices, and layouts shall not relieve the CONTRACTOR from the responsibility of furnishing same of proper dimensions, size, quantity, quality and all performance characteristics to efficiently perform the requirements and intent of the contract documents. Such approval shall not relieve the CONTRACTOR from responsibility for errors of any sort on the shop drawings. If the shop drawings deviate from the Contract Documents, the CONTRACTOR shall advise the Engineer of the deviations in writing, accompanying the shop drawings, including the reason for the deviations.

1.8 Record Documents for OWNER

A. Conductor and cable megger test results.

1.9 DRAWINGS AND SPECIFICATIONS

A. The Electrical drawings and specifications are complementary each to the other, and what may be called for by one shall be as binding as if called for by both. The drawings are diagrammatic and indicate generally the location of outlets, devices, equipment wiring, etc and show the general arrangement of raceways, fixtures, and equipment. Drawings shall be followed as closely as actual building construction and the work of other trades will permit; however, all work shall suit the finished surroundings and/or trim.

B. It shall be understood that where the words “furnish,” “provide,” and/or “install” are used, it is intended that this CONTRACTOR shall purchase and install completely all material necessary and required for this particular item, system, equipment, etc.

C. Any omission from either the drawings or the specifications are unintentional, and it shall be the responsibility of the CONTRACTOR to call to the attention of the Engineer any pertinent omissions before submitting a proposal. Complete and working systems are required, whether every small item of material is shown and specified or not.

D. The electrical work shall conform to the requirements shown on all of the drawings. General and Structural drawings shall take precedence over Electrical Drawings. Because of small scale of the electrical drawings, it is not practical to indicate offsets, fittings and accessories that may be required. The CONTRACTOR shall investigate the structural and finish conditions affecting the work and shall arrange his work accordingly, providing such fittings and accessories as may be required to meet such conditions, without additional cost to the OWNER and as directed by the Engineer.

E. Load circuits shall be installed as indicated on the drawings. Circuit number revisions will not be accepted unless approved in writing by the Engineer.

1.10 COORDINATION OF WORK

A. It is understood and agreed that by submitting a bid, the CONTRACTOR has, by careful examination, satisfied himself as to the nature and location of the work, the conformation of the ground, the character, quality and quantity of the materials to be encountered, the general and local conditions and all other matters which can and may affect the work under this contract. The CONTRACTOR shall be held responsible for visiting the site and thoroughly familiarizing himself with the existing conditions and also any contractual requirements as may be set forth in the other divisions of these specifications. No extras will be considered because of additional work necessitated by obvious job conditions that are not indicated on the drawings.

B. The CONTRACTOR shall compare the electrical drawings and specifications with the drawings and specifications for other trades and shall report any discrepancies between them to the Engineer and obtain from him written instructions for changes necessary in the electrical work. The electrical work shall be installed in cooperation with other trades installing interrelated work. Before installation, the CONTRACTOR shall make proper provisions to avoid interferences in a manner approved by the Engineer. All changes required in the work of the CONTRACTOR caused by his neglect to do so shall be made by him at his expense.

C. Location of electrical raceways, switches, panels, equipment, fixtures, etc., shall be adjusted to accommodate the work to interferences anticipated and encountered. The CONTRACTOR shall determine the exact route and location of each electrical raceway prior to make up and assembly.

D. Right-of-Way: Lines which pitch shall have the right-of-way over those which do not pitch. For example, steam, condensate and plumbing drains shall normally have right of way. Lines whose elevations cannot be changed shall have the right of way over lines whose elevations can be changed.

E. Offsets and changes in direction of electrical raceways shall be made as required to maintain proper headroom and to clear pitched lines whether or not indicated on the drawings. The CONTRACTOR shall furnish and install elbows, pull boxes, etc., as required to affect these offsets, transitions, and changes in directions. Conflicts between electrical raceways, fixtures, etc., and ductwork which cannot be resolved otherwise, will be resolved by the Engineer.

