EMD Facility HVAC Upgrades

CFPUA Contract No: 21-C0428

CFPUA Capital Project No: 16W213

235 Government Center Drive
Wilmington, NC 28403
Tel: 910-332-6573
Fax: 910-799-6066
www.cfpua.org

EMD Facility HVAC Upgrades

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BIDDING REQUIREMENTS

CONTRACT FORMS

ADVERTISEMENT FOR BIDS

Sealed bids will be received by the CAPE FEAR PUBLIC UTILITY AUTHORITY addressed to Julia Faircloth, Procurement Manager, 235 Government Center Drive, Wilmington, NC 28403 and marked **EMD Facility HVAC Upgrades**. Bids will be received until **Tuesday, November 24, 2020 at 2:00 PM and will be received at the front door of 235 Government Center Drive, Wilmington, NC 28403,** at which time they will be publicly opened and read.

Sealed bids submitted prior to bid opening must be addressed to:

Cape Fear Public Utility Authority
Attn: Julia Faircloth, Procurement Manager
235 Government Center Drive
Wilmington, NC 28403

It is the bidder's responsibility to ensure that the bids are received prior to bid closing on Tuesday, November 24, 2020 at 2:00 PM.

At this time, CFPUA requests that only prime bidders, and only one representative per bidder attend bid opening.

Pre-Bid Conference: A pre-bid conference will be held, and IS NOT mandatory. The Conference will be located at the EMD Building located at 628 Groundwater Way, Wilmington, NC 28411 on the 10th day of November 2020 at 2:00 PM.

Bid Opening: Bids must be delivered to the attention of Julia Faircloth, Procurement Manager, at 235 Government Center Drive by Tuesday, November 24, 2020 at 2:00 PM. Bids must be received by Julia Faircloth, Procurement Manager, or designee at the front door. The official time will be by the clock at the front door of 235 Government Center Drive and no late bids will be accepted. The Bidders are responsible for allowing time for traffic and parking prior to delivering the bids to the attention of Julia Faircloth, Procurement Manager, at 235 Government Center Drive. It is the bidder's responsibility to ensure that the bids are received on time.

Contract Documents: Plans and specifications relevant to the bid may be viewed at the following locations listed below. Cape Fear Public Utility Authority cannot guarantee the accuracy of documents and information at the plan rooms. Official sets only available from Cape Fear Public Utility Authority.

1. iSqft + bidclerk Plan Rooms: View online at: www.isqft.com or www.bidclerk.com
2. Dodge Plan Room/McGraw-Hill Construction: View online at: www.dodgeprojects.construction.com
3. Construction Journal: View online at: www.ConstructionJournal.com
4. Carolina AGC and Hispanic Contractors Association of the Carolinas: View online at: www.isqft.com

5. North American Procurement Council, Inc.: View online at www.NorthCarolinabids.com
6. The Blue Book Building & Construction Network: View online at www.thebluebook.com

Prospective bidders must register and obtain an official set of the relevant contract documents from Teresa McPherson (Bid Manager). To register and obtain bid documents, prospective bidders will be required to email the Bid Manager at bids@cfpua.org and provide contact information. An official set of relevant bid documents will then be provided to prospective bidder via email. If you send an email to bids@cfpua.org and do not receive a response with two (2) business days, please call 910-332-6472 or 910-332-6589. Bids received from bidders who cannot prove registration at time bids are due will not be opened or considered.

Bid Bond: A deposit is required with the submission of the bid. When a deposit is required, the bidder must submit with the bid cash or a certified check, drawn on a bank or trust company authorized to do business in the State of North Carolina, payable to Cape Fear Public Utility Authority, in an amount at least equal to five percent (5%) of the total amount of the bid, as a guarantee that a contract will be entered into and that satisfactory performance and payment bonds will be executed. In lieu of making the cash deposit above described, a satisfactory bid bond in the amount of five percent (5%) of the total bid, executed by a corporate surety licensed under the laws of the State of North Carolina to execute such bonds, shall be submitted with each bid, conditioned that the surety will upon demand forthwith make payment to the obligee upon said bond if the bidder fails to execute the contract in accordance with the bid bond. This deposit shall be retained if the successful bidder fails to execute the contract within ten (10) days after the award of the bid or fails to give satisfactory surety as required in North Carolina General Statutes Section 143-129.

Affidavit and Certification of Non-Collusion, Non-Suspension and Non-Conviction: The Affidavit and Certificate of Non-Collusion, Non-Suspension and Non-Conviction provided with bid documents must be completely executed and submitted with bid.

Each bidder must show evidence that it is licensed as a contractor under Chapter 87 of the North Carolina General Statutes.

The bidder must have either of the following of the following License to be qualified to perform the work associated with this bid:

North Carolina General Contractor's License: Limitation: Intermediate

Classification(s): Building

OR

North Carolina State Board of Examiners of Plumbing, Heating & Fire Sprinkler License:

Active Classification: Heating Group 2

No bid may be withdrawn after bids have been opened, except as provided in the North Carolina General Statutes.

In accordance with the North Carolina General Statutes Section 143-128.2, Cape Fear Public Utility Authority has established a goal of ten percent (10%) for minority business participation for building construction and repair projects in the amount of $300,000 and more. Bidders shall make a good faith effort to solicit minority and women owned businesses to participate on the project.

The successful bidder will be required to furnish a construction performance bond and a construction payment bond as security in the amount of one hundred percent (100%) of the contract amount for the faithful performance and the payment of all bills and obligations arising from the performance of the Contract.

If the bidder fails to complete and submit all requirements stated in this Advertisement for Bids and those further requirements stated in the Instruction to Bidders included with the relevant contract documents, the Cape Fear Public Utility Authority may deem such failure nonresponsive and therefore a forfeiture of the bid.

Cape Fear Public Utility Authority reserves the right to reject any and all bids.

All inquiries concerning this bid shall be directed to CFPUA Purchasing Division by e-mail to bids@cfpua.org.

1. DEFINED TERMS

1.01 Terms used in these Instructions to Bidders will have the meanings indicated in the General and Supplementary Conditions. Additional terms used in these Instructions to Bidders have the meanings indicated below:

A. Issuing Office: The office from which the Bidding Documents are to be issued and where the bidding procedures are to be administered.

2. COPIES OF BIDDING DOCUMENTS

2.01 Complete sets of the Bidding Documents in the number and for the deposit sum, if any, stated in the Advertisement for Bids may be obtained from the Issuing Office.

2.02 Complete sets of Bidding Documents must be used in preparing Bids; neither Owner nor Engineer assumes any responsibility for errors or misinterpretations resulting from the use of incomplete sets of Bidding Documents.

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

3. QUALIFICATIONS OF BIDDERS

3.01 Bidder must hold a North Carolina General Contractor's License or NC State Board of Examiners of Plumbing, Heating & Fire Sprinkler License with the specific classification and/or limitation stated on the bid form. Additional qualifications may be required and will be stated on the bid form. Failure to properly submit requested qualification documentation, including subcontractor's qualification, shall be treated as a non-responsive bid, and may result in the Bid being rejected.

4. EXAMINATION OF BIDDING DOCUMENTS, OTHER RELATED DATA, AND SITE

4.01 The Contractor is responsible for examining and carefully studying the Contract Documents, Drawings, Site, and all reports pertaining to supplementary examinations, investigations, explorations, tests, studies, and data concerning

conditions (surface, subsurface, underground facilities, and hazards), and Bids shall include all considerations noted in these documents and found on Site.

4.02 On request, the Owner will provide the Bidder access to the Site to conduct such examinations, investigations, explorations, tests, and studies as Bidder deems necessary for submission of a Bid. Bidder shall fill all holes and clean up and restore the Site to its former condition upon completion of such explorations, investigations, tests, and studies. Bidder shall comply with all applicable Laws and Regulations relative to excavation and utility locates.

4.03 Any supplementary reports ordered and obtained for supplementary conditions related to this project, including examinations, investigations, explorations, tests, studies, and data concerning conditions (surface, subsurface, underground facilities, and hazards) shall be included in these Bidding Documents.

4.04 The Bidder shall notify the Owner and Engineer if it believes more examinations, investigations, explorations, tests, studies, or data concerning conditions (surface, subsurface, underground facilities, and hazards) are necessary for determination of its Bid for performance of the Work.

4.05 In some cases other work is being performed on the Site by Owner as a separate contract. On request, the Owner will provide to each Bidder for examination access to or copies of Contract Documents (other than portions related to the price) for such other work.

4.06 It is the responsibility of each Bidder before submitting a Bid to:

A. Examine and carefully study the Bidding Documents, the other related data identified in the Bidding Documents, and any Addenda;

B. Visit the Site and become familiar with and satisfy Bidder as to the general, local, and Site conditions that may affect cost, progress, or performance of the Work;

C. Become familiar and satisfy Bidder as to all Federal, State and local Laws and Regulations that may affect cost, progress, or performance of the Work;

D. Carefully study all: (1) reports of explorations and tests of subsurface conditions at or contiguous to the Site and all drawings of physical conditions in or relating to existing surface or subsurface structures at or

contiguous to the Site (except Underground Facilities) which have been included in the Contract Documents, and (2) reports and drawings of Hazardous Environmental Conditions at the Site which have been included in the Contract Documents;

E. Carefully study all additional or supplementary examinations, investigations, explorations, tests, studies, and data concerning conditions (surface, subsurface, and Underground Facilities) at or contiguous to the Site which may affect cost, progress, or performance of Work or which relate to any aspect of the means, methods, techniques, sequences, and procedures of construction to be employed by Bidder, including applying any specific means, methods, techniques, sequences, and procedures of construction expressly required by the Bidding Documents, and safety precautions and programs incident thereto;

F. Agree at the time of submitting its Bid that no further examinations, investigations, explorations, tests, studies, or data are necessary for the determination of its Bid for performance of the Work at the price(s) bid and within the times in accordance with the other terms and conditions of the Bidding Documents;

G. Become aware of the general nature of the work to be performed by Owner and others at the Site that relates to the Work as indicated in the Bidding Documents.

H. Correlate the information known to Bidder, information and observations obtained from visits to the Site, reports and drawings identified in the Bidding Documents, and all additional examinations, investigations, explorations, tests, studies, and data with the Bidding Documents;

I. Promptly give Owner and Engineer written notice of all conflicts, errors, ambiguities, or discrepancies that Bidder discovers in the Bidding Documents and confirm that the written resolution thereof by Engineer is acceptable to Bidder; and

J. Determine that the Bidding Documents are generally sufficient to indicate and convey understanding of all terms and conditions of the performance of the Work.

K. Environmental Management: The Cape Fear Public Utility Authority has developed and implemented an ISO 14001 Environmental Management System (EMS), and is third party certified. Per the certification the Authority must ensure all persons doing work on their behalf is made aware of our Environmental Policy. The Environmental Policy can be found on the CFPUA website www.cfpua.org, click on the Departments tab, Environmental Management, and then choose Environmental Management. Contractor/Vendor certifies by signing this agreement that they have reviewed the Environmental Policy and understand their work contributes to the effectiveness of the EMS and may have a positive or negative impact on the Environment.

4.07 The submission of a Bid will constitute an incontrovertible representation by Bidder that Bidder has complied with every requirement listed in this Section 4 of the Instruction to Bidders, that without exception the Bid is premised upon performing and furnishing the Work required by the Bidding Documents and applying any specific means, methods, techniques, sequences, and procedures of construction that may be shown or indicated or expressly required by the Bidding Documents.

5. PRE-BID CONFERENCE

5.01 Details and requirements for a pre-bid conference, if required, will be stated in the Advertisement for Bids.

6. INTERPRETATION OF ADDENDA

6.01 All questions about the meaning or intent of the Bidding Documents are to be submitted to Purchasing in writing as detailed in the Advertisement for Bid. Interpretations or clarifications considered necessary by the Engineer in response to such questions will be issued by Addenda to all parties recorded by the Owner as having received the Bidding Documents. Questions received after the deadline may not be answered. Deadline for questions will be stated in Section 00311, Available Project Information. Only questions answered by Addenda will be binding. Oral and other interpretations or clarifications will be without legal effect.

7. BID SECURITY

7.01 Details and requirements for a Bid security, if required, will be stated in the Advertisement for Bids.

7.02 Bid Bond shall be executed by surety company legally authorized to do business in the State of North Carolina. The attorney-in-fact who executes the bid bond on behalf of the surety shall attach a certified current copy of his or her power of attorney indicating his or her authority to execute the bond. Bid Bond Form and Affidavit must have original signatures and seals, otherwise; the Bid will be considered non-responsive.

7.03 The Bid security of the lowest, responsive, responsible Bidder will be retained until such Bidder has executed the Contract Documents, furnished the required contract security and met the other conditions of the Contract, whereupon the Bid security will be returned. If the lowest, responsive, responsible Bidder fails to execute and deliver the Contract Documents and furnish the required contract security within 10 days after the Award, Owner may annul the Award and the Bid security of that Bidder will be forfeited. The Bid security of other Bidders whom the Owner believes to have a reasonable chance of receiving the award may be retained by Owner until the earlier of 7 days after the Effective Date of the Agreement or 91 days after the Bid opening, whereupon Bid security furnished by such Bidders will be returned.

7.04 Bid security of other Bidders whom Owner believes do not have a reasonable chance of receiving the award will be returned within 7 days after the Bid opening.

8. CONTRACT TIMES

8.01 The number of days within which, or dates by which, the Work is to be substantially complete and ready for final payment are set forth in the Agreement.

9. MINORITY BUSINESS PARTICIPATION

9.01 In accordance with North Carolina General Statutes Section 143-128.2, the Owner has established a goal of ten percent (10%) for minority business participation for building construction and repair projects in the amount of $300,000 and more. Bidders shall make a good faith effort to solicit minority businesses to participate on the project, and shall include with the Bid on the

Identification of Minority Business Participation Form a list of minority owned businesses that will be subcontracted for this project and the amount of the total Bid to be subcontracted to each. Bidder shall also provide Affidavit A or B with their bid.

The Owner and its Contractors shall not discriminate on the basis of race, color, national origin, religion, or sex in the award and performance of its contracts.

10. PREPARATION OF BID

10.01 The Bid shall be submitted on the Bid Form provided by CFPUA.

10.02 All blanks on the Bid Form shall be completed in ink and the Bid Form signed and sealed in ink. Grammatic or numeric corrections to the Bid shall be initialed in ink by the person signing the Bid Form. A Bid price shall be indicated for each Bid Item listed therein, or the words "No Bid" or "Not Applicable" entered.

10.03 Bidder/Company Name shall be listed on Bid Form as it appears on the North Carolina General Contractors Certificate of License.

10.04 Bid submitted by a North Carolina General Contractor engaging in business under an assumed name or under any designation, name or style other than; the real name of the owner or owners of the individual or partnership thereof; other than the name set out in the Certificate filed with the Office of the Secretary of State for a limited partnership or limited liability company; other than the corporate name set out in the articles of organization filed with the Office of the Secretary of State for a corporation, must be accompanied by Certificate of Assumed Name as filed with the Register of Deeds in the County of North Carolina in which the bidder is conducting business, pursuant to G.S. 66-68.

10.05 A Bid by a corporation shall be executed in the corporate name as it appears on the North Carolina General Contractors Certificate of License. If corporation is conducting business under an assumed name please also provide the corporate name as it is filed with the North Carolina Secretary of State, as per 10.04. Bid shall be signed by an Officer as registered with the North Carolina Secretary of State, or signed by person duly authorized, accompanied by evidence of authority to sign. The corporation's business address and state of incorporation shall be provided on the Bid Form.

10.06 A Bid by a partnership shall be executed in the partnership name as it appears on the North Carolina General Contractors Certificate of License. If partnership is conducting business under an assumed name please also provide the partnership name as it is filed with the North Carolina Secretary of State, as per 10.04. Bid shall be signed by a partner (whose title must appear under the signature), accompanied by evidence of authority to sign. The business address of the partnership shall be provided on the Bid Form.

10.07 A Bid by a limited liability company shall be executed in the name of the limited liability company (LLC) as it appears on the North Carolina General Contractors Certificate of License. If LLC is conducting business under an assumed name please also provide the LLC name as it is filed with the North Carolina Secretary of State, as per 10.04. Bid shall be signed by a Manager-Member and accompanied by evidence of authority to sign. The state of formation of the limited liability company and the business address shall be provided on the Bid Form.

10.08 A Bid by an individual shall show the Bidder's name and business address.

10.09 A Bid by a joint venture shall be executed by each joint venturer in the manner indicated on the Bid Form. The business address of the joint venture shall be provided on the Bid Form.

10.10 All names shall be typed or printed in ink below the signatures.

10.11 The Bid shall contain an acknowledgement of receipt of all Addenda, the numbers and dates of which shall be filled in on the Bid Form.

10.12 The Bid shall contain evidence of the Bidder's authority and qualification to do business in the State of North Carolina prior to the award of the Contract.

10.13 The Bidder shall completely execute the Affidavit and Certificate of Non-Collusion, Non-Suspension and Non-Conviction, and submit it with the Bid Form; otherwise, the Bid will be considered non-responsive.

10.14 The Bidder shall completely execute and submit with the Bid Form; Affidavit A-Listing of Good Faith Efforts OR Affidavit B-Intent to Perform Contract with Own Workforce AND Identification of HUB Certified/Minority Business Participation form; Otherwise, the Bid will be considered non-responsive and rejected.

10.15 Upon request by the Owner or Engineer, the Bidder shall provide evidence of previous work performed of similar nature and qualification to perform the Work in this Contract. Please see section 3.01 of the Instruction to Bidders.

10.16 Subcontractor's shall be identified on the bid form on Table 6.02 Subcontractor Summary Table. Bidders shall list subcontractors as detailed in section 6.01 of the Bid Form. Failure to list the requested subcontractors shall result in the bid being ruled non-responsive and rejected.

11. BASIS OF BID; COMPARISON OF BIDS

11.01 When Unit Price is required on the Bid Form:

A. Bidders shall submit a Bid on a unit price basis for each item of Work listed in the Bid Schedule.

B. The total of all bid prices will be the sum of the products of the estimated quantity of each item and the corresponding unit price. The final quantities and Contract Price will be determined in accordance with the General and Supplementary Conditions.

C. Discrepancies between the multiplication of units of Work and unit prices will be resolved in favor of the unit prices. Discrepancies between the indicated sum of any column of figures and the correct sum thereof will be resolved in favor of the correct sum.

11.02 Both Unit and Lump Sum price(s): Discrepancies between the words and figures will be resolved in favor of the words.

12. SUBMITTAL OF BID

12.01 A Bid shall be submitted no later than the date and time prescribed and at the place indicated in the Advertisement for Bids and shall be enclosed in an opaque sealed envelope plainly marked with the Project title (and, if applicable, the designated portion of the Project for which the Bid is submitted), the name and address of Bidder, the Bidders North Carolina Contractors License Number, and shall be accompanied by the Bid security (if applicable) and other required documents. If a Bid is sent by mail or other delivery system, the sealed envelope containing the Bid shall be enclosed in a separate opaque envelope plainly marked on the outside with the notation "BID ENCLOSED." When using the mail or other delivery system, the Bidder is totally responsible for the mail or other

delivery system delivering the Bid at the place and prior to the time indicated in the Advertisement for Bids. A mailed Bid shall be addressed as stated in the Advertisement for Bids.

13. MODIFICATION OR WITHDRAWAL OF BID

13.01 A Bid may be modified or withdrawn by an appropriate document duly executed in the manner that a Bid must be executed and delivered to the place where Bids are to be submitted prior to the date and time for the opening of Bids.

13.02 Pursuant to North Carolina General Statutes Section 143-129.1, Owner shall allow a Bidder to withdraw its Bid from consideration without forfeiture of its Bid security if the Bidder can clearly show to the Owner by objective evidence drawn from inspection of the original work papers, documents, or materials used in the preparation of the Bid that: (i) the price bid was based upon a mistake that constituted a substantial error, (ii) the Bid was submitted in good faith, (iii) the mistake was clerical in nature and not a judgment error, and (iv) the price bid was actually due to an unintentional and substantial arithmetic error or an unintentional omission of a substantial quantity of work, labor, apparatus, supplies, materials, equipment, or services made directly in the compilation of the Bid. To be considered valid, a request to withdraw a Bid must be made in writing and received by Owner within 72 hours of the Bid opening or prior to the award of the Contract, whichever occurs first. Thereafter, if the Work is rebid or negotiated, the withdrawn Bidder, its partners, and affiliates shall be disqualified from further bidding on the Work. Furthermore, the withdrawn Bidder shall be disqualified from supplying any material or labor to, or perform any subcontract on, the Work without prior written approval of the Owner.

14. OPENING OF BIDS

14.01 Bids will be opened at the time and place indicated in the Advertisement for Bids and read aloud publicly, unless obviously non-responsive or is an informal bid, as stated on the Advertisement for Bids. An abstract of the amounts of the Bids and major alternates, if any, will be made available to Bidders after the opening of Bids.

15. BIDS TO REMAIN SUBJECT TO ACCEPTANCE

15.01 All Bids will remain valid and subject to acceptance for the period ninety (90) calendar days after the Bid opening.

16. EVALUATION OF BIDS AND AWARD OF CONTRACT

16.01 The Owner reserves the right to reject any or all Bids, including without limitation, nonconforming, nonresponsive, unbalanced, or conditional Bids. Owner further reserves the right to reject the Bid of any Bidder whom it finds, after reasonable inquiry and evaluation, to be non-responsible. Owner also reserves the right to waive all informalities not involving price, time, or changes in the Work and to negotiate contract terms with the Successful Bidder.

16.02 More than one Bid for the same Work from an individual or entity under the same or different names will not be considered. Reasonable grounds for believing that any Bidder has an interest in more than one Bid for the Work may be cause for disqualification of that Bidder and the rejection of all Bids in which that Bidder has an interest.

16.03 In evaluating Bidders, Owner will consider the qualifications of Bidders and may consider the qualifications and experience of Subcontractors, Suppliers, and other individuals or entities proposed for those portions of the Work for which the identity of Subcontractors, Suppliers, and other individuals or entities must be submitted as provided in the Supplementary Conditions.

16.04 Owner may conduct such investigations as Owner deems necessary to establish the responsibility, qualifications, and financial ability of Bidders, proposed Subcontractors, Suppliers, individuals, or entities to perform the Work in accordance with the Contract Documents.

17. CONTRACT SECURITY AND INSURANCE

17.01 Details and requirements for payment bonds and insurance are stated in the General and Supplementary Conditions.

18. SIGNING OF AGREEMENT

18.01 The Owner will give Notice to the apparent lowest, responsive, responsible Bidder. This Notice shall be accompanied by the required number of unsigned counterparts of the Agreement with the other Contract Documents with which are identified in the Agreement as attached thereto. Within ten (10) calendar days thereafter, the apparent lowest, responsive, responsible Bidder shall sign and deliver the required number of counterparts of the Agreement and attached documents to Owner.

18.02 When the apparent lowest, responsive, responsible bid is $300,000 or more, this Notice is contingent upon approval by the CFPUA Board of Directors and is not legally binding until executed by the Executive Director.

18.03 When the apparent lowest, responsive, responsible bid is $300,000 or less, this Notice is contingent upon approval by the CFPUA Executive Director and is not legally binding until executed by the Executive Director.

Bidder's Checklist

Bidder/Company Name: _____
(As it appears on NC General Contractor's License)

The following checklist shall be signed and submitted with the bid to indicate that all required documents have been completed in full and included with the bid.

- ☐ Read and Understand:
  - All special notices
  - All addenda
  - Bid Form
  - Instructions to Bidders
  - General & Supplementary Conditions
- ☐ Complete and Submit Bid Form:
  - Acknowledge the acceptance of all addenda (Section 2.01)
  - Complete bid tabulation (Section 5)
  - Complete Subcontractor Summary Table and Sign (Section 6.02)
  - Complete bidding Contractor's License number, expiration and include copy of Contractor's License (Section 7.01)
  - Complete Bidder Contact (Section 9.01)
  - Complete appropriate signature blocks (Section 9)
- ☐ Enclose properly executed original Bid Bond. *Please refer to Instructions to Bidders, Section 7*
- ☐ Minority Business Documents:
  - Complete and Submit Affidavit A: Listing of Good Faith Efforts, or Affidavit B: Intent to Perform Contract with Own Workforce, whichever is applicable
  - Complete and Submit Identification of Minority Business Participation Table
- ☐ Execute and Submit Affidavit and Certificate of Non-Collusion, Non-Suspension and Non-Conviction
- ☐ Enclose entire Bid package in opaque envelope plainly marked with the Project title and NC Contractors License Number, and seal.
  - If a Bid is sent by mail or other delivery system, the sealed envelope containing the Bid shall be enclosed in a separate opaque envelope plainly marked on the outside with the notation "BID ENCLOSED".
- ☐ Low bidder shall within 72 hours of being notified of being the low bidder Complete and Submit Affidavit C: Portion of the Work to be Performed by Minority Businesses, or Affidavit D: Good Faith Efforts

Bidder's Signature: _____
By signing I acknowledge I have completed and enclosed all items indicated above.

- Please contact Jordan Evans at 910-332-6674 to schedule appointment to visit EMD Facility.
- Inquiries concerning the bid shall be directed to the CFPUA Purchasing Division by email to bids@cfpua.org. **Deadline for questions is Tuesday, November 17, 2020 at 3:00 PM.**
- Contractor performing work in Section 230010 will be required to complete and submit the Cyber Security Questionnaire for Current and Initial Vendor Agreements located in Section 00623 to Jordan.Evans@cfpua.org before the Pre-Construction Meeting.

BID FORM

CFPUA Project Name:	EMD Facility HVAC Upgrades
Bid Opening Date/Time:	Tuesday, November 24, 2020 at 2:00 PM
Bid Opening Location:	Front Door at 235 Government Center Drive
Bids may be submitted and received prior to the Bid opening at this location:	Cape Fear Public Utility Authority Attn: Julia Faircloth, Procurement Manager 235 Government Center Drive Wilmington, NC 28403

1. GENERAL

1.01 The undersigned Bidder proposes and agrees, if this Bid is accepted, to enter into an Agreement with Owner in the form included in the Bidding Documents to complete all Work as specified or indicated in the Bidding Documents for the prices and within the times indicated in this Bid and in accordance with the Bidding Documents.