F. The CONTRACTOR shall install all electrical work to permit removal (without damage to other parts) of any equipment requiring periodic replacement or maintenance. The CONTRACTOR shall arrange electrical raceways and equipment to permit ready access to valves, cocks, traps, starters, motors, control components, etc., and to clear the opening of swinging and overhead doors and of access panels.

G. Work at Existing Facilities:

1. Where work may be required to be performed at existing and/or occupied facilities, such work shall be scheduled and arranged to be done at the convenience of the OWNER so as not to interfere with, disrupt, or disturb normal operations at the facilities. The CONTRACTOR shall obtain written approval from the OWNER before proceeding with work at existing facilities and shall work at existing facilities on schedule as agreed upon with the OWNER. This is not to be necessarily construed to mean that the CONTRACTOR is expected to perform work at existing facilities on holidays, weekends, etc., but that the Contractor must schedule work with the OWNER for the OWNER's beneficial and normal usage of the facilities, and that the CONTRACTOR will be required to maintain the schedule as approved by the OWNER.
2. The CONTRACTOR shall, at all times, provide safety barriers, protective devices, screening, dust barriers, etc., as required to maintain the safety and comfort of the building's personnel and/or occupants in or near his work area.
3. The CONTRACTOR shall be responsible for cleanup in connection with his work at existing facilities. At the end of each working day, all debris, boxes, waste, etc. shall be removed from the facilities and properly disposed of. Equipment, materials, etc. may be left inside the facilities, but such must be properly stored, stacked, and located as approved by the OWNER.
4. The CONTRACTOR shall do all cutting, patching, finishing, repairing, painting, etc., necessary for electrical work to be installed at existing facilities. All finishes shall be left to equal finish and condition prior to cutting. No cutting of structural members will be allowed. All cutting of walls, floors, roofs, etc. shall be repaired and/or replaced to equal finish prior to cutting. The CONTRACTOR shall route conduits and locate equipment as approved by the OWNER and Architect and/or Engineer. Routing and locations shall be firmly established and approved before proceeding with any phase of the work.
5. The CONTRACTOR shall be responsible for any and all damage to the existing facilities, grounds, walkways, paving, etc. caused by the work, the CONTRACTOR and/or his personnel, and/or his equipment in the accomplishment of this work. Such damages shall be repaired and/or replaced by the CONTRACTOR at no additional cost to the OWNER, to equal finish prior to damage. The ENGINEER shall be the judge as to equal finishes, etc.
6. Certain power requirements must be met without interruption during certain times on the existing electrical system. It is anticipated that partial power outages will be necessary to accomplish the work covered by these drawings and specifications. The CONTRACTOR shall determine in advance the dates, times and duration of these outages and shall obtain permission from the OWNER to shut down the electric power. Unauthorized power outages will not be tolerated.

H. Equipment and Materials (General):

1. Materials shall be new and shall bear the manufacturer's name, trade name, and listing label in every case where a standard has been established for the particular material. The equipment to be

furnished under this specification shall be essentially the standard product of manufacturers regularly engaged in the production of the required type of equipment and shall be the manufacturer's latest approved design.

2. Electrical motors shall meet the minimum efficiency requirements of applicable tables in the North Carolina Energy Conservation Code.
3. Delivery and Storage:
    a. Store products to allow for inspection and measurement of quantity or counting of units.
    b. Store products that are subject to damage by the elements, under cover in a weathertight enclosure above ground, with ventilation adequate to prevent condensation.
        1) Electrical equipment shall be delivered to the site and stored in original containers. Store protected from the elements, but readily accessible for inspection by the Engineer until installed. Equipment shall be tightly covered and protected against dirt, water and chemical or mechanical injury and theft. Corrosion inhibitors shall be installed in all panelboards, switches, starters and control panels immediately upon receipt. Install one inhibitor for every 8 cubic feet of enclosure volume. Replace inhibitors every 90 days and at final inspection in the ARCHITECT AND/OR ENGINEER 's presence. Rusty and/or corroded materials and equipment will be replaced at the direction of the Engineer.
        2) Rusty and/or corroded materials and equipment will be replaced at the direction of the Engineer.
    c. Comply with product manufacturer's written instructions for temperature, humidity, ventilation, and weather-protection requirements for storage.
    d. Protect stored products from damage.
4. Equipment and materials of the same general type shall be of the same make throughout the work to provide uniform appearance, operation and maintenance.
5. At the completion of the work; fixtures, equipment, and materials shall be cleaned and polished thoroughly and turned over to the OWNER in a condition satisfactory to the Engineer. Damage or defects, developing before acceptance of the work shall be corrected at the CONTRACTOR's expense.
6. Manufacturer's directions shall be followed completely in the delivery, storage, protection, and installation of all equipment and materials. The CONTRACTOR shall promptly notify the Engineer, in writing, of any conflicts between any requirements of the Contract Documents and the manufacturer's directions and shall obtain the Engineer's written instructions before proceeding with the work. Should the CONTRACTOR perform any work that does not comply with the manufacturer's instructions, recommendations, or requirements; it shall be corrected at the direction of the Engineer at no additional cost to the Owner.

I. Sleeves, Inserts, Openings, Etc.:

1. Anchor bolts, sleeves, inserts, supports, etc., that may be required for electrical work shall be furnished, located, and installed by the electrical contractor.

J. Cutting and Patching:

1. The electrical contractor shall do all rough cutting and patching as required for the proper installation of work under this contract. Cutting shall be kept to a minimum, and finishes shall be restored to the satisfaction of the Engineer.

K. Locations and Measurements:

1. Outlets, equipment, and appliances are shown and located on the drawings as accurately as possible. All measurements shall be verified on the project and coordinated with the drawings of other disciplines. In all cases, the work shall suit the surrounding trim and/or decoration and construction. The locations of outlets for special appliances shall be installed so that when

extended, they are flush with the finished wall, floor, or ceiling and permit the proper installation of fixtures, devices, equipment, appliances, etc. Heights of all outlets shown on the drawings are approximate only. Slight relocations of outlets, devices, and equipment shall be made by the electrical contractor as required or as directed by the Engineer at no additional cost to the OWNER.

L. Workmanship:

1. Work shall be executed as required by the specifications and the accompanying drawings and shall be done in a workmanlike manner by skilled mechanics, and shall present a neat, trim, and mechanical appearance when completed. All work shall be performed as required by the progress of the job.

M. Final Inspections and Equipment Demonstrations:

1. The CONTRACTOR shall acquire permits for construction & coordinate all required inspections with the office of the local electrical inspector and/or local authority having jurisdiction, if required. The CONTRACTOR shall provide the Owner two (2) copies of Electrical Inspectors' written reports.
2. The CONTRACTOR shall furnish ladders, required tools, and men to open fixtures, boxes, panels, or any other equipment to enable the Engineer representatives to see into any parts of the installation he may request.
3. The CONTRACTOR shall furnish meters for observation of readings as directed by the Engineer representative. Meters to be furnished include: clamp-on type ammeter, voltmeter, megger, and clamp-on type ground resistance tester.

N. Operating Instructions:

1. At the completion of the entire installation, the CONTRACTOR shall arrange to operate each component of systems and then systems as a whole.

END OF SECTION 260000

SECTION 260500 - BASIC ELECTRICAL MATERIALS AND METHODS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:

1. Supporting devices for electrical components.
2. Cutting and patching for electrical construction.
3. Touchup painting.
4. Electrical demolition.

1.3 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 SUPPORTING DEVICES

A. Material: Cold-formed steel, with corrosion-resistant coating acceptable to authorities having jurisdiction.

B. Metal Items for Use Outdoors or in Damp Locations: Hot-dip galvanized steel.

C. Slotted-Steel Channel Supports: Flange edges turned toward web, and 9/16-inch diameter slotted holes at a maximum of 2 inches o.c., in webs.

1. Channel Thickness: Selected to suit structural loading.
2. Fittings and Accessories: Products of the same manufacturer as channel supports.

D. Raceway and Cable Supports: Manufactured clevis hangers, riser clamps, straps, threaded C-clamps with retainers, ceiling trapeze hangers, wall brackets, and spring-steel clamps or click-type hangers.