1.02 Terms contained in the Bidding Documents, including this Bid Form, have the same meaning as defined in the general and supplementary conditions made part of the Bidding Documents.

1.03 Bidder accepts all the terms and conditions of the Advertisement for Bid and Instruction to Bidders, including without limitation those dealing with the disposition of Bid Security. This bid will remain open and valid for ninety (90) calendar days after the day of the Bid opening. Bidder will sign the Agreement and submit insurance, bonding and other documents required by the Contract Documents within ten (10) calendar days from the date the Owner gives notice to apparent lowest, responsive, responsible Bidder.

2. PROJECT EXPECTATIONS

2.01 In submitting this Bid, Bidder represents, as fully set forth in the Agreement, that:

A. Bidder has examined and carefully studied the Bidding Documents, the other related data identified in the Bidding Documents, and the following Addenda, receipt of all which is hereby acknowledged.

No. _____ Dated _____

No. _____ Dated _____

No. _____ Dated _____

No. _____ Dated _____

B. The undersigned Bidder agrees that Bidder has carefully examined and become familiar with the expectations of the Work described in the Bidding Documents, and agrees that he/she has met the bidding responsibilities stated in Section 4 of the Instructions to Bidders.

3. NON-COLLUSION, NON-SUSPENSION, AND NON-CONVICTION

3.01 Bidder represents that this Bid is genuine and is non-collusive.

3.02 Bidder further represents that he/she is not suspended or debarred from bidding on this Work, and that Bidder has not been convicted of any charges or engaged in any unlawful act of trade in Federal or any state jurisdiction.

3.03 Bidder is fully aware that Bid is not considered responsive, if CFPUA's Affidavit and Certificate of Non-Collusion, Non-Suspension and Non-Conviction is not properly executed and submitted with Bid Form.

4. CONTRACT TIMES

4.01 Bidder agrees to the contract times and liquidated damages stated in the Agreement made part of the Bidding Documents.

5. BID AMOUNT

5.01 Bidder agrees to perform all the work described in the Bidding Documents for the unit and/or lump sum prices found in the Bid tabulation. *(Bid tabulation to be completed by Bidder can be found on next page. If Bid tabulation intentionally excluded by Owner and Owner is requesting one lump sum price for the complete Work, Bidder shall write out the lump sum amount in both word format and number format at the bottom of this page. Ex: one hundred twenty-five and 12/100 dollars; $125.12)*

BID TABULATION - EMD HVAC UPGRADES
CAPE FEAR PUBLIC UTILITYAUTHORITY

ITEM	DESCRIPTION	UNIT	QTY	PRICE
Base Bid	LUMP SUM BID: Lump sum shall include all contractor's cost to complete the demolition and construction work as shown in the contract documents. Work includes installation of: • Packaged Air Conditioner PAC-108 • Electric Duct Heaters EDH-110-1 through 6 • Exhaust Fan FEF-101 • New DDC controls combination temperature/humidity sensor • Operator workstation This lump sum price shall include all labor, materials, tools, equipment and any other items the contractor requires to fully complete all work. This item shall include all bonds, insurance, mobilization and all other expenses to complete this project as required by the contract documents.	LS	1	$
Written Total Base Bid Price **$**				

6. SUBCONTRACTS

6.01 Bidder shall list all the subcontractors they have selected to perform the following subdivisions of work: HVAC and Electrical. Bidder shall also list the Work/Service to performed, amount the subcontractor shall be paid, the percent of the total bid amount the subcontractor shall perform and the subcontractor's NC license permitting them to perform this type of work (if applicable). Bidders shall only list one subcontractor for each work/service to be performed.

6.02 Subcontractor Summary Table

Subcontractor Name or indicate self-performing	Work/Service to be Performed	Amount to be Paid	Percentage of Total Bid	License Number (If applicable)
	HVAC			
	Electrical			

Bidder acknowledges by signing below that all subcontractors performing the subdivisions of work as described in 6.01 are listed above in 6.02 the Subcontractor Summary Table. A contractor whose bid is accepted shall not substitute any person as a subcontractor in the place of the subcontractor listed in the original bid unless approved by CFPUA with justification from the contractor. Failure to comply with these terms may result in the bid being rejected based on non-responsiveness.

BIDDER SIGNATURE: _____

7. BIDDER LICENSE

7.01 The bidder must have either of the following License to be qualified to perform the work associated with this bid. Bidder must list License number and provide copy of North Carolina Contractors Certificate.

North Carolina General Contractor's License: Limitation: Intermediate
Classification(s): Building

OR

NC State Board of Examiners of Plumbing, Heating & Fire Sprinkler License:

Active Classification: Heating Group 2

NC License Number: _____ License Expiration Date: _____

8. BIDDER QUALIFICATIONS

8.01 Other Qualifications: None

9. BIDDER CONTACT

9.01 Communications concerning this Bid shall be sent to the Bidder at the following:

Name: _____

Address: _____

Phone: _____ Email: _____

BIDDER SIGNATURE

Please see Section 10 of the Instruction to Bidder for additional information.

If a Corporation:

Bidder Name: _____
(As it appears on NC General Contractor's License)

By: _____ Date: _____
(Officer as registered with the NC Secretary of State, or authorized person and provide evidence of authority to sign)

Printed Name: _____ Title: _____

Business Address: _____

Phone: _____Email: _____

Bidder is conducting Business under an Assumed Name (DBA) ____Yes _____No

If the above answer is Yes, please provide the Corporate Name as filed with the NC Secretary of State, and Provide Certificate of Assumed Name:

_____
(Corporate Name as filed with NC Secretary of State)

If a Limited Liability Company

Bidder Name: _____
(As it appears on NC General Contractor's License)

By: _____ Date: _____
(Member-Manager)

Printed Name: _____ Title: _____

Business Address: _____

Phone: _____ Email: _____

Bidder is conducting Business under an Assumed Name (DBA) ____Yes _____No

If the above answer is Yes, please provide the Company Name as filed with the NC Secretary of State, and Provide Certificate of Assumed Name:

_____
(Name as filed with NC Secretary of State)

If a Partnership

Bidder Name: _____
(As it appears on NC General Contractor's License)

By: _____ Date: _____
(Partner)

Printed Name: _____ Title: _____

Business Address: _____

Phone: _____ Email: _____

Bidder is conducting Business under an Assumed Name (DBA) ____Yes _____No

If the above answer is Yes, please provide the Partnership Name as filed with the NC Secretary of State, and Provide Certificate of Assumed Name:

_____
(Name as filed with NC Secretary of State)

If an Individual

By: _____ Date: _____

Printed Name: _____

Doing business as: _____

Business Address: _____

Phone: _____ Email: _____

If a Joint Venture (other party must complete below)

Contractor: _____

Type (Ind., Part., Corp.) / Name: _____

By: _____ Date: _____

Printed Name: _____ Title: _____

Doing business as (if Individual): _____

Business Address: _____

Phone: _____ Email: _____

BID BOND

This Bond is executed on _____, 20____.

CONTRACTOR (as PRINCIPAL)

NAME: _____

ADDRESS:

_____

_____

SURETY

NAME: _____

ADDRESS:

_____

_____

OWNER (as CONTRACTING BODY)

CAPE FEAR PUBLIC UTILITY AUTHORITY

ADDRESS:

235 Government Center Drive
Wilmington, North Carolina 28403

BOND

AMOUNT: $_____

_____

_____Dollars

KNOW ALL MEN BY THESE PRESENTS THAT we, the above named PRINCIPAL and above named SURETY, who is duly licensed to act as surety in North Carolina, are held and firmly bound unto the Cape Fear Public Utility Authority, as CONTRACTING BODY, in the penal sum of the above stated dollar amount, BOND, lawful money of the United States of America, for the payment of which, well and truly to be made, we bind ourselves, our heirs, executors, administrators, successors and assigns, jointly and severally, firmly by these presents.

WHEREAS, the said PRINCIPAL is herewith submitting proposal for _____ project, and the PRINCIPAL desires to file this bid bond in lieu of making the cash deposit as required by North Carolina G.S. 143-129.

NOW, THEREFORE, THE CONDITION OF THE ABOVE OBLIGATION is such, that if the PRINCIPAL shall be awarded the contract for which the bid is submitted and shall execute the contract and give bond for the faithful performance thereof within ten days after the award of same to the PRINCIPAL, then this obligation shall be null and void; but if the PRINCIPAL fails to so execute such contract and give performance bond as required by North Carolina G.S. 143-129, the SURETY shall, upon demand, forthwith pay to the CONTRACTING BODY the amount set forth above as BOND. Provided further, that the bid may be withdrawn as provided by North Carolina G.S. 143-129.1.

IN WITNESS WHEREOF, the above-bounden parties have executed this instrument under their several seals on the date indicated above, the name and corporate seal of each corporate party being hereto affixed and these presents duly signed by its undersigned representative, pursuant to authority of its governing body.

If additional signature required:

CONTRACTOR (as PRINCIPAL)

_____

BY: _____

PRINTED: _____

TITLE: _____

DATE: _____

CONTRACTOR (as PRINCIPAL)

_____

BY: _____

PRINTED: _____

TITLE: _____

DATE: _____

WITNESS TO PRINCIPAL

BY: _____

PRINTED: _____

ADDRESS:

_____

_____

CONTRACTOR'S SEAL:

SURETY

_____

BY: _____

PRINTED: _____

ADDRESS:

_____

_____

PHONE #: _____

SURETY'S SEAL:

WITNESS TO SURETY

BY: _____

PRINTED: _____

ADDRESS:

_____

_____

This Bid Bond is not official without a completed affidavit validating the surety agent's authority and a Power of Attorney attached.

AFFIDAVIT

STATE OF:

COUNTY OF:

_____being first duly sworn on oath deposes and says that s/he is

_____(agent-in-fact or agent) of _____

(bonding company) surety on the attached Agreement on _____(Date)

executed by _____(Contractor).

Affiant further deposes and says that no officer, official, or employee of the Owner has any interest directly or indirectly, or is receiving any premium, commission fee, or other thing of value on account of the same or furnishing of the Bond, undertaking or Contract of Indemnity, Guaranty, Suretyship in connection with the above mentioned Agreement.

Signed _____

(agent-in-fact or agent)

Subscribed and sworn to before me this ____day of _____, 20____.

_____

Notary Public

My Commission Expires: _____

MINORITY BUSINESS CONTRACT PROVISIONS
INSTRUCTION

INTENT

1. It is the policy of the Cape Fear Public Utility Authority that minority businesses as defined in NCGS 143-128.2(g)(1)(2) and (3) shall have the maximum opportunity to participate in the performance of contracts financed in whole or in part by Authority funds under this agreement. Consequently, the Minority Business requirements of NCGS 143-128 apply to this bid and any subsequent contract.

2. Failure to submit and complete documents as well as comply with terms in this section is grounds for rejection of the bids.

3. The goals for participation by minority firms as subcontractors on this project have been set at 10% of the dollar value of the prime contract. Minority Business goals are accomplished via subcontracts performed by certified businesses. Subcontracts may include supplying of materials.

4. All firms submitting bids for this project must make a good faith effort, as defined in this Section 00433 and NCGS 143-128 to subcontract 10% of the work to certified minority business firms. This requirement **does** apply even if the bidder is a certified minority business contractor. This requirement **does not** apply if the firm will be performing all of the work with their own workforce and will not be subcontracting any of the work.

5. CFPUA proposes to award the contract to the lowest responsible bidder submitting a reasonable bid, provided s/he has made a "GOOD FAITH EFFORT" as defined in Affidavit A to meet the established Minority Business participation goals. Nothing in these guidelines shall be construed to require contractors or CFPUA to award contracts or subcontract to or make purchase of materials or equipment from minority-business contractors or minority business subcontractors who do not submit the lowest responsible, responsive bid or bids.

6. Bidders are advised that CFPUA has the sole authority to determine if the bidder has made a "GOOD FAITH EFFORT" toward meeting the Minority Business goals to qualify for contract award. CFPUA reserves the right to reject any and all bids submitted.

7. Agreements between the bidder/proposer and a Minority Business in which the Minority Business promises not to provide subcontracting quotations to other bidders/proposers are prohibited.

8. All bidders and potential contractors hereby assure CFPUA that they will include the above clauses in all subcontracts which offer further subcontracting opportunities. The terms, conditions and requirements of each contract between the contractor and each subcontractor performing work under a subdivision of branch of work listed in the bid documents shall be incorporated by reference the terms, conditions and requirements of this contract between CFPUA and the CONTRACTOR.

BID REQUIREMENTS

1. As part of the submitted bid document bidders must identify the minority business subcontractors that will be used on the project with corresponding total dollar value of the bid. These firms shall be listed on the "Identification of Minority Business Participation" Form. Bidder should also list the minority firm's address, phone number, work type and minority category.

2. Only Minority Businesses that meet the minimum requirements as established by NCGS 143-128.2 and are certified by the following agency will be counted towards the established goal:

   North Carolina Department of Administration, Office for Historically Underutilized Business (HUB) certification.

3. Bidders must submit with their bid, the enclosed Affidavit A, "Listing of Good Faith Efforts". The affidavit must include evidence of the good faith efforts made by the bidder to contract with and hire minority business firms as subcontractors for this project. A minimum of 50 points is required from the good faith efforts listed for the bid to be considered responsive. A listing of "Good Faith Compliance" is included in the bid document.

   OR

   Bidders must submit with their bid, the enclosed Affidavit B, "Intent to Perform Contract with Own Workforce" as required by G.S. 143-128.2 (c) and G.S. 143-128.2 (f).

   A bid that fails to meet these requirements will be considered non-responsive.

4. Minority Businesses identified in the bid document may not be substituted or replaced without just cause and only with the written approval of CFPUA. If a substitution is agreed to by CFPUA, the CONTRACTOR must make a good faith effort to replace the Minority Business with another Minority Business. Please see NCGS 143-128.2(d).

LOWEST REPONSIVE, RESPONSIBLE BIDDER

1. The lowest responsible, responsive bidder must within 72 hours of being notified provide Affidavit C "Portion of the Work to be Performed by Minority Businesses" that includes a description of the portion of work to be executed by minority businesses, expressed as percentage of the total contract price, which is equal to or more than the applicable goal.

   Or

   The lowest responsible, responsive bidder must within 72 hours of being notified provide Affidavit D "Good Faith Efforts" that that includes a description of the portion of work to be executed by minority businesses, expressed as percentage of the total contract price, with documentation of Good Faith Effort if the percentage is not equal to the applicable goal. A listing of documentation that may be required to demonstrate the bidder's good faith effort to meet the goals set forth in these provisions is listed on Affidavit D.

   Or

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

2. The contractor shall maintain adequate records of the minority business's performance and payments and shall submit regular reports to CFPUA. These reports shall be sent with the contractors monthly "CONTRACTOR PAYMENT TO MBE/DBE FIRMS". The request shall include a breakdown of the amount of the payment to be made by CFPUA which will be paid to the minority business identified in the bid documents.

DISPUTE RESOLUTION

CFPUA Dispute Resolution can found in the EJCDC Standard General Conditions of the Construction Contract and Supplemental Conditions to the General Conditions.

MINIMUM COMPLIANCE REQUIREMENTS:

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

In determining whether a contractor has made Good Faith Efforts, CFPUA will evaluate all efforts made by the Contractor and will determine compliance in regard to quantity, intensity, and results of these efforts. The bidder must earn a minimum of 50 points. Good Faith Efforts include:

1. Contacting minority businesses that reasonably could have been expected to submit a quote and that were known to the contractor or available on State or local government maintained lists at least 10 days before the bid or proposal date and notifying them of the nature and scope of the work to be performed. (10 pts)

2. Making the construction plans, specifications and requirements available for review by prospective minority businesses, or providing these documents to them at least 10 days before the bid or proposals are due. (10 pts)

3. Breaking down or combining elements of work into economically feasible units to facilitate minority participation. (15 pts)

4. Working with minority trade, community, or contractor organizations identified by the Office for Historically Underutilized Businesses and included in the bid documents that provide assistance in recruitment of minority businesses. (10 pts)

5. Attending any pre-bid meetings scheduled by the public owner. (10 pts)

6. Providing assistance in getting required bonding or insurance or providing alternatives to bonding or insurance for subcontractors. (20 pts)

7. Negotiating in good faith with interested minority businesses and not rejecting them as unqualified without sound reasons based on their capabilities. Any rejection of a minority business based on lack of qualification should have the reasons documented in writing. (15 pts)

8. Providing assistance to an otherwise qualified minority business in need of equipment, loan capital, lines of credit, or joint pay agreements to secure loans, supplies, or letters of credit, including waiving credit that is ordinarily required. Assisting minority businesses in obtaining the same unit pricing with the bidder's suppliers in order to help minority businesses in establishing credit. (25 pts)

9. Negotiating joint venture and partnership arrangements with minority businesses in order to increase opportunities for minority business participation on a public construction or repair project when possible. (20pts)

10. Providing quick pay agreements and policies to enable minority contractors and suppliers to meet cash-flow demands. (20 pts)

POTENTIAL SUBCONTRACTING OPPORTUNITIES

PROJECT NAME: EMD Facility HVAC Upgrades

PROJECT NUMBER: 16W213

WORK ITEM DESCRIPTION: HVAC, Electrical & Plumbing

THE ABOVE LISTED AREAS OF SUBCONTRACT OPPORTUNITIES ARE THE AREAS THAT HAVE BEEN IDENTIFIED BY CFPUA STAFF AND/OR CFPUA CONSULTANTS FOR THE ABOVE REFERENCED PROJECT.

THE LIST IS BY NO MEANS EXHAUSTIVE AND BIDDERS ARE ENCOURAGED TO SEARCH FOR OTHER AREAS OF POTENTIAL SUBCONTRACTING OPPORTUNITIES. THE BIDDERS EFFORTS IN THIS REGARD WILL ALSO BE A CONSIDERATION IN CFPUA'S REVIEW OF THE GOOD FAITH EFFORT.

IF THERE ARE NO IDENTIFIED AREAS OF POTENTIAL SUBCONTRACT OPPORTUNITIES FOR A PARTICULAR CONTRACT THEN THE BIDDER MUST MAKE A GOOD FAITH EFFORT TO IDENTIFY OTHER AREAS OF POTENTIAL SUBCONTRACT WORK.

THE CONTRACT GOAL FOR MBE/DBE PARTICIPATION IS 10%.

Identification of HUB Certified/ Minority Business Participation

I,_____,
(Name of Bidder)
do hereby certify that on this project, we will use the following HUB Certified/ minority business as construction subcontractors, vendors, suppliers or providers of professional services.

Firm Name, Address and Phone #	Work Type	*Minority Category	**HUB Certified (Y/N)

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

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

The total value of minority business contracting will be ($)_____.

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

County of _____

(Name of Bidder)

Affidavit of_____

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

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

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

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

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

Date:_____ Name of Authorized Officer:_____

Signature:_____

Title:_____

SEAL

State of_____, County of_____

Subscribed and sworn to before me this _____day of _____20____

Notary Public_____

My commission expires _____

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

County of _____

Affidavit of _____
(Name of Bidder)

I hereby certify that it is our intent to perform 100% of the work required for the _____

_____ contract.
(Name of Project)

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

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

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

Date: _____ Name of Authorized Officer: _____

Signature: _____

Title: _____

SEAL

State of _____, County of _____

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

Notary Public _____

My commission expires _____

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

County of _____

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

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

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

_____
(Project Name)

Project ID#_____ Amount of Bid $_____

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

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

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

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

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

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

Date:_____ Name of Authorized Officer:_____

SEAL

Signature:_____

Title:_____

State of _____, County of _____
Subscribed and sworn to before me this _____day of _____20____
Notary Public_____
My commission expires_____

State of North Carolina AFFIDAVIT D – Good Faith Efforts

County of _____

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

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

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

_____
(Project Name)

Project ID#_____ Amount of Bid $_____

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

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

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

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

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

A. Copies of solicitations for quotes to at least three (3) minority business firms from the source list provided by the State for each subcontract to be let under this contract (if 3 or more firms are shown on the source list). Each solicitation shall contain a specific description of the work to be subcontracted, location where bid documents can be reviewed, representative of the Prime Bidder to contact, and location, date and time when quotes must be received.

B. Copies of quotes or responses received from each firm responding to the solicitation.

C. A telephone log of follow-up calls to each firm sent a solicitation.

D. For subcontracts where a minority business firm is not considered the lowest responsible sub-bidder, copies of quotes received from all firms submitting quotes for that particular subcontract.

E. Documentation of any contacts or correspondence to minority business, community, or contractor organizations in an attempt to meet the goal.

F. Copy of pre-bid roster

G. Letter documenting efforts to provide assistance in obtaining required bonding or insurance for minority business.

H. Letter detailing reasons for rejection of minority business due to lack of qualification.

I. Letter documenting proposed assistance offered to minority business in need of equipment, loan capital, lines of credit, or joint pay agreements to secure loans, supplies, or letter of credit, including waiving credit that is ordinarily required.

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

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

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

Date:_____ Name of Authorized Officer:_____

Signature:_____

Title:_____

SEAL

State of _____, County of _____

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

Notary Public_____

My commission expires _____

STATE OF _____

COUNTY OF _____

AFFIDAVIT AND CERTIFICATE OF
NON-COLLUSION, NON-SUSPENSION AND NON-CONVICTION

The undersigned, being first duly sworn, deposes and says:

1. I understand that for the purposes of this affidavit, the term "bidder" shall include the person(s), firm(s), or corporation(s) signing this affidavit, the undersigned's subcontractor(s), subsidiary(ies) and affiliate(s) and any officer, director, employee or agent of the bidder; and the term "conviction" shall include guilty pleas, pleadings of nolo contendere and similar pleas.

2. This Affidavit and Certificate is made in accordance with Article 3 of Chapter 133 of the North Carolina General Statutes; I certify that this proposal is made without prior understanding, agreement, or connection with any person(s), firm(s), or corporation(s) making bids or proposals; I further certify that the bidder has not entered into any agreement with any other bidder or prospective bidder or with any other person(s), firm(s) or corporation(s) relating to the price named in said proposal, nor any agreement or arrangement under which any person(s), firm(s) or corporation(s) is to refrain from bidding, nor any agreement or arrangement for any act or omission in restraint of free competition among bidders; I understand collusive bidding is a violation of state and federal law and can result in fines, prison sentences, and civil damage awards; and I further certify that the bidder will abide by all terms of this bid or proposal.

3. The bidder is not presently suspended, debarred or proposed for debarment from bidding by any federal or state governmental agency.

4. The bidder is not presently charged in an indictment or information with engaging in any conspiracy, combination, or other unlawful act in restraint of trade or any similar charges in any federal court or a court of this or any other state.

5. The bidder, within three years immediately preceding the date of this affidavit, has not been convicted of charges or engaging in any conspiracy, combination, or other act in restraint of trade or commerce declared to be unlawful by the provisions of G.S. 75-1 and 75-2 in any federal court or a court of this or any other state.

6. If, during the time of this proposal, from the date advertised to the date bids are opened, the bidder is indicted or convicted of bid-rigging, I understand this proposal shall be rejected and not considered for award.

7. I hereby affirm that all information contained in this affidavit is true, correct, accurate and complete, and any untrue, incorrect, inaccurate or incomplete statements will result in the disqualification and rejection of this proposal. I certify that I am authorized to sign this bid and to make the representations set forth herein on behalf of myself and the bidder.

8. The Bidder shall completely execute this Affidavit and Certificate of Non-Collusion, Non-Suspension and Non-Conviction, and submit it with the Bid Form; otherwise, the Bid will be considered non-responsive.

This the _____ day of _____, 20___

CONTRACTOR'S SEAL:

COMPANY NAME: _____

BY: _____
(Owner, Partner, or Corporate President, Vice President or Assistant Vice President Only)

PRINTED: _____

TITLE: _____

ATTEST:

BY: _____
(Secretary, Assistant Secretary, or Trust Officer Only)

PRINTED: _____

TITLE: _____

STATE OF _____

COUNTY OF _____

I, _____, a Notary Public, certify that the corporation's Secretary,
[Notary-(Print)]
Assistant Secretary, or Trust Officer, Mr./Mrs./Ms. _____
(Name)-Secretary, Asst. Secretary, Trust Officer]
personally came before me this day and acknowledged that s/he is the _____ of _____, a corporation,
[(Title)-Secretary, Asst. Secretary, Trust Officer] *[Corporation Name]*
and that by authority duly given and as act of the corporation, the foregoing instrument was signed in its name by its President, Vice President, or Assistant Vice President, Mr./Mrs./Ms. _____, sealed with its Corporate Seal, and attested by
[(Name) - President, Vice President, Asst. Vice President]
its Secretary, Assistant Secretary, or Trust Officer.

WITNESS my hand and official seal this the _____ day of _____, 20 ____.

_____
Notary Public
My commission expires: _____

AGREEMENT FOR CONSTRUCTION SERVICES

New Hanover County, State of North Carolina

21-C0428

THIS AGREEMENT FOR CONSTRUCTION SERVICES ("Agreement"), made this the day of_____, 2020, (the "Effective Date") is an agreement by and between CAPE FEAR PUBLIC UTILITY AUTHORITY, a body politic and corporate organized under North Carolina General Statutes Chapter 162A and located in New Hanover County, North Carolina (hereinafter called OWNER) and , licensed as a contractor in the State of North Carolina (herein called CONTRACTOR).

1. PURPOSE

The OWNER hereby employs the CONTRACTOR to furnish all labor, materials, and equipment to perform all work (the "Work") in a manner and form as specified by the attached plans, specifications, and/or documents consisting of, but not limited to: Advertisement, Instructions to Bidders, General and Supplementary Conditions, Technical Specifications, Proposal, Agreement, and Performance and Payment Bonds (collectively, the "Contract Documents"), which are incorporated as if fully set out, for the following:

EMD Facility HVAC Upgrades

2. ENGINEER

The Project has been designed by CHEATHAM AND ASSOCIATES, P.A., who is referred to in the Contract Documents as ENGINEER. Engineer and its duly authorized agents are to act as OWNER'S representatives, assume all duties and responsibilities, and have the rights and authority assigned to ENGINEER in the Contract Documents in connection with completion of the Work in accordance with the Contract Documents.

3. CONTRACT TIMES

The CONTRACTOR shall commence Work to be performed under this Agreement within ten (10) consecutive calendar days of the issuance of a Notice to Proceed by the OWNER. The Work shall achieve Substantial Completion within 125 consecutive calendar days of the Notice to Proceed, and Final Completion of all Work within 155 consecutive calendar days of the Notice to Proceed. Time is of the essence.

4. LIQUIDATED DAMAGES

The OWNER and CONTRACTOR agree that time is of the essence of this Agreement. The CONTRACTOR agrees to pay, as liquidated damages, to the OWNER Five Hundred 00/100 Dollars ($500.00) for each consecutive calendar day the Work extends beyond the total time allotted for Substantial Completion of all Work and Thirty 00/100 Dollars ($30.00) for each consecutive calendar day the Work extends beyond the total time allotted for Final Completion of all Work, not as a penalty, but as liquidated damages. CONTRACTOR and OWNER agree to liquidated damages because of the impractablility and extreme difficulty of fixing and ascertaining the actual damages the OWNER would sustain in the event CONTRACTOR fails to achieve Substantial and Final Completion within the Contract Time, as may be adjusted.

OWNER shall have the right to deduct the liquidated damages from any payments, otherwise due, or to become due, to the CONTRACTOR, and to initiate applicable dispute resolution procedures to recover such liquidated damages to the extent they exceed amounts owed to the CONTRACTOR.

5. CONTRACT PRICE & PAYMENT PROCEDURES

The OWNER agrees to pay the CONTRACTOR for the faithful performance of this Agreement, subject to any additions or deductions as provided for in the Contract Documents as set forth in the Proposal, the total cost of Dollars ($).

CONTRACTOR shall submit an Application for Payment for partial payment to the ENGINEER no later than the 30th day of every month, and shall expect a periodic payment for such Application for Payment from the OWNER by the last day of the following month, assuming the Application for Payment is complete and has been accepted by both the ENGINEER and OWNER. The Application for Payment may include the value of materials on the jobsite, but not installed.

Until the Work is fifty percent (50%) complete based on gross invoices, five percent (5%) of each periodic payment due to CONTRACTOR shall be retained by OWNER. When the Work is fifty percent (50%) complete, OWNER shall, with written consent of the surety, not retain any further retainage from periodic payments due to the CONTRACTOR provided CONTRACTOR continues to satisfactorily perform the Work and any nonconforming Work identified as provided herein has been corrected by CONTRACTOR and accepted by OWNER. In the event the OWNER determines that CONTRACTOR'S performance of the Work is unsatisfactory, the OWNER may reinstate retainage from each subsequent periodic payment. The value of stored on-site materials shall not

exceed twenty percent (20%) of the gross project invoices for the purposes of determining whether the Work is fifty percent (50%) complete.

Upon Substantial Completion, OWNER may release a portion of the retainage to CONTRACTOR, retaining at all times an amount sufficient to cover the cost of the Work remaining to be completed. Consent of the Surety shall be obtained before any retainage is paid by the OWNER. Consent of the Surety signed by an agent, must be accompanied by a certified copy of such agent's authority to act for the Surety.

Upon completion and acceptance of the Work and under the condition that there are no outstanding items preventing final payment as defined in the General and Supplementary Conditions, the OWNER shall pay the CONTRACTOR the final payment in accordance with North Carolina General Statutes Section 143-134.1.

6. INTEREST

Pursuant to North Carolina General Statutes Section 143-134.1, i**nterest on amounts due but not paid shall bear interest at the rate of one percent (1%) per month.**

7. PERFORMANCE BOND

It is agreed that if, at any time after the execution of this Agreement and the Performance Bond, the OWNER shall deem the surety or sureties upon such bond to be unsatisfactory, or if for any reason such bond ceases to be adequate to cover the performance of the Work, the CONTRACTOR shall, at its expense, within five (5) days after receipt of notice from the OWNER to do so, furnish an additional bond or bonds in such form and amount, and with such surety, or sureties, as shall be satisfactory to the OWNER.

8. INSURANCE

The CONTRACTOR shall take out and maintain, during the term of this Agreement, all insurance required by the General and Supplementary Conditions, and shall, at the execution of this Agreement, attach to each of the counterparts thereof documentary proof of compliance in the form of a certificate from its insurer, stating the amount, policy numbers, and kinds of insurance carried. The contractor shall provide that the insurance contributing to satisfaction of insurance requirements in the Supplementary Conditions, Section SC-5. Minimum Scope and Insurance Requirements shall not be canceled, terminated or modified by the contractor without prior written approval of CFPUA; Contractor shall provide immediate notice to CFPUA (by letter) if any policy required by this contract is canceled or non-renewed.

9. WARRANTY

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

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

C. Additionally, OWNER may bring an action for latent defects caused by the CONTRACTOR, which are hidden or not readily apparent to OWNER at the time of beneficial occupancy or final acceptance, whichever occurred first, in accordance with applicable law.

10. RESERVED

11. CONTRACTOR'S REPRESENTATIONS

The CONTRACTOR acknowledges, represents, and warrants the following:

A. CONTRACTOR has examined and carefully studied the Contract Documents and other related data identified in the Bidding Documents.

B. CONTRACTOR has visited the Site and become familiar with and is satisfied as to the general, local, and Site conditions that may affect cost, progress, and performance of the Work.

C. CONTRACTOR is familiar with and is satisfied as to all Federal, State, and Local laws and regulations that may affect cost, progress, and performance of Work.

D. CONTRACTOR has carefully studied all provided reports on supplementary (surface, subsurface, underground facilities, and hazards).

E. CONTRACTOR does not consider that any further examinations, investigations, explorations, tests, studies, and data are necessary for the performance of the Work at the Contract Price and within the Contract Time, and in accordance with the terms and conditions of the Contract Documents.

F. CONTRACTOR has given written notice to the ENGINEER of all conflicts, errors, ambiguities, or discrepancies that the CONTRACTOR has discovered in the Contract Documents and the written resolution thereof by ENGINEER is acceptable to CONTRACTOR.

G. The Bid, for which this Agreement is based, is genuine and not made in the interest of or on the behalf of any undisclosed individual or entity and is not submitted in conformity with any agreement or rules of any group, association, organization, or corporation. Also, CONTRACTOR has not sought by collusion any advantage over any other Bidder or over OWNER.

12. E-VERIFY

CONTRACTOR shall comply with E-VERIFY requirements of Article 2 of Chapter 64 of the General Statutes. Further, if CONTRACTOR utilizes a subcontractor, CONTRACTOR shall require the subcontractor to comply with the requirements of Article 2 of Chapter 64 of the General Statutes.

13. IRAN DIVESTMENT ACT CERTIFICATION

CONTRACTOR certifies by signing this agreement that they are in compliance with the Iran Divestment Act, N.C.G.S. Chapter 147 Article 6E, and as of the date listed below, the Contractor named in this agreement is not listed on the Final Divestment List created by the State Treasurer pursuant to N.C.G.S. Article 6E, §147-86.58. Contractor shall not utilize any subcontractor found on the State www.nctreasurer.com/Iran.

14. ASSIGNMENT OF AGREEMENT

It is mutually agreed by the parties hereto that this Agreement may not be assigned by CONTRACTOR without the prior written consent of the OWNER.

15. SUBCONTRACTS

The CONTRACTOR shall utilize no subcontracts for carrying out the services to be performed under this Agreement without written approval from the OWNER and as otherwise provided in the General and Supplemental Conditions.

16. BINDING EFFECT & CONTINUING OBLIGATION

This Agreement shall be binding upon the heirs, successors, assigns, agents, officials, employees, independent contractors, and subcontractors of the parties.

The parties will make and execute all further instruments and documents required to carry out the purposes and intent of the Agreement.

17. AMENDMENTS

This Agreement shall not be modified or otherwise amended except in writing signed by both parties to this Agreement.

18. CONTRACT DOCUMENTS

The following are included in the Contract Documents as part of this Agreement:

A. This Agreement

B. Performance and Payment Bonds

C. EJCDC Standard General Conditions of the Construction Contract copyrighted 2007, as revised.

D. Cape Fear Public Utility Authority Supplementary Conditions

E. Technical Specifications as indicated in the Table of Contents and included with the bid documents.

F. Drawings as indicated in the Table of Contents and included with the bid documents.

G. Total project addenda distributed before Bid Opening:

H. Exhibits to this Agreement:

1. Bid form with CONTRACTOR'S bid

2. Notice to Proceed

3. Documentation submitted by CONTRACTOR prior to Notice of Award *(list)*

I. Documents established after the Effective Date of this Agreement, which are not attached hereto:

1. Written Amendments

2. Work Change Directives

3. Change Orders

There are no Contract Documents other than those listed above in this section. The Contract Documents represent the entire and integrated agreement between the parties hereto and supersede prior negotiations, representations or agreements, either written or oral. The Contract Documents may only be amended, modified, or supplemented as stated in the General and Supplementary Conditions.

To the extent the terms of this Agreement conflict with any terms or conditions of any other Contract Document, the terms and conditions contained herein shall control.

IN WITNESS WHEREOF, the OWNER has caused this Agreement to be duly executed in its name and behalf and the CONTRACTOR has caused this Agreement to be duly executed in its name and behalf and its corporate seal to be hereunto affixed, and attested to.

This Agreement will be effective on _____, 2020.

CONTRACTOR

CONTRACTOR'S SEAL:

_____

ADDRESS:

_____

_____

ATTEST:

BY: _____
[President, Vice President, Asst. Vice President]

BY: _____
[Secretary, Asst. Secretary, Trust Officer]

PRINTED: _____

PRINTED: _____

TITLE: _____

TITLE: _____

CONTRACTOR'S LICENSE NO.: _____

EXPIRATION DATE: _____

STATE OF _____

COUNTY OF _____

I, _____, a Notary Public, certify that the corporation's Secretary,
[Notary-(Print)]
Assistant Secretary, or Trust Officer, Mr./Mrs./Ms. _____
[(Name)-Secretary, Asst. Secretary, Trust Officer]
personally came before me this day and acknowledged that s/he is the _____ of _____, a corporation,
[(Title)-Secretary, Asst. Secretary, Trust Officer] *[Corporation Name]*
and that by authority duly given and as act of the corporation, the foregoing instrument was signed in its name by its President, Vice President, or Assistant Vice President, Mr./Mrs./Ms. _____, sealed with its Corporate Seal, and attested by
[(Name) - President, Vice President, Asst. Vice President]
its Secretary, Assistant Secretary, or Trust Officer.
WITNESS my hand and official seal this the _____ day of _____, 20 ____.

_____
Notary Public
My commission expires: _____

OWNER

CAPE FEAR PUBLIC UTILITY AUTHORITY SEAL:

235 Government Center Drive
Wilmington, North Carolina 28403

BY: _____ ATTEST: _____

James R. Flechtner
Executive Director

Donna S. Pope
Clerk to the Board

NORTH CAROLINA
NEW HANOVER COUNTY

I, _____ the undersigned Notary Public do hereby certify that Donna S. Pope personally came before me this date and acknowledged that she is the Clerk to the Board of Cape Fear Public Utility Authority, Wilmington, North Carolina, and that, by authority duly given and the act of the Board, the foregoing document was signed in its name by its Executive Director, sealed with its corporate seal, and attested by herself as its Clerk.

WITNESS my hand and official seal this the _____ day of _____, 20 ____.

_____
Notary Public

My commission expires: _____

AUTHORITY ATTORNEY'S CERTIFICATION

This instrument has been reviewed and is approved as to form this the _____ day of _____, 20____.

_____
Linda Miles
Consulting Attorney to the Board

AUTHORITY ACCOUNTANT'S CERTIFICATION

This instrument has been pre-audited in the manner required by the Local Government Budget and Fiscal Control Act this the _____ day of _____, 20____.

_____
John McLean
Chief Financial Officer

PERFORMANCE BOND

This Bond is executed on _____, 2020.

CONTRACTOR (as PRINCIPAL)

NAME: _____

ADDRESS:

_____

_____

SURETY

NAME: _____

ADDRESS:

_____

_____

OWNER (as CONTRACTING BODY)

CAPE FEAR PUBLIC UTILITY AUTHORITY

ADDRESS:

235 Government Center Drive
Wilmington, North Carolina 28403

BOND

AMOUNT: $_____

_____

_____Dollars

KNOW ALL MEN BY THESE PRESENTS, that we, the PRINCIPAL and SURETY above named, are held and firmly bound unto the above named CONTRACTING BODY in the penal sum of the amount stated above in the lawful money of the United States, for the payment of which sum well and truly to be made, we bind ourselves, our heirs, executors, administrators, and successors, jointly and severally, firmly by these presents.

THE CONDITION OF THIS OBLIGATION IS SUCH, that whereas, the PRINCIPAL entered into a certain Agreement with the CONTRACTING BODY, dated _____, 2020 for work described by Plans and Specifications prepared by CHEATHAM AND ASSOCIATES, P.A herein called and referred to as the ENGINEER, a copy of said Agreement is hereto attached and made a part hereof for the construction of Project: EMD Facility HVAC Upgrades

NOW THEREFORE, if the PRINCIPAL shall well and truly perform and fulfill all the undertakings, covenants, terms, conditions, and agreements of said Agreement during the original term of said Agreement and any extensions thereof that may be granted by the Contracting Body, with or without notice to the SURETY, and during the life of any guaranty required under the Agreement, and shall also well and truly perform and fulfill all the undertakings, covenants, terms, conditions, and agreements of any and all duly authorized modifications to the SURETY being hereby waived, then this obligation is to be void; otherwise, it shall remain in full force and virtue.

IN WITNESS WHEREOF, the above-bounden parties have executed this instrument under their several seals on the date indicated above, the name and corporate seal of each corporate party being hereto affixed and these presents duly signed by its undersigned representative, pursuant to authority of its governing body.

CONTRACTOR (as PRINCIPAL)

_____

BY: _____

PRINTED: _____

TITLE: _____

DATE: _____

If additional signature required:

CONTRACTOR (as PRINCIPAL)

_____

BY: _____

PRINTED: _____

TITLE: _____

DATE: _____

WITNESS TO PRINCIPAL

BY: _____

PRINTED: _____

ADDRESS:

_____

_____

CONTRACTOR'S SEAL:

SURETY

_____

BY: _____

PRINTED: _____

ADDRESS:

_____

_____

PHONE #: _____

SURETY'S SEAL:

WITNESS TO SURETY

BY: _____

PRINTED: _____

ADDRESS:

_____

_____

This Performance Bond is not official without a completed affidavit validating the surety agent's authority and a Power of Attorney attached.

NOTE: Date of Bond must not be prior to date of Agreement

AFFIDAVIT

STATE OF:

COUNTY OF:

_____being first duly sworn on oath deposes and says that s/he is
(Name of agent-in-fact or agent)
_____(agent-in-fact or agent) of _____

(bonding company) surety on the attached Agreement on _____,2020 (Date of Agreement)

executed by _____ (Contractor).

Affiant further deposes and says that no officer, official, or employee of the Owner has any interest directly or indirectly, or is receiving any premium, commission fee, or other thing of value on account of the same or furnishing of the Bond, undertaking or Contract of Indemnity, Guaranty, Suretyship in connection with the above mentioned Agreement.

Signed _____
(agent-in-fact or agent)

Subscribed and sworn to before me this ____day of _____, 20____.

_____
Notary Public

My Commission Expires: _____

PAYMENT BOND

This Bond is executed on _____, 2020.

CONTRACTOR (as PRINCIPAL)

NAME: _____

ADDRESS:

_____

_____

SURETY

NAME: _____

ADDRESS:

_____

_____

OWNER (as CONTRACTING BODY)

CAPE FEAR PUBLIC UTILITY AUTHORITY

ADDRESS:

235 Government Center Drive
Wilmington, North Carolina 28403

BOND

AMOUNT: $_____

_____

_____Dollars

KNOW ALL MEN BY THESE PRESENTS, that we, the PRINCIPAL and SURETY above named, are held and firmly bound unto the above named CONTRACTING BODY in the penal sum of the amount stated above in the lawful money of the United States, for the payment of which sum well and truly to be made, we bind ourselves, our heirs, executors, administrators, and successors, jointly and severally, firmly by these presents.

THE CONDITION OF THIS OBLIGATION IS SUCH, that whereas, the PRINCIPAL entered into a certain Agreement with the CONTRACTING BODY, dated _____, 2020 for work described by Plans and Specifications prepared by CHEATHAM AND ASSOCIATES, P.A herein called and referred to as the ENGINEER, a copy of said Agreement is hereto attached and made a part hereof for the construction of Project: EMD Facility HVAC Upgrades

NOW THEREFORE, if the PRINCIPAL shall promptly make payment to all persons supplying labor and material in the prosecution of the work provided for in said Agreement, and any and all duly authorized modifications of said Agreement that may hereafter be made, notice of which modifications to the SURETY being hereby waived, then this obligation is to be void; otherwise, it shall remain in full force and virtue.

IN WITNESS WHEREOF, the above-bounden parties have executed this instrument under their several seals on the date indicated above, the name and corporate seal of each corporate party being hereto affixed and these presents duly signed by its undersigned representative, pursuant to authority of its governing body.

CONTRACTOR (as PRINCIPAL)

_____

BY: _____

PRINTED: _____

TITLE: _____

DATE: _____

If additional signature required:

CONTRACTOR (as PRINCIPAL)

_____

BY: _____

PRINTED: _____

TITLE: _____

DATE: _____

WITNESS TO PRINCIPAL

BY: _____

PRINTED: _____

ADDRESS:

_____

_____

CONTRACTOR'S SEAL:

SURETY

_____

BY: _____

PRINTED: _____

ADDRESS:

_____

_____

PHONE #: _____

SURETY'S SEAL:

WITNESS TO SURETY

BY: _____

PRINTED: _____

ADDRESS:

_____

_____

This Payment Bond is not official without a completed affidavit validating the surety agent's authority and a Power of Attorney attached.

NOTE: Date of Bond must not be prior to date of Agreement

AFFIDAVIT

STATE OF:

COUNTY OF:

_____being first duly sworn on oath deposes and says that s/he is
(Name of agent-in-fact or agent)
_____(agent-in-fact or agent) of _____

(bonding company) surety on the attached Agreement on _____,2020 (Date of Agreement)

executed by _____ (Contractor).

Affiant further deposes and says that no officer, official, or employee of the Owner has any interest directly or indirectly, or is receiving any premium, commission fee, or other thing of value on account of the same or furnishing of the Bond, undertaking or Contract of Indemnity, Guaranty, Suretyship in connection with the above mentioned Agreement.

Signed _____
(agent-in-fact or agent)

Subscribed and sworn to before me this____day of_____, 20____.

_____
Notary Public

My Commission Expires: _____

Attach Required Insurance Documents Here
(Including Endorsements)

Cyber Security Questionnaire for Current and Initial Vendor Agreements

* This questionaire is used to align the organizations expectations with those of the vendor.

* The following questionaire may require follow-up discussion. Non-compliance or the inability to answer all questions does not invalidate your bid or qualification to submit a bid/proposal.

* If vendor believes that specific questions below do not apply to the work they're performing for the Authority, please answer with NA (not applicable) and IT Division will review.

Question	Vendor Response
Vendor name	
Vendor location (Address, City, State, Zip)	
Vendor contact (Name, Phone, Email, Fax)	
Date	
How many employees does vendor have employed?	
How long has vendor been in business?	
Will the vendor be using any subcontractors? (personnel that are not direct hires and on your payroll)	❑ YES ❑ NO ❑ MAYBE
Is the vendor offering any cloud based solutions?	❑ YES ❑ NO ❑ MAYBE
If yes, please state what services or components.	
Are your cloud based solutions contained in a “Gov Cloud” region? If so, please state the provider.	

Is vendor able to provide references?	
Does vendor provide monitoring services? If so, explain further.	
Does vendor provide support currently?	❑ YES ❑ NO
What security software and/or antivirus does vendor install on vendor owned equipment? And how often does vendor update definitions?	
Does the vendor follow a security policy currently within their own environment?	❑ YES ❑ NO
What cyber security standard(s) have you adopted? When was your last audit?	
What password policy does vendor use when setting passwords on devices? (I.e. complexity rules, length, renewal period, etc.)	
What process do you follow when reporting incidents, including security incidents, hardware failures, or network events that could lead to operational events?	
How many staff members will be supporting or currently do support the organization?	
What items will be support and managed?	❑ PC's ❑ Servers ❑ Network Devices ❑ Software ❑ Other
Are there any technical items that are and will not be supported?	
What products do you focus your experience on most? (I.e. Microsoft, Cisco, Citrix, VMware, etc.)	

What are the supported response times? (Please include during normal business hours, emergencies during normal business hours, and after hours emergencies)	
Will vendor software need to be installed to support the systems?	❑ YES ❑ NO ❑ MAYBE
If vendor software will be used does it require licensing?	❑ YES ❑ NO ❑ MAYBE
What is your policy on performing updates, do you have maintenance periods or specific days and times that you perform updates?	
Do you provide monthly or annual reports on tickets, issues, or findings that would be useful for the organization? If so, how often are these reports created and what is included in them?	
Are you able to provide hardware replacement? If so, do you carry any inventory onsite?	
What experience does vendor have in supporting environments that follow compliance regulations such as PCI or HIPPA?	
What is your policy and where do you store passwords and procedural documents for clients? Are these documents encrypted?	
What backup methods do you recommend or support, including strategy? (i.e. differential, incremental, etc.)	
Do you carry cyber liability insurance coverage? If so, what are the limits of the policy?	
Where will our data be stored? Be specific in regards to physical location and all storage mediums.	

What protection do you provide for our data in transit?	
What protection do you provide for our data at rest?	
How many employees will be working with our data?	
How many employees will have the ABILITY to access our data?	

I attest the above is true and accurate to the best of my knowledge.

Name (Printed)

Title

Signature

Date

Cape Fear Public Utility Authority
Stewardship. Sustainability. Service.

TO: Participating Consultants and Contractors
Associated with Cape Fear Public Utility Authority Related Projects

FROM: Jamie Grimes, Fiscal Contract Account Manager

RE: Required Documents for Monthly Estimates and Project Close Outs

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The following items are required for monthly payment requests on contracts:

- Two (2) copies of Estimate/Invoice; One original, One copy
- Two (2) copies of Sales Tax Report (Attachment "A")
- Two (2) copies of Material Inventory Statement, when applicable (Attachment "B")
- Two (2) copies of Paid Invoices for all materials for which payment is being requested
- Two (2) copies of Certified Payrolls (when federal monies are involved)
- One (1) copy of MBE/DBE Certification for each MBE/DBE Subcontractor on project (Attachment "C").

The following items are required prior to a project close out and from an administrative standpoint.*

- One (1) copy of Certificate of Substantial Completion (Attachment "D")
- One (1) copy of Contractor's Affidavit of Payment of Debts and Claims and release or Waiver of liens form (Attachment "E")
- One (1) copy of Subcontractors' Release or Waiver of Liens form (Attachment "F")
- One (1) copy of Contractor's Assignment of all Warranties and Guarantees form (Attachment "G")
- One (1) copy of Consent of Surety Company to Final Payment form (Attachment "H")

* **The Project Engineer, and Consultant may require additional items to be submitted and finalized prior to release of final payment.**

235 Government Center Drive, Wilmington, NC 28403

t: 910-332-6560 f: 910-332-6353 www.cfpua.org

WILMINGTON, NORTH CAROLINA

SALES TAX REPORT
CAPE FEAR PUBLIC UTILITY AUTHORITY

I HEREBY CERTIFY TAXES LISTED WERE PAID AS SALES TAX OR WILL BE PAID AS USE TAX ON THE PURCHASES LISTED.

PROJECT:
CONTRACTOR:
FOR PERIOD: **TO**

ITEM	VENDOR	CITY	INVOICE	DATE	TAXABLE AMOUNT	NC TAX (4.75%)	NHC TAX (2.25%)	*OTHER COUNTIES	COUNTY
				SHEET TOTALS:					
		(This sheet plus previous sheets being submitted)		**GRAND TOTALS:**					

** Tax amount if being paid to a county different from New Hanover and the tax rate is different. You must note the tax percentage being paid next to the county in the COUNTY column.*

AND THESE PURCHASES WERE FOR THE COST OF BUILDING MATERIALS, SUPPLIES, FIXTURES, AND/OR EQUIPMENT THAT BECAME PART OF, OR ANNEXED TO ANY BUILDING OR STRUCTURE BEING ERECTED, ALTERED, OR REPAIRED, UNDER THE ABOVE REFERENCED CONTRACT WITH THE CAPE FEAR PUBLIC UTILITY AUTHORITY.

SIGNED: ______________________ DATE: __________ PRINT: ______________________ TITLE: ______________________

CFPUA MATERIAL INVENTORY STATEMENT

PROJECT: _____ DATE: _____

CONTRACTOR: _____

DESCRIPTION	ON HAND PREVIOUS ESTIMATE	DELIVERED THIS MONTH	INCORP. IN WORK	ON HAND THIS ESTIMATE	UNIT PRICE	TOTAL DUE
TOTAL						

CONTRACTOR PAYMENT TO MBE/DBE FIRMS

1	CONTRACT NAME		
2	CONTRACTOR'S NAME		
3	SUB-CONTRACTOR'S NAME		
4	SUB-CONTRACTOR'S ADDRESS		
5	SUB-CONTRACTOR'S PHONE NUMBER		
6	Date of this Month's Payment to Subcontractor		
7	Original Total Dollar Amount of Sub-contract Work		$.
8	Change Orders to Date	Add or (Deduct)	
9	Sub-contract Total Dollar Amount to Date		$.
10	Total Dollar Amount Paid to Sub-contractor to Date		$.
11	Amount Paid to Sub-contractor this Month		$.
12	Outstanding balance to be paid to Sub-contractor		$.

I hereby certify that the amount indicated in Number 11 has been or will be paid to the indicated MBE/DBE firm. I further certify that the amount indicated in Number 10 has been or will be paid to the indicated MBE/DBE firm.

Signed (Contactor): Date:

I hereby certify that I have received the amount indicated in Number 10, and that I am in agreement concerning that payment amount indicated in Number 10.

Signed (MBE/DBE Firm): Date:

This must be signed by the MBE/DBE firm before payment to the Prime Contractor can be processed.