E. Expansion Anchors:

1. Inside: Carbon-steel wedge or sleeve type.
2. Outside: Hot-dip galvanized steel wedge or sleeve type.

F. Toggle Bolts:

1. Inside: All steel springhead type.

2. Outside: Hot-dip galvanized steel springhead type.

2.2 TOUCHUP PAINT

A. For Equipment: Equipment manufacturer's paint selected to match installed equipment finish.

B. Galvanized Surfaces: Zinc-rich paint recommended by item manufacturer.

PART 3 - EXECUTION

3.1 ELECTRICAL EQUIPMENT INSTALLATION

A. Headroom Maintenance: If mounting heights or other location criteria are not indicated, arrange and install components and equipment to provide the maximum possible headroom.

B. Materials and Components: Install level, plumb, and parallel and perpendicular to other building systems and components, unless otherwise indicated.

C. Equipment: Install to facilitate service, maintenance, and repair or replacement of components. Connect for ease of disconnecting, with minimum interference with other installations.

D. Right of Way: Give to raceways and piping systems installed at a required slope.

3.2 ELECTRICAL SUPPORTING DEVICE APPLICATION

A. Selection of Supports: Comply with manufacturer's written instructions.

B. Strength of Supports: Adequate to carry present and future loads, times a safety factor of at least four; minimum of 200-lb (90-kg) design load.

3.3 SUPPORT INSTALLATION

A. Install support devices to securely and permanently fasten and support electrical components.

B. Install individual and multiple raceway hangers and riser clamps to support raceways. Provide U-bolts, clamps, attachments, and other hardware necessary for hanger assemblies and for securing hanger rods and conduits.

C. Support individual horizontal raceways with separate pipe hangers or clamps.

D. Spring-steel fasteners specifically designed for supporting single conduits or tubing may be used instead of hangers for 1-1/2-inch and smaller raceways serving lighting and receptacle branch circuits above suspended ceilings and for fastening raceways to slotted channel and angle supports.

E. Install metal channel racks for mounting cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices unless components are mounted directly to structural elements of adequate strength.

F. Securely fasten electrical items and their supports to the building structure, unless otherwise indicated. Perform fastening according to the following unless other fastening methods are indicated:

1. Wood: Fasten with wood screws or screw-type nails.
2. Masonry: Toggle bolts on hollow masonry units and expansion bolts on solid masonry units.
3. New Concrete: Concrete inserts with machine screws and bolts.
4. Existing Concrete: Expansion bolts.
5. Steel: Spring-tension clamps on steel.
6. Light Steel: Sheet-metal screws.
7. Fasteners: Select so the load applied to each fastener does not exceed 25 percent of its proof-test load.

3.4 DEMOLITION

A. Protect existing electrical equipment and installations indicated to remain. If damaged or disturbed in the course of the Work, remove damaged portions and install new products of equal capacity, quality, and functionality.

B. Accessible Work: Remove exposed electrical equipment and installations, indicated to be demolished, in their entirety.

C. Abandoned Work: Cut and remove buried raceway and wiring, indicated to be abandoned in place, 2 inches (50 mm) below the surface of adjacent construction. Cap raceways and patch surface to match existing finish.

D. Remove demolished material from Project site after coordination with the Owner's representative. Equipment and/or materials that the Owner desires to retain shall be moved to a location designated by the Owner's representative.

E. Remove, store, clean, reinstall, reconnect, and make operational components indicated for relocation.

3.5 CUTTING AND PATCHING

A. Cut, channel, chase, and drill floors, walls, partitions, ceilings, and other surfaces required to permit electrical installations. Perform cutting by skilled mechanics of trades involved.

B. Repair and refinish disturbed finish materials and other surfaces to match adjacent undisturbed surfaces. Install new fireproofing where existing firestopping has been disturbed. Repair and refinish materials and other surfaces by skilled mechanics of trades involved.

3.6 FIELD QUALITY CONTROL

A. Inspect installed components for damage and faulty work.

3.7 REFINISHING AND TOUCHUP PAINTING

A. Refinish and touch up paint.

1. Clean damaged and disturbed areas and apply primer, intermediate, and finish coats to suit the degree of damage at each location.
2. Follow paint manufacturer's written instructions for surface preparation and for timing and application of successive coats.
3. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
4. Repair damage to PVC or paint finishes with matching touchup coating recommended by manufacturer.

3.8 CLEANING AND PROTECTION

A. On completion of installation, including outlets, fittings, and devices, inspect exposed finish. Remove burrs, dirt, paint spots, and construction debris.

B. Protect equipment and installations and maintain conditions to ensure that coatings, finishes, and cabinets are without damage or deterioration at time of Final Acceptance.

END OF SECTION 260500

SECTION 260519 - CONDUCTORS AND CABLES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes building wires and cables and associated connectors, splices, and terminations for wiring systems rated 600 V and less.

1.3 SUBMITTALS

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

B. Field Quality-Control Test Reports: From Contractor.

1.4 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.

2.2 POWER CONDUCTORS AND CABLES

A. Manufacturers:

1. Cerro Wire LLC.
2. Colonial Wire and Cable.
3. Encore Wire Corporation.
4. General Cable Corporation.
5. Okonite.
6. Prysmian Group.
7. Republic Wire, Inc.
8. Southwire.
9. Or approved equal.

B. Refer to Part 3 "Conductor and Insulation Applications" Article for insulation type, cable construction, and ratings.

C. Conductor Material:

1. Copper complying with NEMA WC70 / ICEA S-95-658 stranded conductor.

D. Conductor Insulation Types: Type THHN/THWN-2 complying with NEMA WC70 / ICEA S-95-658.

2.3 CONNECTORS AND SPLICES

A. Manufacturers:

1. AMP Incorporated/Tyco International.
2. FCI.
3. Greaves Polaris.
4. Hubbell/Anderson.
5. ILSCO.
6. NSI.
7. O-Z/Gedney; EGS Electrical Group LLC.
8. Penn Union.
9. 3M Company; Electrical Products Division.
10. Or approved equal.

B. Description: Factory-fabricated connectors and splices of size, ampacity rating, material, type, and class for application and service indicated.

1. For splices and taps where all conductors are #8 & smaller, use wirenut type twist connectors.
2. For splices and taps where any conductor is #6 & larger, use pre-insulated solderless connectors with one spare port(s) for future cable connection.

PART 3 - EXECUTION

3.1 CONDUCTOR AND INSULATION APPLICATIONS

A. Branch Circuits: Type THHN/THWN-2, single conductors in raceway.

3.2 INSTALLATION

A. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.

B. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables, conductors, or raceway.

C. Identify and color-code conductors and cables according to Section "Electrical Identification."

3.3 CONNECTIONS

A. Connect outlet and component connections to wiring systems and to ground. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

B. Make splices and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.

C. Wiring at Outlets: Install conductor at each outlet, with at least 12 inches (300 mm) of slack.

3.4 FIELD QUALITY CONTROL

A. Testing: Perform the following field quality-control testing:

1. After installing conductors and cables and before electrical circuitry has been energized, test for compliance with requirements.
2. Inspect for physical damage; test conductors and cable for continuity and shorts.
3. Megger testing for building wire and cable:

   a. All current carrying 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 megger. Megger testers shall not be electronic type. Megger testers shall be hand crank or power driven crank type. Minimum readings between conductors and between conductor and the grounded metal raceway shall be: 25 mega-ohms for #6 wire and smaller; 50 mega-ohms for #4 wire or larger.
   b. The CONTRACTOR shall correct malfunctioning conductors and cables, including replacement if necessary, and retest to demonstrate compliance.
   c. Certify compliance with test parameters.

B. Test Reports: Prepare a written report to record the following:

1. Test procedures used.
2. Test results that comply with requirements.
3. Test results that do not comply with requirements and corrective action taken to achieve compliance with requirements.
4. Provide tabulated megger readings for each panel circuit.

C. Witness Tests:

1. The CONTRACTOR shall furnish a megger and show A/E representative and/or Owner that the conductors and panels comply with the above requirements.