Cape Fear Public Utility Authority

Certificate of Substantial Completion

Project:	CFPUA Contract #:
Owner: Cape Fear Public Utility Authority	Date of Contract:
Contractor:	Date of Substantial Completion:

This Certificate of Substantial Completion applies to:

- ☐ All Work under the Contract Documents
- ☐ The following items, as specified in the Contract Documents:

_____

_____

The Work to which this Certificate applies has been inspected by authorized representatives of Owner, Contractor, and Engineer, and found to be substantially complete.

This Certificate declares the date of Substantial Completion for the Contract stated above, and this is the date that applicable warranties commence on the substantially complete Work made part of this Certificate, except as stated below.

A list of items to be completed or corrected, henceforth referred to as punchlist, is attached hereto. This list may not be all-inclusive, and this list does not dismiss or alter the responsibility of the Contractor to complete all Work in accordance with the Contract Documents.

The responsibilities between the Owner and Contractor for security, operation, safety, maintenance, heat, utilities, insurance, and warranties shall be as provided in the Contract Documents, except as amended as follows.

- ☐ Not Amended
- ☐ Amended as follows:

Owner's Amended Responsibilities:

_____

Contractor's Amended Responsibilities:

_____

Documents made part of this Certificate:

- ☐ Punchlist
- ☐ Other: _____

This Certificate does not constitute an acceptance of Work not in accordance with the Contract Documents, nor is it a release of Contractor's obligation to complete the Work in accordance with the Contract Documents.

Accepted by:

_____	_____	_____
Engineer of Record *(signature)*	Printed Name	Date
_____	_____	_____
Contractor Project Manager *(signature)*	Printed Name	Date
_____	_____	_____
Owner Project Manager *(signature)*	Printed Name	Date

CONTRACTOR'S AFFIDAVIT -E-
OF PAYMENT OF DEBTS AND
CLAIMS AND RELEASE OF LIENS

To: Cape Fear Public Utility Authority
235 Government Center Drive
Wilmington, N.C. 28403

Project of Contract No. : _____

Contract Date: _____

Attn: _____

Project *(Name and Address)*: _____

STATE OF: _____

COUNTY OF: _____

The undersigned, pursuant to the General and Supplementary Conditions, Articles 14.07 and SC-14.07of the Contract for construction of _____, hereby certifies that, he has paid in full or otherwise has satisfied or will satisfy all obligations for all materials and equipment furnished, for all work, labor and services performed, and for all known indebtedness and claims against the contractor for damages arising in any manner in connection with the performance of the contract referenced above for which the owner or his property might in any way be held responsible.

In addition, the undersigned further certifies that to the best his knowledge, information and belief, the Releases or Waivers of Liens attached hereto include the contractor, all subcontractors, all suppliers of materials and equipment, and all performers of work, labor or services who have or may have any claims against the owner arising in any manner out of the performance of the contract referenced above.

IN WITNESS WHEREOF, the undersigned has hereto set his hand and seal this ____day of _____, 20____.

CONTRACTOR: _____ SEAL:

Address: _____
_____ ATTEST:

By: _____ By: _____
Printed: _____ Printed: _____
Title: _____ Title: _____

Sworn and subscribed to before me this ____day of _____, 20____.

_____
Notary Public

(Seal) My Commission Expires_____

SUBCONTRACTOR'S RELEASE OR WAIVER OF LIENS -F-

To: _____(Contractor) AND Cape Fear Public Utility Authority
_____ 235 Government Center Drive
_____ Wilmington, N.C. 28403
Attn: _____

Project of Contract No. : _____ Contract Date: _____
Project *(Name and Address)*: _____

STATE OF: _____

COUNTY OF: _____

The undersigned subcontractor, hereby acknowledges and certifies that he has received full payment for all work, labor, skill and material furnished, delivered, supplied or performed in connection with the contract referenced above to and for _____ *(contractor's name)*, the general contractor, or anyone in any manner in connection with the contract referenced above; and for value received hereby waives all rights and liens which the undersigned may now or hereafter claim or assert for all or any work, labor, skill or materials furnished, delivered or performed in connection with the contract referenced above, against said contractor, the city, or any natural person or against said improvement, land or buildings thereof and appurtenances thereof.

The undersigned, in consideration of the payment acknowledged herein, affirms that all work, labor and material, furnished, delivered or performed to or for said contract referenced above was furnished, or performed to or for said contract referenced above was furnished, delivered or performed by the undersigned, or his agent, employees and servants or by and through the undersigned by the following subcontractor(s) or material men or their agent(s), employee(s) and servant(s), to wit:_____; and further affirms that the attached receipts and releases represent payment in full, and release in full of all and any hitherto existing or possible future mechanics liens or rights in connection with the above referenced contract.

IN WITNESS WHEREOF, the undersigned has hereto set his hand and seal this ____day of _____, 20____.

SUBCONTRACTOR: _____ SEAL:

Address: _____
_____ ATTEST:

By: _____ By: _____
Printed: _____ Printed: _____
Title: _____ Title: _____

Sworn and subscribed to before me this ____day of _____, 20____.

_____
Notary Public

(Seal) My Commission Expires_____

CONTRACTOR'S ASSIGNMENT OF -G-
ALL WARRANTIES AND GUARANTEES

To: Cape Fear Public Utility Authority
235 Government Center Drive
Wilmington, N.C. 28403

Project of Contract No. : _____

Contract Date: _____

Attn: _____

Project *(Name and Address)*: _____

STATE OF: _____

COUNTY OF: _____

The undersigned, pursuant to the General and Supplementary Conditions, Articles 6.19 and SC-6.19 of the Contract for the construction of _____and in consideration for the sums stated therein, the receipt of which is hereby acknowledged, do hereby assign, transfer, bargain and convey unto the Cape Fear Public Utility Authority all its rights, title and interest in and to all warranties, express or implied, covering warranting, applying or pertaining to all goods, equipment, and materials of whatsoever kind, furnished, delivered or used for or in said contract referenced above.

Also, the undersigned does hereby certify that to the best of his knowledge, information and belief that the warranties attached hereto include all warranties of the contractors, and all subcontractors. And all suppliers of materials and equipment furnished, delivered or used for or in said contract referenced above.

IN TESTIMONY WHEREOF, said contractor or subcontractor has hereunto set his hand and seal this ____day of _____, 20____.

CONTRACTOR: _____ SEAL:

Address: _____
_____ ATTEST:

By: _____ By: _____
Printed: _____ Printed: _____
Title: _____ Title: _____

Sworn and subscribed to before me this ____day of _____, 20____.

_____
Notary Public

(Seal) My Commission Expires_____

CONSENT OF SURETY COMPANY -H-
TO FINAL PAYMENT

To: Cape Fear Public Utility Authority
235 Government Center Drive
Wilmington, N.C. 28403

Project of Contract No. : _____

Contract Date: _____

Attn: _____

Project *(Name and Address)*: _____

In accordance with the provisions of the Contract between the Owner and the Contractor as indicated above, the_____ *(Surety Company Name and Address)* as Surety Company on bond of _____*(Contractor Name and Address),* Contractor, hereby approves of the final payment to the Contractor, and agrees that final payment to the Contractor shall not relieve the Surety Company of any of its obligations to the Cape Fear Public Utility Authority as set forth in said Surety Company's Bond.

IN WITNESS WHEREOF, the Surety Company has hereunto set its hand and seal this ____day of _____, 20____.

SURETY COMPANY: _____ SEAL:

Address: _____
_____

To be signed by an Authorized Agent:

By: _____
Printed: _____
Title: _____

ATTEST:

By: _____
Printed: _____
Title: _____

Sworn and subscribed to before me this ____day of _____, 20____.

_____
Notary Public

(Seal)

My Commission Expires_____

Cape Fear Public Utility Authority (CFPUA)
Work Change Directive No. _____

Project:	CFPUA Capital Project No.:
Contractor:	CFPUA Contract No.:
Engineer:	Date of Issuance:
CFPUA Project Manager:	Effective Date:

This is a directive to proceed with a change that may affect the contract price or times. A change order, if any, should be considered promptly. If the change involves an increase in Contract Price and the estimated amount below is approached before the additional or changed work is completed, another Work Change Directive must be issued to change the estimated price or Contractor may stop changed work when estimated time is reached. Paragraph 10.03.A.2 of the General Conditions requires that a Change Order be initiated and processed to cover any undisputed sum or amount of time for Work actually performed pursuant to this Work Change Directive.

Contractor is directed to proceed promptly with the following change(s):

Item No.	Description

Attachments (list documents supporting change):

Purpose for Work Change Directive:

Authorization for Work described herein to proceed on the basis of Cost of the Work due to:

- ☐ Non-agreement on pricing of proposed change.
- ☐ Necessity to expedite Work described herein prior to agreeing to changes on Contract Price and Contract Time.
- ☐ Bid quantity adjustment.

Estimated not-to-exceed change in Contract Price and Contract Times (as applicable):

Contract Price $_____ (increase/decrease) Contract Time _____ (increase/decrease)
days

Recommended for Approval by Engineer:	Date:
Authorized for CFPUA by Director of Engineering: Carel Vandermeyden	Date:
This instrument has been pre-audited in a manner required by the Local Government Budget & Fiscal Control Act Chief Financial Officer: John McLean	Date:
Received for Contractor by:	Date:

This document has important legal consequences; consultation with an attorney is encouraged with respect to its use or modification. This document should be adapted to the particular circumstances of the contemplated Project and the controlling Laws and Regulations.

STANDARD GENERAL CONDITIONS OF THE CONSTRUCTION CONTRACT

Prepared by

ENGINEERS JOINT CONTRACT DOCUMENTS COMMITTEE

and

Issued and Published Jointly by

ACEC
American Council of Engineering Companies

The Associated General Contractors of America — Skill Responsibility Integrity

ASCE American Society of Civil Engineers

National Society of Professional Engineers
Professional Engineers in Private Practice

AMERICAN COUNCIL OF ENGINEERING COMPANIES

ASSOCIATED GENERAL CONTRACTORS OF AMERICA

AMERICAN SOCIETY OF CIVIL ENGINEERS

PROFESSIONAL ENGINEERS IN PRIVATE PRACTICE
A Practice Division of the
NATIONAL SOCIETY OF PROFESSIONAL ENGINEERS

Endorsed by

CSI

CONSTRUCTION SPECIFICATIONS INSTITUTE

These General Conditions have been prepared for use with the Suggested Forms of Agreement Between Owner and Contractor (EJCDC C-520 or C-525, 2007 Editions). Their provisions are interrelated and a change in one may necessitate a change in the other. Comments concerning their usage are contained in the Narrative Guide to the EJCDC Construction Documents (EJCDC C-001, 2007 Edition). For guidance in the preparation of Supplementary Conditions, see Guide to the Preparation of Supplementary Conditions (EJCDC C-800, 2007 Edition).

STANDARD GENERAL CONDITIONS OF THE CONSTRUCTION CONTRACT

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ARTICLE 1 – DEFINITIONS AND TERMINOLOGY

1.01 *Defined Terms*

A. Wherever used in the Bidding Requirements or Contract Documents and printed with initial capital letters, the terms listed below will have the meanings indicated which are applicable to both the singular and plural thereof. In addition to terms specifically defined, terms with initial capital letters in the Contract Documents include references to identified articles and paragraphs, and the titles of other documents or forms.

1. *Addenda*—Written or graphic instruments issued prior to the opening of Bids which clarify, correct, or change the Bidding Requirements or the proposed Contract Documents.

2. *Agreement*—The written instrument which is evidence of the agreement between Owner and Contractor covering the Work.

3. *Application for Payment*—The form acceptable to Engineer which is to be used by Contractor during the course of the Work in requesting progress or final payments and which is to be accompanied by such supporting documentation as is required by the Contract Documents.

4. *Asbestos*—Any material that contains more than one percent asbestos and is friable or is releasing asbestos fibers into the air above current action levels established by the United States Occupational Safety and Health Administration.

5. *Bid*—The offer or proposal of a Bidder submitted on the prescribed form setting forth the prices for the Work to be performed.

6. *Bidder*—The individual or entity who submits a Bid directly to Owner.

7. *Bidding Documents*—The Bidding Requirements and the proposed Contract Documents (including all Addenda).

8. *Bidding Requirements*—The advertisement or invitation to bid, Instructions to Bidders, Bid security of acceptable form, if any, and the Bid Form with any supplements.

9. *Change Order*—A document recommended by Engineer which is signed by Contractor and Owner and authorizes an addition, deletion, or revision in the Work or an adjustment in the Contract Price or the Contract Times, issued on or after the Effective Date of the Agreement.

10. *Claim*—A demand or assertion by Owner or Contractor seeking an adjustment of Contract Price or Contract Times, or both, or other relief with respect to the terms of the Contract. A demand for money or services by a third party is not a Claim.

11. *Contract*—The entire and integrated written agreement between the Owner and Contractor concerning the Work. The Contract supersedes prior negotiations, representations, or agreements, whether written or oral.

12. *Contract Documents*—Those items so designated in the Agreement. Only printed or hard copies of the items listed in the Agreement are Contract Documents. Approved Shop Drawings, other Contractor submittals, and the reports and drawings of subsurface and physical conditions are not Contract Documents.

13. *Contract Price*—The moneys payable by Owner to Contractor for completion of the Work in accordance with the Contract Documents as stated in the Agreement (subject to the provisions of Paragraph 11.03 in the case of Unit Price Work).

14. *Contract Times*—The number of days or the dates stated in the Agreement to: (i) achieve Milestones, if any; (ii) achieve Substantial Completion; and (iii) complete the Work so that it is ready for final payment as evidenced by Engineer's written recommendation of final payment.

15. *Contractor*—The individual or entity with whom Owner has entered into the Agreement.

16. *Cost of the Work*—See Paragraph 11.01 for definition.

17. *Drawings*—That part of the Contract Documents prepared or approved by Engineer which graphically shows the scope, extent, and character of the Work to be performed by Contractor. Shop Drawings and other Contractor submittals are not Drawings as so defined.

18. *Effective Date of the Agreement*—The date indicated in the Agreement on which it becomes effective, but if no such date is indicated, it means the date on which the Agreement is signed and delivered by the last of the two parties to sign and deliver.

19. *Engineer*—The individual or entity named as such in the Agreement.

20. *Field Order*—A written order issued by Engineer which requires minor changes in the Work but which does not involve a change in the Contract Price or the Contract Times.

21. *General Requirements*—Sections of Division 1 of the Specifications.

22. *Hazardous Environmental Condition*—The presence at the Site of Asbestos, PCBs, Petroleum, Hazardous Waste, or Radioactive Material in such quantities or circumstances that may present a substantial danger to persons or property exposed thereto.

23. *Hazardous Waste*—The term Hazardous Waste shall have the meaning provided in Section 1004 of the Solid Waste Disposal Act (42 USC Section 6903) as amended from time to time.

24. *Laws and Regulations; Laws or Regulations*—Any and all applicable laws, rules, regulations, ordinances, codes, and orders of any and all governmental bodies, agencies, authorities, and courts having jurisdiction.

25. *Liens*—Charges, security interests, or encumbrances upon Project funds, real property, or personal property.

26. *Milestone*—A principal event specified in the Contract Documents relating to an intermediate completion date or time prior to Substantial Completion of all the Work.

27. *Notice of Award*—The written notice by Owner to the Successful Bidder stating that upon timely compliance by the Successful Bidder with the conditions precedent listed therein, Owner will sign and deliver the Agreement.

28. *Notice to Proceed*—A written notice given by Owner to Contractor fixing the date on which the Contract Times will commence to run and on which Contractor shall start to perform the Work under the Contract Documents.

29. *Owner*—The individual or entity with whom Contractor has entered into the Agreement and for whom the Work is to be performed.

30. *PCBs*—Polychlorinated biphenyls.

31. *Petroleum*—Petroleum, including crude oil or any fraction thereof which is liquid at standard conditions of temperature and pressure (60 degrees Fahrenheit and 14.7 pounds per square inch absolute), such as oil, petroleum, fuel oil, oil sludge, oil refuse, gasoline, kerosene, and oil mixed with other non-Hazardous Waste and crude oils.

32. *Progress Schedule*—A schedule, prepared and maintained by Contractor, describing the sequence and duration of the activities comprising the Contractor's plan to accomplish the Work within the Contract Times.

33. *Project*—The total construction of which the Work to be performed under the Contract Documents may be the whole, or a part.

34. *Project Manual*—The bound documentary information prepared for bidding and constructing the Work. A listing of the contents of the Project Manual, which may be bound in one or more volumes, is contained in the table(s) of contents.

35. *Radioactive Material*—Source, special nuclear, or byproduct material as defined by the Atomic Energy Act of 1954 (42 USC Section 2011 et seq.) as amended from time to time.

36. *Resident Project Representative*—The authorized representative of Engineer who may be assigned to the Site or any part thereof.

37. *Samples*—Physical examples of materials, equipment, or workmanship that are representative of some portion of the Work and which establish the standards by which such portion of the Work will be judged.

38. *Schedule of Submittals*—A schedule, prepared and maintained by Contractor, of required submittals and the time requirements to support scheduled performance of related construction activities.

39. *Schedule of Values*—A schedule, prepared and maintained by Contractor, allocating portions of the Contract Price to various portions of the Work and used as the basis for reviewing Contractor's Applications for Payment.

40. *Shop Drawings*—All drawings, diagrams, illustrations, schedules, and other data or information which are specifically prepared or assembled by or for Contractor and submitted by Contractor to illustrate some portion of the Work.

41. *Site*—Lands or areas indicated in the Contract Documents as being furnished by Owner upon which the Work is to be performed, including rights-of-way and easements for access thereto, and such other lands furnished by Owner which are designated for the use of Contractor.

42. *Specifications*—That part of the Contract Documents consisting of written requirements for materials, equipment, systems, standards and workmanship as applied to the Work, and certain administrative requirements and procedural matters applicable thereto.

43. *Subcontractor*—An individual or entity having a direct contract with Contractor or with any other Subcontractor for the performance of a part of the Work at the Site.

44. *Substantial Completion*—The time at which the Work (or a specified part thereof) has progressed to the point where, in the opinion of Engineer, the Work (or a specified part thereof) is sufficiently complete, in accordance with the Contract Documents, so that the Work (or a specified part thereof) can be utilized for the purposes for which it is intended. The terms "substantially complete" and "substantially completed" as applied to all or part of the Work refer to Substantial Completion thereof.

45. *Successful Bidder*—The Bidder submitting a responsive Bid to whom Owner makes an award.

46. *Supplementary Conditions*—That part of the Contract Documents which amends or supplements these General Conditions.

47. *Supplier*—A manufacturer, fabricator, supplier, distributor, materialman, or vendor having a direct contract with Contractor or with any Subcontractor to furnish materials or equipment to be incorporated in the Work by Contractor or Subcontractor.

48. *Underground Facilities*—All underground pipelines, conduits, ducts, cables, wires, manholes, vaults, tanks, tunnels, or other such facilities or attachments, and any encasements containing such facilities, including those that convey electricity, gases, steam, liquid petroleum products, telephone or other communications, cable television, water, wastewater, storm water, other liquids or chemicals, or traffic or other control systems.

49. *Unit Price Work*—Work to be paid for on the basis of unit prices.

50. *Work*—The entire construction or the various separately identifiable parts thereof required to be provided under the Contract Documents. Work includes and is the result of performing or providing all labor, services, and documentation necessary to produce such construction, and furnishing, installing, and incorporating all materials and equipment into such construction, all as required by the Contract Documents.

51. *Work Change Directive*—A written statement to Contractor issued on or after the Effective Date of the Agreement and signed by Owner and recommended by Engineer ordering an

addition, deletion, or revision in the Work, or responding to differing or unforeseen subsurface or physical conditions under which the Work is to be performed or to emergencies. A Work Change Directive will not change the Contract Price or the Contract Times but is evidence that the parties expect that the change ordered or documented by a Work Change Directive will be incorporated in a subsequently issued Change Order following negotiations by the parties as to its effect, if any, on the Contract Price or Contract Times.

1.02 *Terminology*

A. The words and terms discussed in Paragraph 1.02.B through F are not defined but, when used in the Bidding Requirements or Contract Documents, have the indicated meaning.

B. *Intent of Certain Terms or Adjectives:*

1. The Contract Documents include the terms "as allowed," "as approved," "as ordered," "as directed" or terms of like effect or import to authorize an exercise of professional judgment by Engineer. In addition, the adjectives "reasonable," "suitable," "acceptable," "proper," "satisfactory," or adjectives of like effect or import are used to describe an action or determination of Engineer as to the Work. It is intended that such exercise of professional judgment, action, or determination will be solely to evaluate, in general, the Work for compliance with the information in the Contract Documents and with the design concept of the Project as a functioning whole as shown or indicated in the Contract Documents (unless there is a specific statement indicating otherwise). The use of any such term or adjective is not intended to and shall not be effective to assign to Engineer any duty or authority to supervise or direct the performance of the Work, or any duty or authority to undertake responsibility contrary to the provisions of Paragraph 9.09 or any other provision of the Contract Documents.

C. *Day:*

1. The word "day" means a calendar day of 24 hours measured from midnight to the next midnight.

D. *Defective:*

1. The word "defective," when modifying the word "Work," refers to Work that is unsatisfactory, faulty, or deficient in that it:

a. does not conform to the Contract Documents; or

b. does not meet the requirements of any applicable inspection, reference standard, test, or approval referred to in the Contract Documents; or

c. has been damaged prior to Engineer's recommendation of final payment (unless responsibility for the protection thereof has been assumed by Owner at Substantial Completion in accordance with Paragraph 14.04 or 14.05).

E. *Furnish, Install, Perform, Provide:*

1. The word "furnish," when used in connection with services, materials, or equipment, shall mean to supply and deliver said services, materials, or equipment to the Site (or some other specified location) ready for use or installation and in usable or operable condition.

2. The word "install," when used in connection with services, materials, or equipment, shall mean to put into use or place in final position said services, materials, or equipment complete and ready for intended use.

3. The words "perform" or "provide," when used in connection with services, materials, or equipment, shall mean to furnish and install said services, materials, or equipment complete and ready for intended use.

4. When "furnish," "install," "perform," or "provide" is not used in connection with services, materials, or equipment in a context clearly requiring an obligation of Contractor, "provide" is implied.

F. Unless stated otherwise in the Contract Documents, words or phrases that have a well-known technical or construction industry or trade meaning are used in the Contract Documents in accordance with such recognized meaning.

ARTICLE 2 – PRELIMINARY MATTERS

2.01 *Delivery of Bonds and Evidence of Insurance*

A. When Contractor delivers the executed counterparts of the Agreement to Owner, Contractor shall also deliver to Owner such bonds as Contractor may be required to furnish.

B. *Evidence of Insurance:* Before any Work at the Site is started, Contractor and Owner shall each deliver to the other, with copies to each additional insured identified in the Supplementary Conditions, certificates of insurance (and other evidence of insurance which either of them or any additional insured may reasonably request) which Contractor and Owner respectively are required to purchase and maintain in accordance with Article 5.

2.02 *Copies of Documents*

A. Owner shall furnish to Contractor up to ten printed or hard copies of the Drawings and Project Manual. Additional copies will be furnished upon request at the cost of reproduction.

2.03 *Commencement of Contract Times; Notice to Proceed*

A. The Contract Times will commence to run on the thirtieth day after the Effective Date of the Agreement or, if a Notice to Proceed is given, on the day indicated in the Notice to Proceed. A Notice to Proceed may be given at any time within 30 days after the Effective Date of the Agreement. In no event will the Contract Times commence to run later than the sixtieth day after the day of Bid opening or the thirtieth day after the Effective Date of the Agreement, whichever date is earlier.

2.04 *Starting the Work*

A. Contractor shall start to perform the Work on the date when the Contract Times commence to run. No Work shall be done at the Site prior to the date on which the Contract Times commence to run.

2.05 *Before Starting Construction*

A. *Preliminary Schedules:* Within 10 days after the Effective Date of the Agreement (unless otherwise specified in the General Requirements), Contractor shall submit to Engineer for timely review:

1. a preliminary Progress Schedule indicating the times (numbers of days or dates) for starting and completing the various stages of the Work, including any Milestones specified in the Contract Documents;

2. a preliminary Schedule of Submittals; and

3. a preliminary Schedule of Values for all of the Work which includes quantities and prices of items which when added together equal the Contract Price and subdivides the Work into component parts in sufficient detail to serve as the basis for progress payments during performance of the Work. Such prices will include an appropriate amount of overhead and profit applicable to each item of Work.

2.06 *Preconstruction Conference; Designation of Authorized Representatives*

A. Before any Work at the Site is started, a conference attended by Owner, Contractor, Engineer, and others as appropriate will be held to establish a working understanding among the parties as to the Work and to discuss the schedules referred to in Paragraph 2.05.A, procedures for handling Shop Drawings and other submittals, processing Applications for Payment, and maintaining required records.

B. At this conference Owner and Contractor each shall designate, in writing, a specific individual to act as its authorized representative with respect to the services and responsibilities under the Contract. Such individuals shall have the authority to transmit instructions, receive information, render decisions relative to the Contract, and otherwise act on behalf of each respective party.

2.07 *Initial Acceptance of Schedules*

A. At least 10 days before submission of the first Application for Payment a conference attended by Contractor, Engineer, and others as appropriate will be held to review for acceptability to Engineer as provided below the schedules submitted in accordance with Paragraph 2.05.A. Contractor shall have an additional 10 days to make corrections and adjustments and to complete and resubmit the schedules. No progress payment shall be made to Contractor until acceptable schedules are submitted to Engineer.

1. The Progress Schedule will be acceptable to Engineer if it provides an orderly progression of the Work to completion within the Contract Times. Such acceptance will not impose on

Engineer responsibility for the Progress Schedule, for sequencing, scheduling, or progress of the Work, nor interfere with or relieve Contractor from Contractor's full responsibility therefor.

2. Contractor's Schedule of Submittals will be acceptable to Engineer if it provides a workable arrangement for reviewing and processing the required submittals.

3. Contractor's Schedule of Values will be acceptable to Engineer as to form and substance if it provides a reasonable allocation of the Contract Price to component parts of the Work.

ARTICLE 3 – CONTRACT DOCUMENTS: INTENT, AMENDING, REUSE

3.01 *Intent*

A. The Contract Documents are complementary; what is required by one is as binding as if required by all.

B. It is the intent of the Contract Documents to describe a functionally complete project (or part thereof) to be constructed in accordance with the Contract Documents. Any labor, documentation, services, materials, or equipment that reasonably may be inferred from the Contract Documents or from prevailing custom or trade usage as being required to produce the indicated result will be provided whether or not specifically called for, at no additional cost to Owner.

C. Clarifications and interpretations of the Contract Documents shall be issued by Engineer as provided in Article 9.

3.02 *Reference Standards*

A. Standards, Specifications, Codes, Laws, and Regulations

1. Reference to standards, specifications, manuals, or codes of any technical society, organization, or association, or to Laws or Regulations, whether such reference be specific or by implication, shall mean the standard, specification, manual, code, or Laws or Regulations in effect at the time of opening of Bids (or on the Effective Date of the Agreement if there were no Bids), except as may be otherwise specifically stated in the Contract Documents.

2. No provision of any such standard, specification, manual, or code, or any instruction of a Supplier, shall be effective to change the duties or responsibilities of Owner, Contractor, or Engineer, or any of their subcontractors, consultants, agents, or employees, from those set forth in the Contract Documents. No such provision or instruction shall be effective to assign to Owner, Engineer, or any of their officers, directors, members, partners, employees, agents, consultants, or subcontractors, any duty or authority to supervise or direct the performance of the Work or any duty or authority to undertake responsibility inconsistent with the provisions of the Contract Documents.

3.03 *Reporting and Resolving Discrepancies*

A. *Reporting Discrepancies:*

1. *Contractor's Review of Contract Documents Before Starting Work*: Before undertaking each part of the Work, Contractor shall carefully study and compare the Contract Documents and check and verify pertinent figures therein and all applicable field measurements. Contractor shall promptly report in writing to Engineer any conflict, error, ambiguity, or discrepancy which Contractor discovers, or has actual knowledge of, and shall obtain a written interpretation or clarification from Engineer before proceeding with any Work affected thereby.

2. *Contractor's Review of Contract Documents During Performance of Work*: If, during the performance of the Work, Contractor discovers any conflict, error, ambiguity, or discrepancy within the Contract Documents, or between the Contract Documents and (a) any applicable Law or Regulation , (b) any standard, specification, manual, or code, or (c) any instruction of any Supplier, then Contractor shall promptly report it to Engineer in writing. Contractor shall not proceed with the Work affected thereby (except in an emergency as required by Paragraph 6.16.A) until an amendment or supplement to the Contract Documents has been issued by one of the methods indicated in Paragraph 3.04.

3. Contractor shall not be liable to Owner or Engineer for failure to report any conflict, error, ambiguity, or discrepancy in the Contract Documents unless Contractor had actual knowledge thereof.

B. *Resolving Discrepancies:*

1. Except as may be otherwise specifically stated in the Contract Documents, the provisions of the Contract Documents shall take precedence in resolving any conflict, error, ambiguity, or discrepancy between the provisions of the Contract Documents and:

a. the provisions of any standard, specification, manual, or code, or the instruction of any Supplier (whether or not specifically incorporated by reference in the Contract Documents); or

b. the provisions of any Laws or Regulations applicable to the performance of the Work (unless such an interpretation of the provisions of the Contract Documents would result in violation of such Law or Regulation).

3.04 *Amending and Supplementing Contract Documents*

A. The Contract Documents may be amended to provide for additions, deletions, and revisions in the Work or to modify the terms and conditions thereof by either a Change Order or a Work Change Directive.

B. The requirements of the Contract Documents may be supplemented, and minor variations and deviations in the Work may be authorized, by one or more of the following ways:

1. A Field Order;

2. Engineer's approval of a Shop Drawing or Sample (subject to the provisions of Paragraph 6.17.D.3); or

3. Engineer's written interpretation or clarification.

3.05 *Reuse of Documents*

A. Contractor and any Subcontractor or Supplier shall not:

1. have or acquire any title to or ownership rights in any of the Drawings, Specifications, or other documents (or copies of any thereof) prepared by or bearing the seal of Engineer or its consultants, including electronic media editions; or

2. reuse any such Drawings, Specifications, other documents, or copies thereof on extensions of the Project or any other project without written consent of Owner and Engineer and specific written verification or adaptation by Engineer.

B. The prohibitions of this Paragraph 3.05 will survive final payment, or termination of the Contract. Nothing herein shall preclude Contractor from retaining copies of the Contract Documents for record purposes.

3.06 *Electronic Data*

A. Unless otherwise stated in the Supplementary Conditions, the data furnished by Owner or Engineer to Contractor, or by Contractor to Owner or Engineer, that may be relied upon are limited to the printed copies (also known as hard copies). Files in electronic media format of text, data, graphics, or other types are furnished only for the convenience of the receiving party. Any conclusion or information obtained or derived from such electronic files will be at the user's sole risk. If there is a discrepancy between the electronic files and the hard copies, the hard copies govern.

B. Because data stored in electronic media format can deteriorate or be modified inadvertently or otherwise without authorization of the data's creator, the party receiving electronic files agrees that it will perform acceptance tests or procedures within 60 days, after which the receiving party shall be deemed to have accepted the data thus transferred. Any errors detected within the 60-day acceptance period will be corrected by the transferring party.

C. When transferring documents in electronic media format, the transferring party makes no representations as to long term compatibility, usability, or readability of documents resulting from the use of software application packages, operating systems, or computer hardware differing from those used by the data's creator.

ARTICLE 4 – AVAILABILITY OF LANDS; SUBSURFACE AND PHYSICAL CONDITIONS; HAZARDOUS ENVIRONMENTAL CONDITIONS; REFERENCE POINTS

4.01 *Availability of Lands*

A. Owner shall furnish the Site. Owner shall notify Contractor of any encumbrances or restrictions not of general application but specifically related to use of the Site with which Contractor must comply in performing the Work. Owner will obtain in a timely manner and pay for easements for permanent structures or permanent changes in existing facilities. If Contractor and Owner are unable to agree on entitlement to or on the amount or extent, if any, of any adjustment in the Contract Price or Contract Times, or both, as a result of any delay in Owner's furnishing the Site or a part thereof, Contractor may make a Claim therefor as provided in Paragraph 10.05.

B. Upon reasonable written request, Owner shall furnish Contractor with a current statement of record legal title and legal description of the lands upon which the Work is to be performed and Owner's interest therein as necessary for giving notice of or filing a mechanic's or construction lien against such lands in accordance with applicable Laws and Regulations.

C. Contractor shall provide for all additional lands and access thereto that may be required for temporary construction facilities or storage of materials and equipment.

4.02 *Subsurface and Physical Conditions*

A. *Reports and Drawings:* The Supplementary Conditions identify:

1. those reports known to Owner of explorations and tests of subsurface conditions at or contiguous to the Site; and

2. those drawings known to Owner of physical conditions relating to existing surface or subsurface structures at the Site (except Underground Facilities).

B. *Limited Reliance by Contractor on Technical Data Authorized:* Contractor may rely upon the accuracy of the "technical data" contained in such reports and drawings, but such reports and drawings are not Contract Documents. Such "technical data" is identified in the Supplementary Conditions. Except for such reliance on such "technical data," Contractor may not rely upon or make any claim against Owner or Engineer, or any of their officers, directors, members, partners, employees, agents, consultants, or subcontractors with respect to:

1. the completeness of such reports and drawings for Contractor's purposes, including, but not limited to, any aspects of the means, methods, techniques, sequences, and procedures of construction to be employed by Contractor, and safety precautions and programs incident thereto; or

2. other data, interpretations, opinions, and information contained in such reports or shown or indicated in such drawings; or

3. any Contractor interpretation of or conclusion drawn from any "technical data" or any such other data, interpretations, opinions, or information.

4.03 *Differing Subsurface or Physical Conditions*

A. *Notice:* If Contractor believes that any subsurface or physical condition that is uncovered or revealed either:

1. is of such a nature as to establish that any "technical data" on which Contractor is entitled to rely as provided in Paragraph 4.02 is materially inaccurate; or

2. is of such a nature as to require a change in the Contract Documents; or

3. differs materially from that shown or indicated in the Contract Documents; or

4. is of an unusual nature, and differs materially from conditions ordinarily encountered and generally recognized as inherent in work of the character provided for in the Contract Documents;

then Contractor shall, promptly after becoming aware thereof and before further disturbing the subsurface or physical conditions or performing any Work in connection therewith (except in an emergency as required by Paragraph 6.16.A), notify Owner and Engineer in writing about such condition. Contractor shall not further disturb such condition or perform any Work in connection therewith (except as aforesaid) until receipt of written order to do so.

B. *Engineer's Review*: After receipt of written notice as required by Paragraph 4.03.A, Engineer will promptly review the pertinent condition, determine the necessity of Owner's obtaining additional exploration or tests with respect thereto, and advise Owner in writing (with a copy to Contractor) of Engineer's findings and conclusions.

C. *Possible Price and Times Adjustments:*

1. The Contract Price or the Contract Times, or both, will be equitably adjusted to the extent that the existence of such differing subsurface or physical condition causes an increase or decrease in Contractor's cost of, or time required for, performance of the Work; subject, however, to the following:

a. such condition must meet any one or more of the categories described in Paragraph 4.03.A; and

b. with respect to Work that is paid for on a unit price basis, any adjustment in Contract Price will be subject to the provisions of Paragraphs 9.07 and 11.03.

2. Contractor shall not be entitled to any adjustment in the Contract Price or Contract Times if:

a. Contractor knew of the existence of such conditions at the time Contractor made a final commitment to Owner with respect to Contract Price and Contract Times by the submission of a Bid or becoming bound under a negotiated contract; or

b. the existence of such condition could reasonably have been discovered or revealed as a result of any examination, investigation, exploration, test, or study of the Site and

contiguous areas required by the Bidding Requirements or Contract Documents to be conducted by or for Contractor prior to Contractor's making such final commitment; or

c. Contractor failed to give the written notice as required by Paragraph 4.03.A.

3. If Owner and Contractor are unable to agree on entitlement to or on the amount or extent, if any, of any adjustment in the Contract Price or Contract Times, or both, a Claim may be made therefor as provided in Paragraph 10.05. However, neither Owner or Engineer, or any of their officers, directors, members, partners, employees, agents, consultants, or subcontractors shall be liable to Contractor for any claims, costs, losses, or damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) sustained by Contractor on or in connection with any other project or anticipated project.

4.04 *Underground Facilities*

A. *Shown or Indicated:* The information and data shown or indicated in the Contract Documents with respect to existing Underground Facilities at or contiguous to the Site is based on information and data furnished to Owner or Engineer by the owners of such Underground Facilities, including Owner, or by others. Unless it is otherwise expressly provided in the Supplementary Conditions:

1. Owner and Engineer shall not be responsible for the accuracy or completeness of any such information or data provided by others; and

2. the cost of all of the following will be included in the Contract Price, and Contractor shall have full responsibility for:

a. reviewing and checking all such information and data;

b. locating all Underground Facilities shown or indicated in the Contract Documents;

c. coordination of the Work with the owners of such Underground Facilities, including Owner, during construction; and

d. the safety and protection of all such Underground Facilities and repairing any damage thereto resulting from the Work.

B. *Not Shown or Indicated:*

1. If an Underground Facility is uncovered or revealed at or contiguous to the Site which was not shown or indicated, or not shown or indicated with reasonable accuracy in the Contract Documents, Contractor shall, promptly after becoming aware thereof and before further disturbing conditions affected thereby or performing any Work in connection therewith (except in an emergency as required by Paragraph 6.16.A), identify the owner of such Underground Facility and give written notice to that owner and to Owner and Engineer. Engineer will promptly review the Underground Facility and determine the extent, if any, to which a change is required in the Contract Documents to reflect and document the

consequences of the existence or location of the Underground Facility. During such time, Contractor shall be responsible for the safety and protection of such Underground Facility.

2. If Engineer concludes that a change in the Contract Documents is required, a Work Change Directive or a Change Order will be issued to reflect and document such consequences. An equitable adjustment shall be made in the Contract Price or Contract Times, or both, to the extent that they are attributable to the existence or location of any Underground Facility that was not shown or indicated or not shown or indicated with reasonable accuracy in the Contract Documents and that Contractor did not know of and could not reasonably have been expected to be aware of or to have anticipated. If Owner and Contractor are unable to agree on entitlement to or on the amount or extent, if any, of any such adjustment in Contract Price or Contract Times, Owner or Contractor may make a Claim therefor as provided in Paragraph 10.05.

4.05 *Reference Points*

A. Owner shall provide engineering surveys to establish reference points for construction which in Engineer's judgment are necessary to enable Contractor to proceed with the Work. Contractor shall be responsible for laying out the Work, shall protect and preserve the established reference points and property monuments, and shall make no changes or relocations without the prior written approval of Owner. Contractor shall report to Engineer whenever any reference point or property monument is lost or destroyed or requires relocation because of necessary changes in grades or locations, and shall be responsible for the accurate replacement or relocation of such reference points or property monuments by professionally qualified personnel.

4.06 *Hazardous Environmental Condition at Site*

A. *Reports and Drawings:* The Supplementary Conditions identify those reports and drawings known to Owner relating to Hazardous Environmental Conditions that have been identified at the Site.

B. *Limited Reliance by Contractor on Technical Data Authorized:* Contractor may rely upon the accuracy of the "technical data" contained in such reports and drawings, but such reports and drawings are not Contract Documents. Such "technical data" is identified in the Supplementary Conditions. Except for such reliance on such "technical data," Contractor may not rely upon or make any claim against Owner or Engineer, or any of their officers, directors, members, partners, employees, agents, consultants, or subcontractors with respect to:

1. the completeness of such reports and drawings for Contractor's purposes, including, but not limited to, any aspects of the means, methods, techniques, sequences and procedures of construction to be employed by Contractor and safety precautions and programs incident thereto; or

2. other data, interpretations, opinions and information contained in such reports or shown or indicated in such drawings; or

3. any Contractor interpretation of or conclusion drawn from any "technical data" or any such other data, interpretations, opinions or information.

C. Contractor shall not be responsible for any Hazardous Environmental Condition uncovered or revealed at the Site which was not shown or indicated in Drawings or Specifications or identified in the Contract Documents to be within the scope of the Work. Contractor shall be responsible for a Hazardous Environmental Condition created with any materials brought to the Site by Contractor, Subcontractors, Suppliers, or anyone else for whom Contractor is responsible.

D. If Contractor encounters a Hazardous Environmental Condition or if Contractor or anyone for whom Contractor is responsible creates a Hazardous Environmental Condition, Contractor shall immediately: (i) secure or otherwise isolate such condition; (ii) stop all Work in connection with such condition and in any area affected thereby (except in an emergency as required by Paragraph 6.16.A); and (iii) notify Owner and Engineer (and promptly thereafter confirm such notice in writing). Owner shall promptly consult with Engineer concerning the necessity for Owner to retain a qualified expert to evaluate such condition or take corrective action, if any. Promptly after consulting with Engineer, Owner shall take such actions as are necessary to permit Owner to timely obtain required permits and provide Contractor the written notice required by Paragraph 4.06.E.

E. Contractor shall not be required to resume Work in connection with such condition or in any affected area until after Owner has obtained any required permits related thereto and delivered written notice to Contractor: (i) specifying that such condition and any affected area is or has been rendered safe for the resumption of Work; or (ii) specifying any special conditions under which such Work may be resumed safely. If Owner and Contractor cannot agree as to entitlement to or on the amount or extent, if any, of any adjustment in Contract Price or Contract Times, or both, as a result of such Work stoppage or such special conditions under which Work is agreed to be resumed by Contractor, either party may make a Claim therefor as provided in Paragraph 10.05.

F. If after receipt of such written notice Contractor does not agree to resume such Work based on a reasonable belief it is unsafe, or does not agree to resume such Work under such special conditions, then Owner may order the portion of the Work that is in the area affected by such condition to be deleted from the Work. If Owner and Contractor cannot agree as to entitlement to or on the amount or extent, if any, of an adjustment in Contract Price or Contract Times as a result of deleting such portion of the Work, then either party may make a Claim therefor as provided in Paragraph 10.05. Owner may have such deleted portion of the Work performed by Owner's own forces or others in accordance with Article 7.

G. To the fullest extent permitted by Laws and Regulations, Owner shall indemnify and hold harmless Contractor, Subcontractors, and Engineer, and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to a Hazardous Environmental Condition, provided that such Hazardous Environmental Condition: (i) was not shown or indicated in the Drawings or Specifications or identified in the Contract Documents to be included within the scope of the Work, and (ii) was not created by Contractor or by anyone for whom Contractor is responsible. Nothing in this Paragraph 4.06.G shall obligate Owner to indemnify any individual or entity from and against the consequences of that individual's or entity's own negligence.

H. To the fullest extent permitted by Laws and Regulations, Contractor shall indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to a Hazardous Environmental Condition created by Contractor or by anyone for whom Contractor is responsible. Nothing in this Paragraph 4.06.H shall obligate Contractor to indemnify any individual or entity from and against the consequences of that individual's or entity's own negligence.

I. The provisions of Paragraphs 4.02, 4.03, and 4.04 do not apply to a Hazardous Environmental Condition uncovered or revealed at the Site.

ARTICLE 5 – BONDS AND INSURANCE

5.01 *Performance, Payment, and Other Bonds*

A. Contractor shall furnish performance and payment bonds, each in an amount at least equal to the Contract Price as security for the faithful performance and payment of all of Contractor's obligations under the Contract Documents. These bonds shall remain in effect until one year after the date when final payment becomes due or until completion of the correction period specified in Paragraph 13.07, whichever is later, except as provided otherwise by Laws or Regulations or by the Contract Documents. Contractor shall also furnish such other bonds as are required by the Contract Documents.

B. All bonds shall be in the form prescribed by the Contract Documents except as provided otherwise by Laws or Regulations, and shall be executed by such sureties as are named in the list of "Companies Holding Certificates of Authority as Acceptable Sureties on Federal Bonds and as Acceptable Reinsuring Companies" as published in Circular 570 (amended) by the Financial Management Service, Surety Bond Branch, U.S. Department of the Treasury. All bonds signed by an agent or attorney-in-fact must be accompanied by a certified copy of that individual's authority to bind the surety. The evidence of authority shall show that it is effective on the date the agent or attorney-in-fact signed each bond.

C. If the surety on any bond furnished by Contractor is declared bankrupt or becomes insolvent or its right to do business is terminated in any state where any part of the Project is located or it ceases to meet the requirements of Paragraph 5.01.B, Contractor shall promptly notify Owner and Engineer and shall, within 20 days after the event giving rise to such notification, provide another bond and surety, both of which shall comply with the requirements of Paragraphs 5.01.B and 5.02.

5.02 *Licensed Sureties and Insurers*

A. All bonds and insurance required by the Contract Documents to be purchased and maintained by Owner or Contractor shall be obtained from surety or insurance companies that are duly licensed or authorized in the jurisdiction in which the Project is located to issue bonds or insurance policies for the limits and coverages so required. Such surety and insurance companies shall also

meet such additional requirements and qualifications as may be provided in the Supplementary Conditions.

5.03 *Certificates of Insurance*

A. Contractor shall deliver to Owner, with copies to each additional insured and loss payee identified in the Supplementary Conditions, certificates of insurance (and other evidence of insurance requested by Owner or any other additional insured) which Contractor is required to purchase and maintain.

B. Owner shall deliver to Contractor, with copies to each additional insured and loss payee identified in the Supplementary Conditions, certificates of insurance (and other evidence of insurance requested by Contractor or any other additional insured) which Owner is required to purchase and maintain.

C. Failure of Owner to demand such certificates or other evidence of Contractor's full compliance with these insurance requirements or failure of Owner to identify a deficiency in compliance from the evidence provided shall not be construed as a waiver of Contractor's obligation to maintain such insurance.

D. Owner does not represent that insurance coverage and limits established in this Contract necessarily will be adequate to protect Contractor.

E. The insurance and insurance limits required herein shall not be deemed as a limitation on Contractor's liability under the indemnities granted to Owner in the Contract Documents.

5.04 *Contractor's Insurance*

A. Contractor shall purchase and maintain such insurance as is appropriate for the Work being performed and as will provide protection from claims set forth below which may arise out of or result from Contractor's performance of the Work and Contractor's other obligations under the Contract Documents, whether it is to be performed by Contractor, any Subcontractor or Supplier, or by anyone directly or indirectly employed by any of them to perform any of the Work, or by anyone for whose acts any of them may be liable:

1. claims under workers' compensation, disability benefits, and other similar employee benefit acts;

2. claims for damages because of bodily injury, occupational sickness or disease, or death of Contractor's employees;

3. claims for damages because of bodily injury, sickness or disease, or death of any person other than Contractor's employees;

4. claims for damages insured by reasonably available personal injury liability coverage which are sustained:

a. by any person as a result of an offense directly or indirectly related to the employment of such person by Contractor, or

b. by any other person for any other reason;

5. claims for damages, other than to the Work itself, because of injury to or destruction of tangible property wherever located, including loss of use resulting therefrom; and

6. claims for damages because of bodily injury or death of any person or property damage arising out of the ownership, maintenance or use of any motor vehicle.

B. The policies of insurance required by this Paragraph 5.04 shall:

1. with respect to insurance required by Paragraphs 5.04.A.3 through 5.04.A.6 inclusive, be written on an occurrence basis, include as additional insureds (subject to any customary exclusion regarding professional liability) Owner and Engineer, and any other individuals or entities identified in the Supplementary Conditions, all of whom shall be listed as additional insureds, and include coverage for the respective officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of all such additional insureds, and the insurance afforded to these additional insureds shall provide primary coverage for all claims covered thereby;

2. include at least the specific coverages and be written for not less than the limits of liability provided in the Supplementary Conditions or required by Laws or Regulations, whichever is greater;

3. include contractual liability insurance covering Contractor's indemnity obligations under Paragraphs 6.11 and 6.20;

4. contain a provision or endorsement that the coverage afforded will not be canceled, materially changed or renewal refused until at least 30 days prior written notice has been given to Owner and Contractor and to each other additional insured identified in the Supplementary Conditions to whom a certificate of insurance has been issued (and the certificates of insurance furnished by the Contractor pursuant to Paragraph 5.03 will so provide);

5. remain in effect at least until final payment and at all times thereafter when Contractor may be correcting, removing, or replacing defective Work in accordance with Paragraph 13.07; and

6. include completed operations coverage:

a. Such insurance shall remain in effect for two years after final payment.

b. Contractor shall furnish Owner and each other additional insured identified in the Supplementary Conditions, to whom a certificate of insurance has been issued, evidence satisfactory to Owner and any such additional insured of continuation of such insurance at final payment and one year thereafter.

5.05 *Owner's Liability Insurance*

A. In addition to the insurance required to be provided by Contractor under Paragraph 5.04, Owner, at Owner's option, may purchase and maintain at Owner's expense Owner's own liability insurance as will protect Owner against claims which may arise from operations under the Contract Documents.

5.06 *Property Insurance*

A. Unless otherwise provided in the Supplementary Conditions, Owner shall purchase and maintain property insurance upon the Work at the Site in the amount of the full replacement cost thereof (subject to such deductible amounts as may be provided in the Supplementary Conditions or required by Laws and Regulations). This insurance shall:

1. include the interests of Owner, Contractor, Subcontractors, and Engineer, and any other individuals or entities identified in the Supplementary Conditions, and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them, each of whom is deemed to have an insurable interest and shall be listed as a loss payee;

2. be written on a Builder's Risk "all-risk" policy form that shall at least include insurance for physical loss or damage to the Work, temporary buildings, falsework, and materials and equipment in transit, and shall insure against at least the following perils or causes of loss: fire, lightning, extended coverage, theft, vandalism and malicious mischief, earthquake, collapse, debris removal, demolition occasioned by enforcement of Laws and Regulations, water damage (other than that caused by flood), and such other perils or causes of loss as may be specifically required by the Supplementary Conditions.

3. include expenses incurred in the repair or replacement of any insured property (including but not limited to fees and charges of engineers and architects);

4. cover materials and equipment stored at the Site or at another location that was agreed to in writing by Owner prior to being incorporated in the Work, provided that such materials and equipment have been included in an Application for Payment recommended by Engineer;

5. allow for partial utilization of the Work by Owner;

6. include testing and startup; and

7. be maintained in effect until final payment is made unless otherwise agreed to in writing by Owner, Contractor, and Engineer with 30 days written notice to each other loss payee to whom a certificate of insurance has been issued.

B. Owner shall purchase and maintain such equipment breakdown insurance or additional property insurance as may be required by the Supplementary Conditions or Laws and Regulations which will include the interests of Owner, Contractor, Subcontractors, and Engineer, and any other individuals or entities identified in the Supplementary Conditions, and the officers, directors,

members, partners, employees, agents, consultants and subcontractors of each and any of them, each of whom is deemed to have an insurable interest and shall be listed as a loss payee.

C. All the policies of insurance (and the certificates or other evidence thereof) required to be purchased and maintained in accordance with this Paragraph 5.06 will contain a provision or endorsement that the coverage afforded will not be canceled or materially changed or renewal refused until at least 30 days prior written notice has been given to Owner and Contractor and to each other loss payee to whom a certificate of insurance has been issued and will contain waiver provisions in accordance with Paragraph 5.07.

D. Owner shall not be responsible for purchasing and maintaining any property insurance specified in this Paragraph 5.06 to protect the interests of Contractor, Subcontractors, or others in the Work to the extent of any deductible amounts that are identified in the Supplementary Conditions. The risk of loss within such identified deductible amount will be borne by Contractor, Subcontractors, or others suffering any such loss, and if any of them wishes property insurance coverage within the limits of such amounts, each may purchase and maintain it at the purchaser's own expense.

E. If Contractor requests in writing that other special insurance be included in the property insurance policies provided under this Paragraph 5.06, Owner shall, if possible, include such insurance, and the cost thereof will be charged to Contractor by appropriate Change Order. Prior to commencement of the Work at the Site, Owner shall in writing advise Contractor whether or not such other insurance has been procured by Owner.