END OF SECTION 260519

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SECTION 260526 - GROUNDING AND BONDING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes grounding of electrical systems and equipment. Grounding requirements specified in this Section may be supplemented by special requirements of systems described in other Sections.

1.3 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Comply with UL 467.

PART 2 - PRODUCTS

2.1 GROUNDING CONDUCTORS

A. For insulated conductors, comply with Section "Conductors and Cables."

2.2 CONNECTOR PRODUCTS

A. Comply with IEEE 837 and UL 467; listed for use for specific types, sizes, and combinations of conductors and connected items.

B. Bolted Connectors: Bolted-pressure-type connectors, or compression type.

PART 3 - EXECUTION

3.1 APPLICATION

A. In raceways, use insulated equipment grounding conductors.

B. Equipment Grounding Conductor Terminations: Use bolted pressure clamps.

3.2 EQUIPMENT GROUNDING CONDUCTORS

A. Comply with NFPA 70, Article 250, for types, sizes, and quantities of equipment grounding conductors, unless specific types, larger sizes, or more conductors than required by NFPA 70 are indicated.

B. Install equipment grounding conductors in all feeders and circuits.

3.3 INSTALLATION

A. Grounding Conductors: Route along shortest and straightest paths possible, unless otherwise indicated. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.

3.4 CONNECTIONS

A. General: Make connections so galvanic action or electrolysis possibility is minimized. Select connectors, connection hardware, conductors, and connection methods so metals in direct contact will be galvanically compatible.

1. Use electroplated or hot-tin-coated materials to ensure high conductivity and to make contact points closer to order of galvanic series.
2. Make connections with clean, bare metal at points of contact.
3. Coat and seal connections having dissimilar metals with inert material to prevent future penetration of moisture to contact surfaces.

B. Equipment Grounding Conductor Terminations: For No. 8 AWG and larger, use pressure-type grounding lugs. No. 10 AWG and smaller grounding conductors may be terminated with winged pressure-type connectors.

C. Tighten screws and bolts for grounding and bonding connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A.

END OF SECTION 260526

SECTION 260533 - RACEWAYS AND BOXES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes raceways, fittings, boxes, enclosures, and cabinets for electrical wiring.

B. Related Sections include the following:

1. Section "Basic Electrical Materials and Methods" for supports, anchors, and identification products.

1.3 DEFINITIONS

A. EMT: Electrical metallic tubing.

B. LFMC: Liquidtight flexible metal conduit.

1.4 SUBMITTALS

A. Product Data: For raceways and fittings.

1.5 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.

2.2 METAL CONDUIT AND TUBING

A. Manufacturers:

1. Alflex Inc.
2. Allied Tube and Conduit.
3. Anamet Electrical, Inc.; Anaconda Metal Hose.

4. Atkore International / Calbrite.
5. Conduit Pipe Products Company.
6. Electri-Flex Co.
7. Gibson Stainless.
8. Grinnell Co./Tyco International; Allied Tube and Conduit Div.
9. Manhattan/CDT/Cole-Flex.
10. Maverick Tube.
11. O-Z Gedney; Unit of General Signal.
12. Patriot Industries.
13. Republic Conduit.
14. Shaw Stainless and Alloy.
15. Wheatland Tube Co.
16. Or approved equal.

B. Rigid Aluminum Conduit: Produced to ANSI C80.5; listed to UL 6A.

C. EMT and Fittings: Produced to ANSI C80.3; listed to UL 797.

1. Fittings: Plated-steel, hexagonal, compression type.

D. LFMC: Listed to UL 360.

E. Fittings: NEMA FB 1; compatible with conduit and tubing materials.

PART 3 - EXECUTION

3.1 RACEWAY APPLICATION

A. Outdoors:

1. Exposed: Rigid aluminum conduit.
2. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC.
3. Boxes and Enclosures: NEMA 250, Type 3R.