5.07 *Waiver of Rights*

A. Owner and Contractor intend that all policies purchased in accordance with Paragraph 5.06 will protect Owner, Contractor, Subcontractors, and Engineer, and all other individuals or entities identified in the Supplementary Conditions as loss payees (and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them) in such policies and will provide primary coverage for all losses and damages caused by the perils or causes of loss covered thereby. All such policies shall contain provisions to the effect that in the event of payment of any loss or damage the insurers will have no rights of recovery against any of the insureds or loss payees thereunder. Owner and Contractor waive all rights against each other and their respective officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them for all losses and damages caused by, arising out of or resulting from any of the perils or causes of loss covered by such policies and any other property insurance applicable to the Work; and, in addition, waive all such rights against Subcontractors and Engineer, and all other individuals or entities identified in the Supplementary Conditions as loss payees (and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them) under such policies for losses and damages so caused. None of the above waivers shall extend to the rights that any party making such waiver may have to the proceeds of insurance held by Owner as trustee or otherwise payable under any policy so issued.

B. Owner waives all rights against Contractor, Subcontractors, and Engineer, and the officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them for:

1. loss due to business interruption, loss of use, or other consequential loss extending beyond direct physical loss or damage to Owner's property or the Work caused by, arising out of, or resulting from fire or other perils whether or not insured by Owner; and

2. loss or damage to the completed Project or part thereof caused by, arising out of, or resulting from fire or other insured peril or cause of loss covered by any property insurance maintained on the completed Project or part thereof by Owner during partial utilization pursuant to Paragraph 14.05, after Substantial Completion pursuant to Paragraph 14.04, or after final payment pursuant to Paragraph 14.07.

C. Any insurance policy maintained by Owner covering any loss, damage or consequential loss referred to in Paragraph 5.07.B shall contain provisions to the effect that in the event of payment of any such loss, damage, or consequential loss, the insurers will have no rights of recovery against Contractor, Subcontractors, or Engineer, and the officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them.

5.08 *Receipt and Application of Insurance Proceeds*

A. Any insured loss under the policies of insurance required by Paragraph 5.06 will be adjusted with Owner and made payable to Owner as fiduciary for the loss payees, as their interests may appear, subject to the requirements of any applicable mortgage clause and of Paragraph 5.08.B. Owner shall deposit in a separate account any money so received and shall distribute it in accordance with such agreement as the parties in interest may reach. If no other special agreement is reached, the damaged Work shall be repaired or replaced, the moneys so received applied on account thereof, and the Work and the cost thereof covered by an appropriate Change Order.

B. Owner as fiduciary shall have power to adjust and settle any loss with the insurers unless one of the parties in interest shall object in writing within 15 days after the occurrence of loss to Owner's exercise of this power. If such objection be made, Owner as fiduciary shall make settlement with the insurers in accordance with such agreement as the parties in interest may reach. If no such agreement among the parties in interest is reached, Owner as fiduciary shall adjust and settle the loss with the insurers and, if required in writing by any party in interest, Owner as fiduciary shall give bond for the proper performance of such duties.

5.09 *Acceptance of Bonds and Insurance; Option to Replace*

A. If either Owner or Contractor has any objection to the coverage afforded by or other provisions of the bonds or insurance required to be purchased and maintained by the other party in accordance with Article 5 on the basis of non-conformance with the Contract Documents, the objecting party shall so notify the other party in writing within 10 days after receipt of the certificates (or other evidence requested) required by Paragraph 2.01.B. Owner and Contractor shall each provide to the other such additional information in respect of insurance provided as the other may reasonably request. If either party does not purchase or maintain all of the bonds and insurance required of such party by the Contract Documents, such party shall notify the other party in writing of such failure to purchase prior to the start of the Work, or of such failure to maintain prior to any change in the required coverage. Without prejudice to any other right or remedy, the other party may elect to obtain equivalent bonds or insurance to protect such other party's

interests at the expense of the party who was required to provide such coverage, and a Change Order shall be issued to adjust the Contract Price accordingly.

5.10 *Partial Utilization, Acknowledgment of Property Insurer*

A. If Owner finds it necessary to occupy or use a portion or portions of the Work prior to Substantial Completion of all the Work as provided in Paragraph 14.05, no such use or occupancy shall commence before the insurers providing the property insurance pursuant to Paragraph 5.06 have acknowledged notice thereof and in writing effected any changes in coverage necessitated thereby. The insurers providing the property insurance shall consent by endorsement on the policy or policies, but the property insurance shall not be canceled or permitted to lapse on account of any such partial use or occupancy.

ARTICLE 6 – CONTRACTOR'S RESPONSIBILITIES

6.01 *Supervision and Superintendence*

A. Contractor shall supervise, inspect, and direct the Work competently and efficiently, devoting such attention thereto and applying such skills and expertise as may be necessary to perform the Work in accordance with the Contract Documents. Contractor shall be solely responsible for the means, methods, techniques, sequences, and procedures of construction. Contractor shall not be responsible for the negligence of Owner or Engineer in the design or specification of a specific means, method, technique, sequence, or procedure of construction which is shown or indicated in and expressly required by the Contract Documents.

B. At all times during the progress of the Work, Contractor shall assign a competent resident superintendent who shall not be replaced without written notice to Owner and Engineer except under extraordinary circumstances.

6.02 *Labor; Working Hours*

A. Contractor shall provide competent, suitably qualified personnel to survey and lay out the Work and perform construction as required by the Contract Documents. Contractor shall at all times maintain good discipline and order at the Site.

B. Except as otherwise required for the safety or protection of persons or the Work or property at the Site or adjacent thereto, and except as otherwise stated in the Contract Documents, all Work at the Site shall be performed during regular working hours. Contractor will not permit the performance of Work on a Saturday, Sunday, or any legal holiday without Owner's written consent (which will not be unreasonably withheld) given after prior written notice to Engineer.

6.03 *Services, Materials, and Equipment*

A. Unless otherwise specified in the Contract Documents, Contractor shall provide and assume full responsibility for all services, materials, equipment, labor, transportation, construction equipment and machinery, tools, appliances, fuel, power, light, heat, telephone, water, sanitary facilities, temporary facilities, and all other facilities and incidentals necessary for the performance, testing, start-up, and completion of the Work.

B. All materials and equipment incorporated into the Work shall be as specified or, if not specified, shall be of good quality and new, except as otherwise provided in the Contract Documents. All special warranties and guarantees required by the Specifications shall expressly run to the benefit of Owner. If required by Engineer, Contractor shall furnish satisfactory evidence (including reports of required tests) as to the source, kind, and quality of materials and equipment.

C. All materials and equipment shall be stored, applied, installed, connected, erected, protected, used, cleaned, and conditioned in accordance with instructions of the applicable Supplier, except as otherwise may be provided in the Contract Documents.

6.04 *Progress Schedule*

A. Contractor shall adhere to the Progress Schedule established in accordance with Paragraph 2.07 as it may be adjusted from time to time as provided below.

1. Contractor shall submit to Engineer for acceptance (to the extent indicated in Paragraph 2.07) proposed adjustments in the Progress Schedule that will not result in changing the Contract Times. Such adjustments will comply with any provisions of the General Requirements applicable thereto.

2. Proposed adjustments in the Progress Schedule that will change the Contract Times shall be submitted in accordance with the requirements of Article 12. Adjustments in Contract Times may only be made by a Change Order.

6.05 *Substitutes and "Or-Equals"*

A. Whenever an item of material or equipment is specified or described in the Contract Documents by using the name of a proprietary item or the name of a particular Supplier, the specification or description is intended to establish the type, function, appearance, and quality required. Unless the specification or description contains or is followed by words reading that no like, equivalent, or "or-equal" item or no substitution is permitted, other items of material or equipment or material or equipment of other Suppliers may be submitted to Engineer for review under the circumstances described below.

1. *"Or-Equal" Items:* If in Engineer's sole discretion an item of material or equipment proposed by Contractor is functionally equal to that named and sufficiently similar so that no change in related Work will be required, it may be considered by Engineer as an "or-equal" item, in which case review and approval of the proposed item may, in Engineer's sole discretion, be accomplished without compliance with some or all of the requirements for approval of proposed substitute items. For the purposes of this Paragraph 6.05.A.1, a proposed item of material or equipment will be considered functionally equal to an item so named if:

a. in the exercise of reasonable judgment Engineer determines that:

1) it is at least equal in materials of construction, quality, durability, appearance, strength, and design characteristics;

2) it will reliably perform at least equally well the function and achieve the results imposed by the design concept of the completed Project as a functioning whole; and

3) it has a proven record of performance and availability of responsive service.

b. Contractor certifies that, if approved and incorporated into the Work:

1) there will be no increase in cost to the Owner or increase in Contract Times; and

2) it will conform substantially to the detailed requirements of the item named in the Contract Documents.

2. *Substitute Items:*

a. If in Engineer's sole discretion an item of material or equipment proposed by Contractor does not qualify as an "or-equal" item under Paragraph 6.05.A.1, it will be considered a proposed substitute item.

b. Contractor shall submit sufficient information as provided below to allow Engineer to determine if the item of material or equipment proposed is essentially equivalent to that named and an acceptable substitute therefor. Requests for review of proposed substitute items of material or equipment will not be accepted by Engineer from anyone other than Contractor.

c. The requirements for review by Engineer will be as set forth in Paragraph 6.05.A.2.d, as supplemented by the General Requirements, and as Engineer may decide is appropriate under the circumstances.

d. Contractor shall make written application to Engineer for review of a proposed substitute item of material or equipment that Contractor seeks to furnish or use. The application:

1) shall certify that the proposed substitute item will:

a) perform adequately the functions and achieve the results called for by the general design,

b) be similar in substance to that specified, and

c) be suited to the same use as that specified;

2) will state:

a) the extent, if any, to which the use of the proposed substitute item will prejudice Contractor's achievement of Substantial Completion on time,

b) whether use of the proposed substitute item in the Work will require a change in any of the Contract Documents (or in the provisions of any other direct contract with Owner for other work on the Project) to adapt the design to the proposed substitute item, and

c) whether incorporation or use of the proposed substitute item in connection with the Work is subject to payment of any license fee or royalty;

3) will identify:

a) all variations of the proposed substitute item from that specified, and

b) available engineering, sales, maintenance, repair, and replacement services; and

4) shall contain an itemized estimate of all costs or credits that will result directly or indirectly from use of such substitute item, including costs of redesign and claims of other contractors affected by any resulting change.

B. *Substitute Construction Methods or Procedures:* If a specific means, method, technique, sequence, or procedure of construction is expressly required by the Contract Documents, Contractor may furnish or utilize a substitute means, method, technique, sequence, or procedure of construction approved by Engineer. Contractor shall submit sufficient information to allow Engineer, in Engineer's sole discretion, to determine that the substitute proposed is equivalent to that expressly called for by the Contract Documents. The requirements for review by Engineer will be similar to those provided in Paragraph 6.05.A.2.

C. *Engineer's Evaluation:* Engineer will be allowed a reasonable time within which to evaluate each proposal or submittal made pursuant to Paragraphs 6.05.A and 6.05.B. Engineer may require Contractor to furnish additional data about the proposed substitute item. Engineer will be the sole judge of acceptability. No "or equal" or substitute will be ordered, installed or utilized until Engineer's review is complete, which will be evidenced by a Change Order in the case of a substitute and an approved Shop Drawing for an "or equal." Engineer will advise Contractor in writing of any negative determination.

D. *Special Guarantee:* Owner may require Contractor to furnish at Contractor's expense a special performance guarantee or other surety with respect to any substitute.

E. *Engineer's Cost Reimbursement*: Engineer will record Engineer's costs in evaluating a substitute proposed or submitted by Contractor pursuant to Paragraphs 6.05.A.2 and 6.05.B. Whether or not Engineer approves a substitute so proposed or submitted by Contractor, Contractor shall reimburse Owner for the reasonable charges of Engineer for evaluating each such proposed substitute. Contractor shall also reimburse Owner for the reasonable charges of Engineer for making changes in the Contract Documents (or in the provisions of any other direct contract with Owner) resulting from the acceptance of each proposed substitute.

F. *Contractor's Expense*: Contractor shall provide all data in support of any proposed substitute or "or-equal" at Contractor's expense.

6.06 *Concerning Subcontractors, Suppliers, and Others*

A. Contractor shall not employ any Subcontractor, Supplier, or other individual or entity (including those acceptable to Owner as indicated in Paragraph 6.06.B), whether initially or as a replacement, against whom Owner may have reasonable objection. Contractor shall not be

required to employ any Subcontractor, Supplier, or other individual or entity to furnish or perform any of the Work against whom Contractor has reasonable objection.

B. If the Supplementary Conditions require the identity of certain Subcontractors, Suppliers, or other individuals or entities to be submitted to Owner in advance for acceptance by Owner by a specified date prior to the Effective Date of the Agreement, and if Contractor has submitted a list thereof in accordance with the Supplementary Conditions, Owner's acceptance (either in writing or by failing to make written objection thereto by the date indicated for acceptance or objection in the Bidding Documents or the Contract Documents) of any such Subcontractor, Supplier, or other individual or entity so identified may be revoked on the basis of reasonable objection after due investigation. Contractor shall submit an acceptable replacement for the rejected Subcontractor, Supplier, or other individual or entity, and the Contract Price will be adjusted by the difference in the cost occasioned by such replacement, and an appropriate Change Order will be issued. No acceptance by Owner of any such Subcontractor, Supplier, or other individual or entity, whether initially or as a replacement, shall constitute a waiver of any right of Owner or Engineer to reject defective Work.

C. Contractor shall be fully responsible to Owner and Engineer for all acts and omissions of the Subcontractors, Suppliers, and other individuals or entities performing or furnishing any of the Work just as Contractor is responsible for Contractor's own acts and omissions. Nothing in the Contract Documents:

   1. shall create for the benefit of any such Subcontractor, Supplier, or other individual or entity any contractual relationship between Owner or Engineer and any such Subcontractor, Supplier or other individual or entity; nor

   2. shall create any obligation on the part of Owner or Engineer to pay or to see to the payment of any moneys due any such Subcontractor, Supplier, or other individual or entity except as may otherwise be required by Laws and Regulations.

D. Contractor shall be solely responsible for scheduling and coordinating the Work of Subcontractors, Suppliers, and other individuals or entities performing or furnishing any of the Work under a direct or indirect contract with Contractor.

E. Contractor shall require all Subcontractors, Suppliers, and such other individuals or entities performing or furnishing any of the Work to communicate with Engineer through Contractor.

F. The divisions and sections of the Specifications and the identifications of any Drawings shall not control Contractor in dividing the Work among Subcontractors or Suppliers or delineating the Work to be performed by any specific trade.

G. All Work performed for Contractor by a Subcontractor or Supplier will be pursuant to an appropriate agreement between Contractor and the Subcontractor or Supplier which specifically binds the Subcontractor or Supplier to the applicable terms and conditions of the Contract Documents for the benefit of Owner and Engineer. Whenever any such agreement is with a Subcontractor or Supplier who is listed as a loss payee on the property insurance provided in Paragraph 5.06, the agreement between the Contractor and the Subcontractor or Supplier will contain provisions whereby the Subcontractor or Supplier waives all rights against Owner,

Contractor, Engineer, and all other individuals or entities identified in the Supplementary Conditions to be listed as insureds or loss payees (and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them) for all losses and damages caused by, arising out of, relating to, or resulting from any of the perils or causes of loss covered by such policies and any other property insurance applicable to the Work. If the insurers on any such policies require separate waiver forms to be signed by any Subcontractor or Supplier, Contractor will obtain the same.

6.07 *Patent Fees and Royalties*

A. Contractor shall pay all license fees and royalties and assume all costs incident to the use in the performance of the Work or the incorporation in the Work of any invention, design, process, product, or device which is the subject of patent rights or copyrights held by others. If a particular invention, design, process, product, or device is specified in the Contract Documents for use in the performance of the Work and if, to the actual knowledge of Owner or Engineer, its use is subject to patent rights or copyrights calling for the payment of any license fee or royalty to others, the existence of such rights shall be disclosed by Owner in the Contract Documents.

B. To the fullest extent permitted by Laws and Regulations, Owner shall indemnify and hold harmless Contractor, and its officers, directors, members, partners, employees, agents, consultants, and subcontractors from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals, and all court or arbitration or other dispute resolution costs) arising out of or relating to any infringement of patent rights or copyrights incident to the use in the performance of the Work or resulting from the incorporation in the Work of any invention, design, process, product, or device specified in the Contract Documents, but not identified as being subject to payment of any license fee or royalty to others required by patent rights or copyrights.

C. To the fullest extent permitted by Laws and Regulations, Contractor shall indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to any infringement of patent rights or copyrights incident to the use in the performance of the Work or resulting from the incorporation in the Work of any invention, design, process, product, or device not specified in the Contract Documents.

6.08 *Permits*

A. Unless otherwise provided in the Supplementary Conditions, Contractor shall obtain and pay for all construction permits and licenses. Owner shall assist Contractor, when necessary, in obtaining such permits and licenses. Contractor shall pay all governmental charges and inspection fees necessary for the prosecution of the Work which are applicable at the time of opening of Bids, or, if there are no Bids, on the Effective Date of the Agreement. Owner shall pay all charges of utility owners for connections for providing permanent service to the Work.

6.09 *Laws and Regulations*

A. Contractor shall give all notices required by and shall comply with all Laws and Regulations applicable to the performance of the Work. Except where otherwise expressly required by applicable Laws and Regulations, neither Owner nor Engineer shall be responsible for monitoring Contractor's compliance with any Laws or Regulations.

B. If Contractor performs any Work knowing or having reason to know that it is contrary to Laws or Regulations, Contractor shall bear all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to such Work. However, it shall not be Contractor's responsibility to make certain that the Specifications and Drawings are in accordance with Laws and Regulations, but this shall not relieve Contractor of Contractor's obligations under Paragraph 3.03.

C. Changes in Laws or Regulations not known at the time of opening of Bids (or, on the Effective Date of the Agreement if there were no Bids) having an effect on the cost or time of performance of the Work shall be the subject of an adjustment in Contract Price or Contract Times. If Owner and Contractor are unable to agree on entitlement to or on the amount or extent, if any, of any such adjustment, a Claim may be made therefor as provided in Paragraph 10.05.

6.10 *Taxes*

A. Contractor shall pay all sales, consumer, use, and other similar taxes required to be paid by Contractor in accordance with the Laws and Regulations of the place of the Project which are applicable during the performance of the Work.

6.11 *Use of Site and Other Areas*

A. *Limitation on Use of Site and Other Areas:*

1. Contractor shall confine construction equipment, the storage of materials and equipment, and the operations of workers to the Site and other areas permitted by Laws and Regulations, and shall not unreasonably encumber the Site and other areas with construction equipment or other materials or equipment. Contractor shall assume full responsibility for any damage to any such land or area, or to the owner or occupant thereof, or of any adjacent land or areas resulting from the performance of the Work.

2. Should any claim be made by any such owner or occupant because of the performance of the Work, Contractor shall promptly settle with such other party by negotiation or otherwise resolve the claim by arbitration or other dispute resolution proceeding or at law.

3. To the fullest extent permitted by Laws and Regulations, Contractor shall indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to any claim or action, legal or equitable, brought

by any such owner or occupant against Owner, Engineer, or any other party indemnified hereunder to the extent caused by or based upon Contractor's performance of the Work.

B. *Removal of Debris During Performance of the Work:* During the progress of the Work Contractor shall keep the Site and other areas free from accumulations of waste materials, rubbish, and other debris. Removal and disposal of such waste materials, rubbish, and other debris shall conform to applicable Laws and Regulations.

C. *Cleaning:* Prior to Substantial Completion of the Work Contractor shall clean the Site and the Work and make it ready for utilization by Owner. At the completion of the Work Contractor shall remove from the Site all tools, appliances, construction equipment and machinery, and surplus materials and shall restore to original condition all property not designated for alteration by the Contract Documents.

D. *Loading Structures:* Contractor shall not load nor permit any part of any structure to be loaded in any manner that will endanger the structure, nor shall Contractor subject any part of the Work or adjacent property to stresses or pressures that will endanger it.

6.12 *Record Documents*

A. Contractor shall maintain in a safe place at the Site one record copy of all Drawings, Specifications, Addenda, Change Orders, Work Change Directives, Field Orders, and written interpretations and clarifications in good order and annotated to show changes made during construction. These record documents together with all approved Samples and a counterpart of all approved Shop Drawings will be available to Engineer for reference. Upon completion of the Work, these record documents, Samples, and Shop Drawings will be delivered to Engineer for Owner.

6.13 *Safety and Protection*

A. Contractor shall be solely responsible for initiating, maintaining and supervising all safety precautions and programs in connection with the Work. Such responsibility does not relieve Subcontractors of their responsibility for the safety of persons or property in the performance of their work, nor for compliance with applicable safety Laws and Regulations. Contractor shall take all necessary precautions for the safety of, and shall provide the necessary protection to prevent damage, injury or loss to:

1. all persons on the Site or who may be affected by the Work;

2. all the Work and materials and equipment to be incorporated therein, whether in storage on or off the Site; and

3. other property at the Site or adjacent thereto, including trees, shrubs, lawns, walks, pavements, roadways, structures, utilities, and Underground Facilities not designated for removal, relocation, or replacement in the course of construction.

B. Contractor shall comply with all applicable Laws and Regulations relating to the safety of persons or property, or to the protection of persons or property from damage, injury, or loss; and

shall erect and maintain all necessary safeguards for such safety and protection. Contractor shall notify owners of adjacent property and of Underground Facilities and other utility owners when prosecution of the Work may affect them, and shall cooperate with them in the protection, removal, relocation, and replacement of their property.

C. Contractor shall comply with the applicable requirements of Owner's safety programs, if any. The Supplementary Conditions identify any Owner's safety programs that are applicable to the Work.

D. Contractor shall inform Owner and Engineer of the specific requirements of Contractor's safety program with which Owner's and Engineer's employees and representatives must comply while at the Site.

E. All damage, injury, or loss to any property referred to in Paragraph 6.13.A.2 or 6.13.A.3 caused, directly or indirectly, in whole or in part, by Contractor, any Subcontractor, Supplier, or any other individual or entity directly or indirectly employed by any of them to perform any of the Work, or anyone for whose acts any of them may be liable, shall be remedied by Contractor (except damage or loss attributable to the fault of Drawings or Specifications or to the acts or omissions of Owner or Engineer or anyone employed by any of them, or anyone for whose acts any of them may be liable, and not attributable, directly or indirectly, in whole or in part, to the fault or negligence of Contractor or any Subcontractor, Supplier, or other individual or entity directly or indirectly employed by any of them).

F. Contractor's duties and responsibilities for safety and for protection of the Work shall continue until such time as all the Work is completed and Engineer has issued a notice to Owner and Contractor in accordance with Paragraph 14.07.B that the Work is acceptable (except as otherwise expressly provided in connection with Substantial Completion).

6.14 *Safety Representative*

A. Contractor shall designate a qualified and experienced safety representative at the Site whose duties and responsibilities shall be the prevention of accidents and the maintaining and supervising of safety precautions and programs.

6.15 *Hazard Communication Programs*

A. Contractor shall be responsible for coordinating any exchange of material safety data sheets or other hazard communication information required to be made available to or exchanged between or among employers at the Site in accordance with Laws or Regulations.

6.16 *Emergencies*

A. In emergencies affecting the safety or protection of persons or the Work or property at the Site or adjacent thereto, Contractor is obligated to act to prevent threatened damage, injury, or loss. Contractor shall give Engineer prompt written notice if Contractor believes that any significant changes in the Work or variations from the Contract Documents have been caused thereby or are required as a result thereof. If Engineer determines that a change in the Contract Documents is

required because of the action taken by Contractor in response to such an emergency, a Work Change Directive or Change Order will be issued.

6.17 *Shop Drawings and Samples*

A. Contractor shall submit Shop Drawings and Samples to Engineer for review and approval in accordance with the accepted Schedule of Submittals (as required by Paragraph 2.07). Each submittal will be identified as Engineer may require.

1. *Shop Drawings:*

a. Submit number of copies specified in the General Requirements.

b. Data shown on the Shop Drawings will be complete with respect to quantities, dimensions, specified performance and design criteria, materials, and similar data to show Engineer the services, materials, and equipment Contractor proposes to provide and to enable Engineer to review the information for the limited purposes required by Paragraph 6.17.D.

2. *Samples:*

a. Submit number of Samples specified in the Specifications.

b. Clearly identify each Sample as to material, Supplier, pertinent data such as catalog numbers, the use for which intended and other data as Engineer may require to enable Engineer to review the submittal for the limited purposes required by Paragraph 6.17.D.

B. Where a Shop Drawing or Sample is required by the Contract Documents or the Schedule of Submittals, any related Work performed prior to Engineer's review and approval of the pertinent submittal will be at the sole expense and responsibility of Contractor.

C. *Submittal Procedures:*

1. Before submitting each Shop Drawing or Sample, Contractor shall have:

a. reviewed and coordinated each Shop Drawing or Sample with other Shop Drawings and Samples and with the requirements of the Work and the Contract Documents;

b. determined and verified all field measurements, quantities, dimensions, specified performance and design criteria, installation requirements, materials, catalog numbers, and similar information with respect thereto;

c. determined and verified the suitability of all materials offered with respect to the indicated application, fabrication, shipping, handling, storage, assembly, and installation pertaining to the performance of the Work; and

d. determined and verified all information relative to Contractor's responsibilities for means, methods, techniques, sequences, and procedures of construction, and safety precautions and programs incident thereto.

2. Each submittal shall bear a stamp or specific written certification that Contractor has satisfied Contractor's obligations under the Contract Documents with respect to Contractor's review and approval of that submittal.

3. With each submittal, Contractor shall give Engineer specific written notice of any variations that the Shop Drawing or Sample may have from the requirements of the Contract Documents. This notice shall be both a written communication separate from the Shop Drawings or Sample submittal; and, in addition, by a specific notation made on each Shop Drawing or Sample submitted to Engineer for review and approval of each such variation.

D. *Engineer's Review:*

1. Engineer will provide timely review of Shop Drawings and Samples in accordance with the Schedule of Submittals acceptable to Engineer. Engineer's review and approval will be only to determine if the items covered by the submittals will, after installation or incorporation in the Work, conform to the information given in the Contract Documents and be compatible with the design concept of the completed Project as a functioning whole as indicated by the Contract Documents.

2. Engineer's review and approval will not extend to means, methods, techniques, sequences, or procedures of construction (except where a particular means, method, technique, sequence, or procedure of construction is specifically and expressly called for by the Contract Documents) or to safety precautions or programs incident thereto. The review and approval of a separate item as such will not indicate approval of the assembly in which the item functions.

3. Engineer's review and approval shall not relieve Contractor from responsibility for any variation from the requirements of the Contract Documents unless Contractor has complied with the requirements of Paragraph 6.17.C.3 and Engineer has given written approval of each such variation by specific written notation thereof incorporated in or accompanying the Shop Drawing or Sample. Engineer's review and approval shall not relieve Contractor from responsibility for complying with the requirements of Paragraph 6.17.C.1.

E. *Resubmittal Procedures:*

1. Contractor shall make corrections required by Engineer and shall return the required number of corrected copies of Shop Drawings and submit, as required, new Samples for review and approval. Contractor shall direct specific attention in writing to revisions other than the corrections called for by Engineer on previous submittals.

6.18 *Continuing the Work*

A. Contractor shall carry on the Work and adhere to the Progress Schedule during all disputes or disagreements with Owner. No Work shall be delayed or postponed pending resolution of any disputes or disagreements, except as permitted by Paragraph 15.04 or as Owner and Contractor may otherwise agree in writing.

6.19 *Contractor's General Warranty and Guarantee*

A. Contractor warrants and guarantees to Owner that all Work will be in accordance with the Contract Documents and will not be defective. Engineer and its officers, directors, members, partners, employees, agents, consultants, and subcontractors shall be entitled to rely on representation of Contractor's warranty and guarantee.

B. Contractor's warranty and guarantee hereunder excludes defects or damage caused by:

1. abuse, modification, or improper maintenance or operation by persons other than Contractor, Subcontractors, Suppliers, or any other individual or entity for whom Contractor is responsible; or

2. normal wear and tear under normal usage.

C. Contractor's obligation to perform and complete the Work in accordance with the Contract Documents shall be absolute. None of the following will constitute an acceptance of Work that is not in accordance with the Contract Documents or a release of Contractor's obligation to perform the Work in accordance with the Contract Documents:

1. observations by Engineer;

2. recommendation by Engineer or payment by Owner of any progress or final payment;

3. the issuance of a certificate of Substantial Completion by Engineer or any payment related thereto by Owner;

4. use or occupancy of the Work or any part thereof by Owner;

5. any review and approval of a Shop Drawing or Sample submittal or the issuance of a notice of acceptability by Engineer;

6. any inspection, test, or approval by others; or

7. any correction of defective Work by Owner.

6.20 *Indemnification*

A. To the fullest extent permitted by Laws and Regulations, Contractor shall indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to the performance of the Work, provided that any such claim, cost, loss, or damage is attributable to bodily injury, sickness, disease, or death, or to injury to or destruction of tangible property (other than the Work itself), including the loss of use resulting therefrom but only to the extent caused by any negligent act or omission of Contractor, any Subcontractor, any Supplier, or any individual or entity directly or indirectly employed by any of them to perform any of the Work or anyone for whose acts any of them may be liable .

B. In any and all claims against Owner or Engineer or any of their officers, directors, members, partners, employees, agents, consultants, or subcontractors by any employee (or the survivor or personal representative of such employee) of Contractor, any Subcontractor, any Supplier, or any individual or entity directly or indirectly employed by any of them to perform any of the Work, or anyone for whose acts any of them may be liable, the indemnification obligation under Paragraph 6.20.A shall not be limited in any way by any limitation on the amount or type of damages, compensation, or benefits payable by or for Contractor or any such Subcontractor, Supplier, or other individual or entity under workers' compensation acts, disability benefit acts, or other employee benefit acts.

C. The indemnification obligations of Contractor under Paragraph 6.20.A shall not extend to the liability of Engineer and Engineer's officers, directors, members, partners, employees, agents, consultants and subcontractors arising out of:

1. the preparation or approval of, or the failure to prepare or approve maps, Drawings, opinions, reports, surveys, Change Orders, designs, or Specifications; or

2. giving directions or instructions, or failing to give them, if that is the primary cause of the injury or damage.

6.21 *Delegation of Professional Design Services*

A. Contractor will not be required to provide professional design services unless such services are specifically required by the Contract Documents for a portion of the Work or unless such services are required to carry out Contractor's responsibilities for construction means, methods, techniques, sequences and procedures. Contractor shall not be required to provide professional services in violation of applicable law.

B. If professional design services or certifications by a design professional related to systems, materials or equipment are specifically required of Contractor by the Contract Documents, Owner and Engineer will specify all performance and design criteria that such services must satisfy. Contractor shall cause such services or certifications to be provided by a properly licensed professional, whose signature and seal shall appear on all drawings, calculations, specifications, certifications, Shop Drawings and other submittals prepared by such professional. Shop Drawings and other submittals related to the Work designed or certified by such professional, if prepared by others, shall bear such professional's written approval when submitted to Engineer.

C. Owner and Engineer shall be entitled to rely upon the adequacy, accuracy and completeness of the services, certifications or approvals performed by such design professionals, provided Owner and Engineer have specified to Contractor all performance and design criteria that such services must satisfy.

D. Pursuant to this Paragraph 6.21, Engineer's review and approval of design calculations and design drawings will be only for the limited purpose of checking for conformance with performance and design criteria given and the design concept expressed in the Contract Documents. Engineer's review and approval of Shop Drawings and other submittals (except design calculations and design drawings) will be only for the purpose stated in Paragraph 6.17.D.1.

E. Contractor shall not be responsible for the adequacy of the performance or design criteria required by the Contract Documents.

ARTICLE 7 – OTHER WORK AT THE SITE

7.01 *Related Work at Site*

A. Owner may perform other work related to the Project at the Site with Owner's employees, or through other direct contracts therefor, or have other work performed by utility owners. If such other work is not noted in the Contract Documents, then:

1. written notice thereof will be given to Contractor prior to starting any such other work; and

2. if Owner and Contractor are unable to agree on entitlement to or on the amount or extent, if any, of any adjustment in the Contract Price or Contract Times that should be allowed as a result of such other work, a Claim may be made therefor as provided in Paragraph 10.05.

B. Contractor shall afford each other contractor who is a party to such a direct contract, each utility owner, and Owner, if Owner is performing other work with Owner's employees, proper and safe access to the Site, provide a reasonable opportunity for the introduction and storage of materials and equipment and the execution of such other work, and properly coordinate the Work with theirs. Contractor shall do all cutting, fitting, and patching of the Work that may be required to properly connect or otherwise make its several parts come together and properly integrate with such other work. Contractor shall not endanger any work of others by cutting, excavating, or otherwise altering such work; provided, however, that Contractor may cut or alter others' work with the written consent of Engineer and the others whose work will be affected. The duties and responsibilities of Contractor under this Paragraph are for the benefit of such utility owners and other contractors to the extent that there are comparable provisions for the benefit of Contractor in said direct contracts between Owner and such utility owners and other contractors.

C. If the proper execution or results of any part of Contractor's Work depends upon work performed by others under this Article 7, Contractor shall inspect such other work and promptly report to Engineer in writing any delays, defects, or deficiencies in such other work that render it unavailable or unsuitable for the proper execution and results of Contractor's Work. Contractor's failure to so report will constitute an acceptance of such other work as fit and proper for integration with Contractor's Work except for latent defects and deficiencies in such other work.

7.02 *Coordination*

A. If Owner intends to contract with others for the performance of other work on the Project at the Site, the following will be set forth in Supplementary Conditions:

1. the individual or entity who will have authority and responsibility for coordination of the activities among the various contractors will be identified;

2. the specific matters to be covered by such authority and responsibility will be itemized; and

3. the extent of such authority and responsibilities will be provided.

B. Unless otherwise provided in the Supplementary Conditions, Owner shall have sole authority and responsibility for such coordination.

7.03 *Legal Relationships*

A. Paragraphs 7.01.A and 7.02 are not applicable for utilities not under the control of Owner.

B. Each other direct contract of Owner under Paragraph 7.01.A shall provide that the other contractor is liable to Owner and Contractor for the reasonable direct delay and disruption costs incurred by Contractor as a result of the other contractor's wrongful actions or inactions.

C. Contractor shall be liable to Owner and any other contractor under direct contract to Owner for the reasonable direct delay and disruption costs incurred by such other contractor as a result of Contractor's wrongful action or inactions.

ARTICLE 8 – OWNER'S RESPONSIBILITIES

8.01 *Communications to Contractor*

A. Except as otherwise provided in these General Conditions, Owner shall issue all communications to Contractor through Engineer.

8.02 *Replacement of Engineer*

A. In case of termination of the employment of Engineer, Owner shall appoint an engineer to whom Contractor makes no reasonable objection, whose status under the Contract Documents shall be that of the former Engineer.

8.03 *Furnish Data*

A. Owner shall promptly furnish the data required of Owner under the Contract Documents.

8.04 *Pay When Due*

A. Owner shall make payments to Contractor when they are due as provided in Paragraphs 14.02.C and 14.07.C.

8.05 *Lands and Easements; Reports and Tests*

A. Owner's duties with respect to providing lands and easements and providing engineering surveys to establish reference points are set forth in Paragraphs 4.01 and 4.05. Paragraph 4.02 refers to Owner's identifying and making available to Contractor copies of reports of explorations and tests of subsurface conditions and drawings of physical conditions relating to existing surface or subsurface structures at the Site.

8.06 *Insurance*

A. Owner's responsibilities, if any, with respect to purchasing and maintaining liability and property insurance are set forth in Article 5.

8.07 *Change Orders*

A. Owner is obligated to execute Change Orders as indicated in Paragraph 10.03.

8.08 *Inspections, Tests, and Approvals*

A. Owner's responsibility with respect to certain inspections, tests, and approvals is set forth in Paragraph 13.03.B.

8.09 *Limitations on Owner's Responsibilities*

A. The Owner shall not supervise, direct, or have control or authority over, nor be responsible for, Contractor's means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto, or for any failure of Contractor to comply with Laws and Regulations applicable to the performance of the Work. Owner will not be responsible for Contractor's failure to perform the Work in accordance with the Contract Documents.

8.10 *Undisclosed Hazardous Environmental Condition*

A. Owner's responsibility in respect to an undisclosed Hazardous Environmental Condition is set forth in Paragraph 4.06.

8.11 *Evidence of Financial Arrangements*

A. Upon request of Contractor, Owner shall furnish Contractor reasonable evidence that financial arrangements have been made to satisfy Owner's obligations under the Contract Documents.

8.12 *Compliance with Safety Program*

A. While at the Site, Owner's employees and representatives shall comply with the specific applicable requirements of Contractor's safety programs of which Owner has been informed pursuant to Paragraph 6.13.D.

ARTICLE 9 – ENGINEER'S STATUS DURING CONSTRUCTION

9.01 *Owner's Representative*

A. Engineer will be Owner's representative during the construction period. The duties and responsibilities and the limitations of authority of Engineer as Owner's representative during construction are set forth in the Contract Documents.

9.02 *Visits to Site*

A. Engineer will make visits to the Site at intervals appropriate to the various stages of construction as Engineer deems necessary in order to observe as an experienced and qualified design professional the progress that has been made and the quality of the various aspects of Contractor's executed Work. Based on information obtained during such visits and observations, Engineer, for the benefit of Owner, will determine, in general, if the Work is proceeding in accordance with the Contract Documents. Engineer will not be required to make exhaustive or

continuous inspections on the Site to check the quality or quantity of the Work. Engineer's efforts will be directed toward providing for Owner a greater degree of confidence that the completed Work will conform generally to the Contract Documents. On the basis of such visits and observations, Engineer will keep Owner informed of the progress of the Work and will endeavor to guard Owner against defective Work.

B. Engineer's visits and observations are subject to all the limitations on Engineer's authority and responsibility set forth in Paragraph 9.09. Particularly, but without limitation, during or as a result of Engineer's visits or observations of Contractor's Work, Engineer will not supervise, direct, control, or have authority over or be responsible for Contractor's means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto, or for any failure of Contractor to comply with Laws and Regulations applicable to the performance of the Work.

9.03 *Project Representative*

A. If Owner and Engineer agree, Engineer will furnish a Resident Project Representative to assist Engineer in providing more extensive observation of the Work. The authority and responsibilities of any such Resident Project Representative and assistants will be as provided in the Supplementary Conditions, and limitations on the responsibilities thereof will be as provided in Paragraph 9.09. If Owner designates another representative or agent to represent Owner at the Site who is not Engineer's consultant, agent or employee, the responsibilities and authority and limitations thereon of such other individual or entity will be as provided in the Supplementary Conditions.

9.04 *Authorized Variations in Work*

A. Engineer may authorize minor variations in the Work from the requirements of the Contract Documents which do not involve an adjustment in the Contract Price or the Contract Times and are compatible with the design concept of the completed Project as a functioning whole as indicated by the Contract Documents. These may be accomplished by a Field Order and will be binding on Owner and also on Contractor, who shall perform the Work involved promptly. If Owner or Contractor believes that a Field Order justifies an adjustment in the Contract Price or Contract Times, or both, and the parties are unable to agree on entitlement to or on the amount or extent, if any, of any such adjustment, a Claim may be made therefor as provided in Paragraph 10.05.

9.05 *Rejecting Defective Work*

A. Engineer will have authority to reject Work which Engineer believes to be defective, or that Engineer believes will not produce a completed Project that conforms to the Contract Documents or that will prejudice the integrity of the design concept of the completed Project as a functioning whole as indicated by the Contract Documents. Engineer will also have authority to require special inspection or testing of the Work as provided in Paragraph 13.04, whether or not the Work is fabricated, installed, or completed.

9.06 *Shop Drawings, Change Orders and Payments*

A. In connection with Engineer's authority, and limitations thereof, as to Shop Drawings and Samples, see Paragraph 6.17.

B. In connection with Engineer's authority, and limitations thereof, as to design calculations and design drawings submitted in response to a delegation of professional design services, if any, see Paragraph 6.21.

C. In connection with Engineer's authority as to Change Orders, see Articles 10, 11, and 12.

D. In connection with Engineer's authority as to Applications for Payment, see Article 14.

9.07 *Determinations for Unit Price Work*

A. Engineer will determine the actual quantities and classifications of Unit Price Work performed by Contractor. Engineer will review with Contractor the Engineer's preliminary determinations on such matters before rendering a written decision thereon (by recommendation of an Application for Payment or otherwise). Engineer's written decision thereon will be final and binding (except as modified by Engineer to reflect changed factual conditions or more accurate data) upon Owner and Contractor, subject to the provisions of Paragraph 10.05.

9.08 *Decisions on Requirements of Contract Documents and Acceptability of Work*

A. Engineer will be the initial interpreter of the requirements of the Contract Documents and judge of the acceptability of the Work thereunder. All matters in question and other matters between Owner and Contractor arising prior to the date final payment is due relating to the acceptability of the Work, and the interpretation of the requirements of the Contract Documents pertaining to the performance of the Work, will be referred initially to Engineer in writing within 30 days of the event giving rise to the question.

B. Engineer will, with reasonable promptness, render a written decision on the issue referred. If Owner or Contractor believes that any such decision entitles them to an adjustment in the Contract Price or Contract Times or both, a Claim may be made under Paragraph 10.05. The date of Engineer's decision shall be the date of the event giving rise to the issues referenced for the purposes of Paragraph 10.05.B.

C. Engineer's written decision on the issue referred will be final and binding on Owner and Contractor, subject to the provisions of Paragraph 10.05.

D. When functioning as interpreter and judge under this Paragraph 9.08, Engineer will not show partiality to Owner or Contractor and will not be liable in connection with any interpretation or decision rendered in good faith in such capacity.

9.09 *Limitations on Engineer's Authority and Responsibilities*

A. Neither Engineer's authority or responsibility under this Article 9 or under any other provision of the Contract Documents nor any decision made by Engineer in good faith either to exercise or not

exercise such authority or responsibility or the undertaking, exercise, or performance of any authority or responsibility by Engineer shall create, impose, or give rise to any duty in contract, tort, or otherwise owed by Engineer to Contractor, any Subcontractor, any Supplier, any other individual or entity, or to any surety for or employee or agent of any of them.

B. Engineer will not supervise, direct, control, or have authority over or be responsible for Contractor's means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto, or for any failure of Contractor to comply with Laws and Regulations applicable to the performance of the Work. Engineer will not be responsible for Contractor's failure to perform the Work in accordance with the Contract Documents.

C. Engineer will not be responsible for the acts or omissions of Contractor or of any Subcontractor, any Supplier, or of any other individual or entity performing any of the Work.

D. Engineer's review of the final Application for Payment and accompanying documentation and all maintenance and operating instructions, schedules, guarantees, bonds, certificates of inspection, tests and approvals, and other documentation required to be delivered by Paragraph 14.07.A will only be to determine generally that their content complies with the requirements of, and in the case of certificates of inspections, tests, and approvals that the results certified indicate compliance with, the Contract Documents.

E. The limitations upon authority and responsibility set forth in this Paragraph 9.09 shall also apply to the Resident Project Representative, if any, and assistants, if any.

9.10 *Compliance with Safety Program*

A. While at the Site, Engineer's employees and representatives shall comply with the specific applicable requirements of Contractor's safety programs of which Engineer has been informed pursuant to Paragraph 6.13.D.

ARTICLE 10 – CHANGES IN THE WORK; CLAIMS

10.01 *Authorized Changes in the Work*

A. Without invalidating the Contract and without notice to any surety, Owner may, at any time or from time to time, order additions, deletions, or revisions in the Work by a Change Order, or a Work Change Directive. Upon receipt of any such document, Contractor shall promptly proceed with the Work involved which will be performed under the applicable conditions of the Contract Documents (except as otherwise specifically provided).

B. If Owner and Contractor are unable to agree on entitlement to, or on the amount or extent, if any, of an adjustment in the Contract Price or Contract Times, or both, that should be allowed as a result of a Work Change Directive, a Claim may be made therefor as provided in Paragraph 10.05.

10.02 *Unauthorized Changes in the Work*

A. Contractor shall not be entitled to an increase in the Contract Price or an extension of the Contract Times with respect to any work performed that is not required by the Contract Documents as amended, modified, or supplemented as provided in Paragraph 3.04, except in the case of an emergency as provided in Paragraph 6.16 or in the case of uncovering Work as provided in Paragraph 13.04.D.

10.03 *Execution of Change Orders*

A. Owner and Contractor shall execute appropriate Change Orders recommended by Engineer covering:

1. changes in the Work which are: (i) ordered by Owner pursuant to Paragraph 10.01.A, (ii) required because of acceptance of defective Work under Paragraph 13.08.A or Owner's correction of defective Work under Paragraph 13.09, or (iii) agreed to by the parties;

2. changes in the Contract Price or Contract Times which are agreed to by the parties, including any undisputed sum or amount of time for Work actually performed in accordance with a Work Change Directive; and

3. changes in the Contract Price or Contract Times which embody the substance of any written decision rendered by Engineer pursuant to Paragraph 10.05; provided that, in lieu of executing any such Change Order, an appeal may be taken from any such decision in accordance with the provisions of the Contract Documents and applicable Laws and Regulations, but during any such appeal, Contractor shall carry on the Work and adhere to the Progress Schedule as provided in Paragraph 6.18.A.

10.04 *Notification to Surety*

A. If the provisions of any bond require notice to be given to a surety of any change affecting the general scope of the Work or the provisions of the Contract Documents (including, but not limited to, Contract Price or Contract Times), the giving of any such notice will be Contractor's responsibility. The amount of each applicable bond will be adjusted to reflect the effect of any such change.

10.05 *Claims*

A. *Engineer's Decision Required*: All Claims, except those waived pursuant to Paragraph 14.09, shall be referred to the Engineer for decision. A decision by Engineer shall be required as a condition precedent to any exercise by Owner or Contractor of any rights or remedies either may otherwise have under the Contract Documents or by Laws and Regulations in respect of such Claims.

B. *Notice:* Written notice stating the general nature of each Claim shall be delivered by the claimant to Engineer and the other party to the Contract promptly (but in no event later than 30 days) after the start of the event giving rise thereto. The responsibility to substantiate a Claim shall rest with the party making the Claim. Notice of the amount or extent of the Claim, with supporting data

shall be delivered to the Engineer and the other party to the Contract within 60 days after the start of such event (unless Engineer allows additional time for claimant to submit additional or more accurate data in support of such Claim). A Claim for an adjustment in Contract Price shall be prepared in accordance with the provisions of Paragraph 12.01.B. A Claim for an adjustment in Contract Times shall be prepared in accordance with the provisions of Paragraph 12.02.B. Each Claim shall be accompanied by claimant's written statement that the adjustment claimed is the entire adjustment to which the claimant believes it is entitled as a result of said event. The opposing party shall submit any response to Engineer and the claimant within 30 days after receipt of the claimant's last submittal (unless Engineer allows additional time).

C. *Engineer's Action*: Engineer will review each Claim and, within 30 days after receipt of the last submittal of the claimant or the last submittal of the opposing party, if any, take one of the following actions in writing:

1. deny the Claim in whole or in part;

2. approve the Claim; or

3. notify the parties that the Engineer is unable to resolve the Claim if, in the Engineer's sole discretion, it would be inappropriate for the Engineer to do so. For purposes of further resolution of the Claim, such notice shall be deemed a denial.

D. In the event that Engineer does not take action on a Claim within said 30 days, the Claim shall be deemed denied.

E. Engineer's written action under Paragraph 10.05.C or denial pursuant to Paragraphs 10.05.C.3 or 10.05.D will be final and binding upon Owner and Contractor, unless Owner or Contractor invoke the dispute resolution procedure set forth in Article 16 within 30 days of such action or denial.

F. No Claim for an adjustment in Contract Price or Contract Times will be valid if not submitted in accordance with this Paragraph 10.05.

ARTICLE 11 – COST OF THE WORK; ALLOWANCES; UNIT PRICE WORK

11.01 *Cost of the Work*

A. *Costs Included:* The term Cost of the Work means the sum of all costs, except those excluded in Paragraph 11.01.B, necessarily incurred and paid by Contractor in the proper performance of the Work. When the value of any Work covered by a Change Order or when a Claim for an adjustment in Contract Price is determined on the basis of Cost of the Work, the costs to be reimbursed to Contractor will be only those additional or incremental costs required because of the change in the Work or because of the event giving rise to the Claim. Except as otherwise may be agreed to in writing by Owner, such costs shall be in amounts no higher than those prevailing in the locality of the Project, shall not include any of the costs itemized in Paragraph 11.01.B, and shall include only the following items:

1. Payroll costs for employees in the direct employ of Contractor in the performance of the Work under schedules of job classifications agreed upon by Owner and Contractor. Such employees shall include, without limitation, superintendents, foremen, and other personnel employed full time on the Work. Payroll costs for employees not employed full time on the Work shall be apportioned on the basis of their time spent on the Work. Payroll costs shall include, but not be limited to, salaries and wages plus the cost of fringe benefits, which shall include social security contributions, unemployment, excise, and payroll taxes, workers' compensation, health and retirement benefits, bonuses, sick leave, vacation and holiday pay applicable thereto. The expenses of performing Work outside of regular working hours, on Saturday, Sunday, or legal holidays, shall be included in the above to the extent authorized by Owner.

2. Cost of all materials and equipment furnished and incorporated in the Work, including costs of transportation and storage thereof, and Suppliers' field services required in connection therewith. All cash discounts shall accrue to Contractor unless Owner deposits funds with Contractor with which to make payments, in which case the cash discounts shall accrue to Owner. All trade discounts, rebates and refunds and returns from sale of surplus materials and equipment shall accrue to Owner, and Contractor shall make provisions so that they may be obtained.

3. Payments made by Contractor to Subcontractors for Work performed by Subcontractors. If required by Owner, Contractor shall obtain competitive bids from subcontractors acceptable to Owner and Contractor and shall deliver such bids to Owner, who will then determine, with the advice of Engineer, which bids, if any, will be acceptable. If any subcontract provides that the Subcontractor is to be paid on the basis of Cost of the Work plus a fee, the Subcontractor's Cost of the Work and fee shall be determined in the same manner as Contractor's Cost of the Work and fee as provided in this Paragraph 11.01.

4. Costs of special consultants (including but not limited to engineers, architects, testing laboratories, surveyors, attorneys, and accountants) employed for services specifically related to the Work.

5. Supplemental costs including the following:

    a. The proportion of necessary transportation, travel, and subsistence expenses of Contractor's employees incurred in discharge of duties connected with the Work.

    b. Cost, including transportation and maintenance, of all materials, supplies, equipment, machinery, appliances, office, and temporary facilities at the Site, and hand tools not owned by the workers, which are consumed in the performance of the Work, and cost, less market value, of such items used but not consumed which remain the property of Contractor.

    c. Rentals of all construction equipment and machinery, and the parts thereof whether rented from Contractor or others in accordance with rental agreements approved by Owner with the advice of Engineer, and the costs of transportation, loading, unloading, assembly, dismantling, and removal thereof. All such costs shall be in accordance with the terms of

said rental agreements. The rental of any such equipment, machinery, or parts shall cease when the use thereof is no longer necessary for the Work.

d. Sales, consumer, use, and other similar taxes related to the Work, and for which Contractor is liable, as imposed by Laws and Regulations.

e. Deposits lost for causes other than negligence of Contractor, any Subcontractor, or anyone directly or indirectly employed by any of them or for whose acts any of them may be liable, and royalty payments and fees for permits and licenses.

f. Losses and damages (and related expenses) caused by damage to the Work, not compensated by insurance or otherwise, sustained by Contractor in connection with the performance of the Work (except losses and damages within the deductible amounts of property insurance established in accordance with Paragraph 5.06.D), provided such losses and damages have resulted from causes other than the negligence of Contractor, any Subcontractor, or anyone directly or indirectly employed by any of them or for whose acts any of them may be liable. Such losses shall include settlements made with the written consent and approval of Owner. No such losses, damages, and expenses shall be included in the Cost of the Work for the purpose of determining Contractor's fee.

g. The cost of utilities, fuel, and sanitary facilities at the Site.

h. Minor expenses such as telegrams, long distance telephone calls, telephone service at the Site, express and courier services, and similar petty cash items in connection with the Work.

i. The costs of premiums for all bonds and insurance Contractor is required by the Contract Documents to purchase and maintain.