B. Indoors:

1. Exposed in electrical room: EMT.

C. Minimum Raceway Size: 3/4-inch trade size (DN 21).

D. Raceway Fittings: Compatible with raceways and suitable for use and location.

E. Do not install aluminum conduits embedded in or in contact with earth or concrete. For direct burial or concrete encasement or penetrations, coat conduit with asphaltum or bitumastic type coating.

3.2 INSTALLATION

A. Complete raceway installation before starting conductor installation.

B. Support raceways as specified in Section "Basic Electrical Materials and Methods."

C. Install temporary closures to prevent foreign matter from entering raceways.

D. Make bends and offsets so ID is not reduced. Keep legs of bends in the same plane and keep straight legs of offsets parallel, unless otherwise indicated.

E. Install exposed raceways parallel or at right angles to nearby surfaces or structural members and follow surface contours as much as possible.

F. Join raceways with fittings designed and approved for that purpose and make joints tight.

G. Raceway connectors shall be insulated throat type. If uninsulated throat connectors are installed, use insulating bushings to protect conductors.

H. Terminations:

1. Where raceways are terminated with locknuts and bushings, align raceways to enter squarely and install locknuts with dished part against box. Use two locknuts, one inside and one outside box.
2. Where raceways are terminated with threaded hubs, screw raceways or fittings tightly into hub so end bears against wire protection shoulder. Where chase nipples are used, align raceways so coupling is square to box; tighten chase nipple so no threads are exposed.
3. Where using boxes with concentric, eccentric, or over-sized knockouts; provide bonding bushings and jumpers. Size bonding jumpers in accordance with NEC Table 250-122, connecting to the box with ground lugs.

I. Flexible Connections:

1. Use maximum of 24 inches of flexible conduit for equipment subject to vibration, noise transmission, or movement; and for all motors.
2. Use LFMC in damp or wet locations.

END OF SECTION 260533

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SECTION 260553 - ELECTRICAL IDENTIFICATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes electrical identification materials and devices intended to comply with NFPA 70, OSHA standards, and authorities having jurisdiction.

1.3 SUBMITTALS

A. Product Data:

1. For each electrical identification product indicated.
2. For double coated, adhesive tape product indicated.

1.4 QUALITY ASSURANCE

A. Comply with NFPA 70.

B. Comply with NFPA 70 for color-coding.

PART 2 - PRODUCTS

2.1 NAMEPLATES AND SIGNS

A. Engraved Plastic Nameplates and Signs: Engraving stock, plastic laminate, minimum 1/16” thick for signs up to 20 sq. in. and 1/8” thick for larger sizes.

B. Fasteners for Nameplates and Signs:

1. High performance, double coated tape with adhesive. Design Basis: 3M #06383, or approved equivalent.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Identification Materials and Devices: Install at locations for most convenient viewing without interference with operation and maintenance of equipment.

B. Lettering, Colors, and Graphics: Coordinate names, abbreviations, colors, and other designations with corresponding designations in the Contract Documents or with those required by codes and standards. Use consistent designations throughout Project.

C. Self-Adhesive Identification Products: Clean surfaces before applying.

D. Circuit Identification Labels on Boxes: Panel and circuit number.

1. Exterior Boxes:

a. Engraved plastic label on cover; and
b. Pressure-sensitive, self-adhesive plastic label inside cover.

E. Color-Coding of Phase, Neutral, and Ground Conductors: Use the following colors for service, feeder, and branch-circuit phase conductors:

1.

Configuration	Phase A	Phase B	Phase C	Neutral	Ground
120/240-V, 1 Ph, 3W	Black	Red	N/A	White	Green
120/240-V, 3 Ph, 4W	Black	Orange	Blue	White	Green
120/208-V, 3 Ph, 4W	Black	Red	Blue	White	Green
277/480-V, 3 Ph, 4W	Brown	Orange	Yellow	Gray	Green

2. For conductors #6 AWG and smaller, factory apply color the entire length of conductors.
3. For conductors #4 AWG and larger, field apply colored, pressure-sensitive plastic tape in half-lapped turns for a distance of 6 inches from terminal points and in boxes where splices or taps are made. Apply last two turns of tape with no tension to prevent possible unwinding. Use 1-inch-wide tape in colors specified. Adjust tape bands to avoid obscuring cable identification markings.
4. At each panelboard, a color code legend shall be permanently posted corresponding to the conductors and voltage in that panelboard.

F. Equipment Identification Labels: Engraved plastic laminate. Install on each unit of equipment unless units are delivered with their own self-explanatory identification. Attached engraved labels with high performance double coated adhesive tape. Apply labels for each unit of the following categories of equipment:

1. Disconnect switches.

Nameplate colors shall be: White surface with black core.

END OF SECTION 260553

SECTION 262816 - ENCLOSED SWITCHES AND CIRCUIT BREAKERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following individually mounted, enclosed switches and circuit breakers:

1. Fusible switches.
2. Enclosures.

1.3 SUBMITTALS

A. Product Data: For each type of enclosed switch, circuit breaker, accessory, and component indicated. Include dimensioned elevations, sections, weights, and manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes.

1. Enclosure types and details for types other than NEMA 250, Type 1.
2. Current and voltage ratings.
3. Short-circuit current rating.

B. Field quality-control test reports including the following:

1. Test procedures used.
2. Test results that comply with requirements.
3. Results of failed tests and corrective action taken to achieve test results that comply with requirements.

1.4 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Comply with NFPA 70.

1.5 COORDINATION

A. Coordinate layout and installation of switches, circuit breakers, and components with other construction, including conduit, piping, equipment, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 FUSIBLE SWITCHES

A. Manufacturers:

1. Eaton Corporation; Cutler-Hammer Products.
2. General Electric Co.; Electrical Distribution & Control Division.
3. Hubbell.
4. Legrand.
5. Siemens Energy & Automation, Inc.
6. Square D/Group Schneider.

B. Fusible Switch, 1200 A and Smaller: NEMA KS 1, Type HD, with clips or bolt pads to accommodate specified fuses, lockable handle with capability to accept two padlocks, and defeatable door interlocks when the operating handle is in the "ON" position. Short-circuit withstand ratings of 100kA or 200kA require Class R or Class J rejection fuse block feature.

C. Nonfusible Switch, 1200 A and Smaller: NEMA KS 1, Type HD, lockable handle with capability to accept two padlocks, and defeatable door interlocks when the operating handle is in the "ON" position.

D. Accessories:

1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.
2. Neutral Kit: Internally mounted; insulated, capable of being grounded, and bonded; and labeled for copper and aluminum neutral conductors.

2.3 ENCLOSURES

A. NEMA AB 1 and NEMA KS 1 to meet environmental conditions of installed location.

1. Outdoor Locations: NEMA 250, Type 3R.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine elements and surfaces to receive enclosed switches and circuit breakers for compliance with installation tolerances and other conditions affecting performance.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Comply with applicable portions of NECA 1, NEMA PB 1.1, and NEMA PB 2.1 for installation of enclosed switches and circuit breakers.

B. Mount individual wall-mounting switches and circuit breakers with tops at uniform height, unless otherwise indicated. Anchor floor-mounting switches to concrete base.

3.3 IDENTIFICATION

A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs as specified in Section "Electrical Identification."

B. Enclosure Nameplates: Label each enclosure with engraved metal or laminated-plastic nameplate as specified in Section "Electrical Identification."

3.4 FIELD QUALITY CONTROL

A. Prepare for acceptance testing as follows:

1. Inspect mechanical and electrical connections.
2. Verify switch type and labeling verification.
3. Verify rating of installed fuses.
4. Inspect proper installation of type, size, quantity, and arrangement of mounting or anchorage devices complying with manufacturer's certification.

B. Perform the following field tests and inspections and prepare test reports:

1. Perform each electrical test and visual and mechanical inspection stated in manufacturer's installation instructions for switches. Certify compliance with test parameters.
2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.

3.5 CLEANING

A. On completion of installation, vacuum dirt and debris from interiors; do not use compressed air to assist in cleaning.

B. Inspect exposed surfaces and repair damaged finishes.

END OF SECTION 262816

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