B. *Costs Excluded:* The term Cost of the Work shall not include any of the following items:

1. Payroll costs and other compensation of Contractor's officers, executives, principals (of partnerships and sole proprietorships), general managers, safety managers, engineers, architects, estimators, attorneys, auditors, accountants, purchasing and contracting agents, expediters, timekeepers, clerks, and other personnel employed by Contractor, whether at the Site or in Contractor's principal or branch office for general administration of the Work and not specifically included in the agreed upon schedule of job classifications referred to in Paragraph 11.01.A.1 or specifically covered by Paragraph 11.01.A.4, all of which are to be considered administrative costs covered by the Contractor's fee.

2. Expenses of Contractor's principal and branch offices other than Contractor's office at the Site.

3. Any part of Contractor's capital expenses, including interest on Contractor's capital employed for the Work and charges against Contractor for delinquent payments.

4. Costs due to the negligence of Contractor, any Subcontractor, or anyone directly or indirectly employed by any of them or for whose acts any of them may be liable, including but not

limited to, the correction of defective Work, disposal of materials or equipment wrongly supplied, and making good any damage to property.

5. Other overhead or general expense costs of any kind and the costs of any item not specifically and expressly included in Paragraphs 11.01.A.

C. *Contractor's Fee:* When all the Work is performed on the basis of cost-plus, Contractor's fee shall be determined as set forth in the Agreement. When the value of any Work covered by a Change Order or when a Claim for an adjustment in Contract Price is determined on the basis of Cost of the Work, Contractor's fee shall be determined as set forth in Paragraph 12.01.C.

D. *Documentation:* Whenever the Cost of the Work for any purpose is to be determined pursuant to Paragraphs 11.01.A and 11.01.B, Contractor will establish and maintain records thereof in accordance with generally accepted accounting practices and submit in a form acceptable to Engineer an itemized cost breakdown together with supporting data.

11.02 *Allowances*

A. It is understood that Contractor has included in the Contract Price all allowances so named in the Contract Documents and shall cause the Work so covered to be performed for such sums and by such persons or entities as may be acceptable to Owner and Engineer.

B. *Cash Allowances:*

1. Contractor agrees that:

a. the cash allowances include the cost to Contractor (less any applicable trade discounts) of materials and equipment required by the allowances to be delivered at the Site, and all applicable taxes; and

b. Contractor's costs for unloading and handling on the Site, labor, installation, overhead, profit, and other expenses contemplated for the cash allowances have been included in the Contract Price and not in the allowances, and no demand for additional payment on account of any of the foregoing will be valid.

C. *Contingency Allowance:*

1. Contractor agrees that a contingency allowance, if any, is for the sole use of Owner to cover unanticipated costs.

D. Prior to final payment, an appropriate Change Order will be issued as recommended by Engineer to reflect actual amounts due Contractor on account of Work covered by allowances, and the Contract Price shall be correspondingly adjusted.

11.03 *Unit Price Work*

A. Where the Contract Documents provide that all or part of the Work is to be Unit Price Work, initially the Contract Price will be deemed to include for all Unit Price Work an amount equal to

the sum of the unit price for each separately identified item of Unit Price Work times the estimated quantity of each item as indicated in the Agreement.

B. The estimated quantities of items of Unit Price Work are not guaranteed and are solely for the purpose of comparison of Bids and determining an initial Contract Price. Determinations of the actual quantities and classifications of Unit Price Work performed by Contractor will be made by Engineer subject to the provisions of Paragraph 9.07.

C. Each unit price will be deemed to include an amount considered by Contractor to be adequate to cover Contractor's overhead and profit for each separately identified item.

D. Owner or Contractor may make a Claim for an adjustment in the Contract Price in accordance with Paragraph 10.05 if:

1. the quantity of any item of Unit Price Work performed by Contractor differs materially and significantly from the estimated quantity of such item indicated in the Agreement; and

2. there is no corresponding adjustment with respect to any other item of Work; and

3. Contractor believes that Contractor is entitled to an increase in Contract Price as a result of having incurred additional expense or Owner believes that Owner is entitled to a decrease in Contract Price and the parties are unable to agree as to the amount of any such increase or decrease.

ARTICLE 12 – CHANGE OF CONTRACT PRICE; CHANGE OF CONTRACT TIMES

12.01 *Change of Contract Price*

A. The Contract Price may only be changed by a Change Order. Any Claim for an adjustment in the Contract Price shall be based on written notice submitted by the party making the Claim to the Engineer and the other party to the Contract in accordance with the provisions of Paragraph 10.05.

B. The value of any Work covered by a Change Order or of any Claim for an adjustment in the Contract Price will be determined as follows:

1. where the Work involved is covered by unit prices contained in the Contract Documents, by application of such unit prices to the quantities of the items involved (subject to the provisions of Paragraph 11.03); or

2. where the Work involved is not covered by unit prices contained in the Contract Documents, by a mutually agreed lump sum (which may include an allowance for overhead and profit not necessarily in accordance with Paragraph 12.01.C.2); or

3. where the Work involved is not covered by unit prices contained in the Contract Documents and agreement to a lump sum is not reached under Paragraph 12.01.B.2, on the basis of the Cost of the Work (determined as provided in Paragraph 11.01) plus a Contractor's fee for overhead and profit (determined as provided in Paragraph 12.01.C).

C. *Contractor's Fee:* The Contractor's fee for overhead and profit shall be determined as follows:

1. a mutually acceptable fixed fee; or

2. if a fixed fee is not agreed upon, then a fee based on the following percentages of the various portions of the Cost of the Work:

   a. for costs incurred under Paragraphs 11.01.A.1 and 11.01.A.2, the Contractor's fee shall be 15 percent;

   b. for costs incurred under Paragraph 11.01.A.3, the Contractor's fee shall be five percent;

   c. where one or more tiers of subcontracts are on the basis of Cost of the Work plus a fee and no fixed fee is agreed upon, the intent of Paragraphs 12.01.C.2.a and 12.01.C.2.b is that the Subcontractor who actually performs the Work, at whatever tier, will be paid a fee of 15 percent of the costs incurred by such Subcontractor under Paragraphs 11.01.A.1 and 11.01.A.2 and that any higher tier Subcontractor and Contractor will each be paid a fee of five percent of the amount paid to the next lower tier Subcontractor;

   d. no fee shall be payable on the basis of costs itemized under Paragraphs 11.01.A.4, 11.01.A.5, and 11.01.B;

   e. the amount of credit to be allowed by Contractor to Owner for any change which results in a net decrease in cost will be the amount of the actual net decrease in cost plus a deduction in Contractor's fee by an amount equal to five percent of such net decrease; and

   f. when both additions and credits are involved in any one change, the adjustment in Contractor's fee shall be computed on the basis of the net change in accordance with Paragraphs 12.01.C.2.a through 12.01.C.2.e, inclusive.

12.02 *Change of Contract Times*

A. The Contract Times may only be changed by a Change Order. Any Claim for an adjustment in the Contract Times shall be based on written notice submitted by the party making the Claim to the Engineer and the other party to the Contract in accordance with the provisions of Paragraph 10.05.

B. Any adjustment of the Contract Times covered by a Change Order or any Claim for an adjustment in the Contract Times will be determined in accordance with the provisions of this Article 12.

12.03 *Delays*

A. Where Contractor is prevented from completing any part of the Work within the Contract Times due to delay beyond the control of Contractor, the Contract Times will be extended in an amount equal to the time lost due to such delay if a Claim is made therefor as provided in Paragraph 12.02.A. Delays beyond the control of Contractor shall include, but not be limited to, acts or

neglect by Owner, acts or neglect of utility owners or other contractors performing other work as contemplated by Article 7, fires, floods, epidemics, abnormal weather conditions, or acts of God.

B. If Owner, Engineer, or other contractors or utility owners performing other work for Owner as contemplated by Article 7, or anyone for whom Owner is responsible, delays, disrupts, or interferes with the performance or progress of the Work, then Contractor shall be entitled to an equitable adjustment in the Contract Price or the Contract Times, or both. Contractor's entitlement to an adjustment of the Contract Times is conditioned on such adjustment being essential to Contractor's ability to complete the Work within the Contract Times.

C. If Contractor is delayed in the performance or progress of the Work by fire, flood, epidemic, abnormal weather conditions, acts of God, acts or failures to act of utility owners not under the control of Owner, or other causes not the fault of and beyond control of Owner and Contractor, then Contractor shall be entitled to an equitable adjustment in Contract Times, if such adjustment is essential to Contractor's ability to complete the Work within the Contract Times. Such an adjustment shall be Contractor's sole and exclusive remedy for the delays described in this Paragraph 12.03.C.

D. Owner, Engineer, and their officers, directors, members, partners, employees, agents, consultants, or subcontractors shall not be liable to Contractor for any claims, costs, losses, or damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) sustained by Contractor on or in connection with any other project or anticipated project.

E. Contractor shall not be entitled to an adjustment in Contract Price or Contract Times for delays within the control of Contractor. Delays attributable to and within the control of a Subcontractor or Supplier shall be deemed to be delays within the control of Contractor.

ARTICLE 13 – TESTS AND INSPECTIONS; CORRECTION, REMOVAL OR ACCEPTANCE OF DEFECTIVE WORK

13.01 *Notice of Defects*

A. Prompt notice of all defective Work of which Owner or Engineer has actual knowledge will be given to Contractor. Defective Work may be rejected, corrected, or accepted as provided in this Article 13.

13.02 *Access to Work*

A. Owner, Engineer, their consultants and other representatives and personnel of Owner, independent testing laboratories, and governmental agencies with jurisdictional interests will have access to the Site and the Work at reasonable times for their observation, inspection, and testing. Contractor shall provide them proper and safe conditions for such access and advise them of Contractor's safety procedures and programs so that they may comply therewith as applicable.

13.03 *Tests and Inspections*

A. Contractor shall give Engineer timely notice of readiness of the Work for all required inspections, tests, or approvals and shall cooperate with inspection and testing personnel to facilitate required inspections or tests.

B. Owner shall employ and pay for the services of an independent testing laboratory to perform all inspections, tests, or approvals required by the Contract Documents except:

1. for inspections, tests, or approvals covered by Paragraphs 13.03.C and 13.03.D below;

2. that costs incurred in connection with tests or inspections conducted pursuant to Paragraph 13.04.B shall be paid as provided in Paragraph 13.04.C; and

3. as otherwise specifically provided in the Contract Documents.

C. If Laws or Regulations of any public body having jurisdiction require any Work (or part thereof) specifically to be inspected, tested, or approved by an employee or other representative of such public body, Contractor shall assume full responsibility for arranging and obtaining such inspections, tests, or approvals, pay all costs in connection therewith, and furnish Engineer the required certificates of inspection or approval.

D. Contractor shall be responsible for arranging and obtaining and shall pay all costs in connection with any inspections, tests, or approvals required for Owner's and Engineer's acceptance of materials or equipment to be incorporated in the Work; or acceptance of materials, mix designs, or equipment submitted for approval prior to Contractor's purchase thereof for incorporation in the Work. Such inspections, tests, or approvals shall be performed by organizations acceptable to Owner and Engineer.

E. If any Work (or the work of others) that is to be inspected, tested, or approved is covered by Contractor without written concurrence of Engineer, Contractor shall, if requested by Engineer, uncover such Work for observation.

F. Uncovering Work as provided in Paragraph 13.03.E shall be at Contractor's expense unless Contractor has given Engineer timely notice of Contractor's intention to cover the same and Engineer has not acted with reasonable promptness in response to such notice.

13.04 *Uncovering Work*

A. If any Work is covered contrary to the written request of Engineer, it must, if requested by Engineer, be uncovered for Engineer's observation and replaced at Contractor's expense.

B. If Engineer considers it necessary or advisable that covered Work be observed by Engineer or inspected or tested by others, Contractor, at Engineer's request, shall uncover, expose, or otherwise make available for observation, inspection, or testing as Engineer may require, that portion of the Work in question, furnishing all necessary labor, material, and equipment.

C. If it is found that the uncovered Work is defective, Contractor shall pay all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to such uncovering, exposure, observation, inspection, and testing, and of satisfactory replacement or reconstruction (including but not limited to all costs of repair or replacement of work of others); and Owner shall be entitled to an appropriate decrease in the Contract Price. If the parties are unable to agree as to the amount thereof, Owner may make a Claim therefor as provided in Paragraph 10.05.

D. If the uncovered Work is not found to be defective, Contractor shall be allowed an increase in the Contract Price or an extension of the Contract Times, or both, directly attributable to such uncovering, exposure, observation, inspection, testing, replacement, and reconstruction. If the parties are unable to agree as to the amount or extent thereof, Contractor may make a Claim therefor as provided in Paragraph 10.05.

13.05 *Owner May Stop the Work*

A. If the Work is defective, or Contractor fails to supply sufficient skilled workers or suitable materials or equipment, or fails to perform the Work in such a way that the completed Work will conform to the Contract Documents, Owner may order Contractor to stop the Work, or any portion thereof, until the cause for such order has been eliminated; however, this right of Owner to stop the Work shall not give rise to any duty on the part of Owner to exercise this right for the benefit of Contractor, any Subcontractor, any Supplier, any other individual or entity, or any surety for, or employee or agent of any of them.

13.06 *Correction or Removal of Defective Work*

A. Promptly after receipt of written notice, Contractor shall correct all defective Work, whether or not fabricated, installed, or completed, or, if the Work has been rejected by Engineer, remove it from the Project and replace it with Work that is not defective. Contractor shall pay all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to such correction or removal (including but not limited to all costs of repair or replacement of work of others).

B. When correcting defective Work under the terms of this Paragraph 13.06 or Paragraph 13.07, Contractor shall take no action that would void or otherwise impair Owner's special warranty and guarantee, if any, on said Work.

13.07 *Correction Period*

A. If within one year after the date of Substantial Completion (or such longer period of time as may be prescribed by the terms of any applicable special guarantee required by the Contract Documents) or by any specific provision of the Contract Documents, any Work is found to be defective, or if the repair of any damages to the land or areas made available for Contractor's use by Owner or permitted by Laws and Regulations as contemplated in Paragraph 6.11.A is found to be defective, Contractor shall promptly, without cost to Owner and in accordance with Owner's written instructions:

1. repair such defective land or areas; or

2. correct such defective Work; or

3. if the defective Work has been rejected by Owner, remove it from the Project and replace it with Work that is not defective, and

4. satisfactorily correct or repair or remove and replace any damage to other Work, to the work of others or other land or areas resulting therefrom.

B. If Contractor does not promptly comply with the terms of Owner's written instructions, or in an emergency where delay would cause serious risk of loss or damage, Owner may have the defective Work corrected or repaired or may have the rejected Work removed and replaced. All claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to such correction or repair or such removal and replacement (including but not limited to all costs of repair or replacement of work of others) will be paid by Contractor.

C. In special circumstances where a particular item of equipment is placed in continuous service before Substantial Completion of all the Work, the correction period for that item may start to run from an earlier date if so provided in the Specifications.

D. Where defective Work (and damage to other Work resulting therefrom) has been corrected or removed and replaced under this Paragraph 13.07, the correction period hereunder with respect to such Work will be extended for an additional period of one year after such correction or removal and replacement has been satisfactorily completed.

E. Contractor's obligations under this Paragraph 13.07 are in addition to any other obligation or warranty. The provisions of this Paragraph 13.07 shall not be construed as a substitute for, or a waiver of, the provisions of any applicable statute of limitation or repose.

13.08 *Acceptance of Defective Work*

A. If, instead of requiring correction or removal and replacement of defective Work, Owner (and, prior to Engineer's recommendation of final payment, Engineer) prefers to accept it, Owner may do so. Contractor shall pay all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) attributable to Owner's evaluation of and determination to accept such defective Work (such costs to be approved by Engineer as to reasonableness) and for the diminished value of the Work to the extent not otherwise paid by Contractor pursuant to this sentence. If any such acceptance occurs prior to Engineer's recommendation of final payment, a Change Order will be issued incorporating the necessary revisions in the Contract Documents with respect to the Work, and Owner shall be entitled to an appropriate decrease in the Contract Price, reflecting the diminished value of Work so accepted. If the parties are unable to agree as to the amount thereof, Owner may make a Claim therefor as provided in Paragraph 10.05. If the acceptance occurs after such recommendation, an appropriate amount will be paid by Contractor to Owner.

13.09 *Owner May Correct Defective Work*

A. If Contractor fails within a reasonable time after written notice from Engineer to correct defective Work, or to remove and replace rejected Work as required by Engineer in accordance with Paragraph 13.06.A, or if Contractor fails to perform the Work in accordance with the Contract Documents, or if Contractor fails to comply with any other provision of the Contract Documents, Owner may, after seven days written notice to Contractor, correct, or remedy any such deficiency.

B. In exercising the rights and remedies under this Paragraph 13.09, Owner shall proceed expeditiously. In connection with such corrective or remedial action, Owner may exclude Contractor from all or part of the Site, take possession of all or part of the Work and suspend Contractor's services related thereto, take possession of Contractor's tools, appliances, construction equipment and machinery at the Site, and incorporate in the Work all materials and equipment stored at the Site or for which Owner has paid Contractor but which are stored elsewhere. Contractor shall allow Owner, Owner's representatives, agents and employees, Owner's other contractors, and Engineer and Engineer's consultants access to the Site to enable Owner to exercise the rights and remedies under this Paragraph.

C. All claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) incurred or sustained by Owner in exercising the rights and remedies under this Paragraph 13.09 will be charged against Contractor, and a Change Order will be issued incorporating the necessary revisions in the Contract Documents with respect to the Work; and Owner shall be entitled to an appropriate decrease in the Contract Price. If the parties are unable to agree as to the amount of the adjustment, Owner may make a Claim therefor as provided in Paragraph 10.05. Such claims, costs, losses and damages will include but not be limited to all costs of repair, or replacement of work of others destroyed or damaged by correction, removal, or replacement of Contractor's defective Work.

D. Contractor shall not be allowed an extension of the Contract Times because of any delay in the performance of the Work attributable to the exercise by Owner of Owner's rights and remedies under this Paragraph 13.09.

ARTICLE 14 – PAYMENTS TO CONTRACTOR AND COMPLETION

14.01 *Schedule of Values*

A. The Schedule of Values established as provided in Paragraph 2.07.A will serve as the basis for progress payments and will be incorporated into a form of Application for Payment acceptable to Engineer. Progress payments on account of Unit Price Work will be based on the number of units completed.

14.02 *Progress Payments*

A. *Applications for Payments:*

1. At least 20 days before the date established in the Agreement for each progress payment (but not more often than once a month), Contractor shall submit to Engineer for review an

Application for Payment filled out and signed by Contractor covering the Work completed as of the date of the Application and accompanied by such supporting documentation as is required by the Contract Documents. If payment is requested on the basis of materials and equipment not incorporated in the Work but delivered and suitably stored at the Site or at another location agreed to in writing, the Application for Payment shall also be accompanied by a bill of sale, invoice, or other documentation warranting that Owner has received the materials and equipment free and clear of all Liens and evidence that the materials and equipment are covered by appropriate property insurance or other arrangements to protect Owner's interest therein, all of which must be satisfactory to Owner.

2. Beginning with the second Application for Payment, each Application shall include an affidavit of Contractor stating that all previous progress payments received on account of the Work have been applied on account to discharge Contractor's legitimate obligations associated with prior Applications for Payment.

3. The amount of retainage with respect to progress payments will be as stipulated in the Agreement.

B. *Review of Applications:*

1. Engineer will, within 10 days after receipt of each Application for Payment, either indicate in writing a recommendation of payment and present the Application to Owner or return the Application to Contractor indicating in writing Engineer's reasons for refusing to recommend payment. In the latter case, Contractor may make the necessary corrections and resubmit the Application.

2. Engineer's recommendation of any payment requested in an Application for Payment will constitute a representation by Engineer to Owner, based on Engineer's observations of the executed Work as an experienced and qualified design professional, and on Engineer's review of the Application for Payment and the accompanying data and schedules, that to the best of Engineer's knowledge, information and belief:

   a. the Work has progressed to the point indicated;

   b. the quality of the Work is generally in accordance with the Contract Documents (subject to an evaluation of the Work as a functioning whole prior to or upon Substantial Completion, the results of any subsequent tests called for in the Contract Documents, a final determination of quantities and classifications for Unit Price Work under Paragraph 9.07, and any other qualifications stated in the recommendation); and

   c. the conditions precedent to Contractor's being entitled to such payment appear to have been fulfilled in so far as it is Engineer's responsibility to observe the Work.

3. By recommending any such payment Engineer will not thereby be deemed to have represented that:

   a. inspections made to check the quality or the quantity of the Work as it has been performed have been exhaustive, extended to every aspect of the Work in progress, or

involved detailed inspections of the Work beyond the responsibilities specifically assigned to Engineer in the Contract Documents; or

b. there may not be other matters or issues between the parties that might entitle Contractor to be paid additionally by Owner or entitle Owner to withhold payment to Contractor.

4. Neither Engineer's review of Contractor's Work for the purposes of recommending payments nor Engineer's recommendation of any payment, including final payment, will impose responsibility on Engineer:

   a. to supervise, direct, or control the Work, or

   b. for the means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto, or

   c. for Contractor's failure to comply with Laws and Regulations applicable to Contractor's performance of the Work, or

   d. to make any examination to ascertain how or for what purposes Contractor has used the moneys paid on account of the Contract Price, or

   e. to determine that title to any of the Work, materials, or equipment has passed to Owner free and clear of any Liens.

5. Engineer may refuse to recommend the whole or any part of any payment if, in Engineer's opinion, it would be incorrect to make the representations to Owner stated in Paragraph 14.02.B.2. Engineer may also refuse to recommend any such payment or, because of subsequently discovered evidence or the results of subsequent inspections or tests, revise or revoke any such payment recommendation previously made, to such extent as may be necessary in Engineer's opinion to protect Owner from loss because:

   a. the Work is defective, or completed Work has been damaged, requiring correction or replacement;

   b. the Contract Price has been reduced by Change Orders;

   c. Owner has been required to correct defective Work or complete Work in accordance with Paragraph 13.09; or

   d. Engineer has actual knowledge of the occurrence of any of the events enumerated in Paragraph 15.02.A.

C. *Payment Becomes Due:*

1. Ten days after presentation of the Application for Payment to Owner with Engineer's recommendation, the amount recommended will (subject to the provisions of Paragraph 14.02.D) become due, and when due will be paid by Owner to Contractor.

D. *Reduction in Payment:*

1. Owner may refuse to make payment of the full amount recommended by Engineer because:

   a. claims have been made against Owner on account of Contractor's performance or furnishing of the Work;

   b. Liens have been filed in connection with the Work, except where Contractor has delivered a specific bond satisfactory to Owner to secure the satisfaction and discharge of such Liens;

   c. there are other items entitling Owner to a set-off against the amount recommended; or

   d. Owner has actual knowledge of the occurrence of any of the events enumerated in Paragraphs 14.02.B.5.a through 14.02.B.5.c or Paragraph 15.02.A.

2. If Owner refuses to make payment of the full amount recommended by Engineer, Owner will give Contractor immediate written notice (with a copy to Engineer) stating the reasons for such action and promptly pay Contractor any amount remaining after deduction of the amount so withheld. Owner shall promptly pay Contractor the amount so withheld, or any adjustment thereto agreed to by Owner and Contractor, when Contractor remedies the reasons for such action.

3. Upon a subsequent determination that Owner's refusal of payment was not justified, the amount wrongfully withheld shall be treated as an amount due as determined by Paragraph 14.02.C.1 and subject to interest as provided in the Agreement.

14.03 *Contractor's Warranty of Title*

A. Contractor warrants and guarantees that title to all Work, materials, and equipment covered by any Application for Payment, whether incorporated in the Project or not, will pass to Owner no later than the time of payment free and clear of all Liens.

14.04 *Substantial Completion*

A. When Contractor considers the entire Work ready for its intended use Contractor shall notify Owner and Engineer in writing that the entire Work is substantially complete (except for items specifically listed by Contractor as incomplete) and request that Engineer issue a certificate of Substantial Completion.

B. Promptly after Contractor's notification, Owner, Contractor, and Engineer shall make an inspection of the Work to determine the status of completion. If Engineer does not consider the Work substantially complete, Engineer will notify Contractor in writing giving the reasons therefor.

C. If Engineer considers the Work substantially complete, Engineer will deliver to Owner a tentative certificate of Substantial Completion which shall fix the date of Substantial Completion. There shall be attached to the certificate a tentative list of items to be completed or corrected before

final payment. Owner shall have seven days after receipt of the tentative certificate during which to make written objection to Engineer as to any provisions of the certificate or attached list. If, after considering such objections, Engineer concludes that the Work is not substantially complete, Engineer will, within 14 days after submission of the tentative certificate to Owner, notify Contractor in writing, stating the reasons therefor. If, after consideration of Owner's objections, Engineer considers the Work substantially complete, Engineer will, within said 14 days, execute and deliver to Owner and Contractor a definitive certificate of Substantial Completion (with a revised tentative list of items to be completed or corrected) reflecting such changes from the tentative certificate as Engineer believes justified after consideration of any objections from Owner.

D. At the time of delivery of the tentative certificate of Substantial Completion, Engineer will deliver to Owner and Contractor a written recommendation as to division of responsibilities pending final payment between Owner and Contractor with respect to security, operation, safety, and protection of the Work, maintenance, heat, utilities, insurance, and warranties and guarantees. Unless Owner and Contractor agree otherwise in writing and so inform Engineer in writing prior to Engineer's issuing the definitive certificate of Substantial Completion, Engineer's aforesaid recommendation will be binding on Owner and Contractor until final payment.

E. Owner shall have the right to exclude Contractor from the Site after the date of Substantial Completion subject to allowing Contractor reasonable access to remove its property and complete or correct items on the tentative list.

14.05 *Partial Utilization*

A. Prior to Substantial Completion of all the Work, Owner may use or occupy any substantially completed part of the Work which has specifically been identified in the Contract Documents, or which Owner, Engineer, and Contractor agree constitutes a separately functioning and usable part of the Work that can be used by Owner for its intended purpose without significant interference with Contractor's performance of the remainder of the Work, subject to the following conditions:

1. Owner at any time may request Contractor in writing to permit Owner to use or occupy any such part of the Work which Owner believes to be ready for its intended use and substantially complete. If and when Contractor agrees that such part of the Work is substantially complete, Contractor, Owner, and Engineer will follow the procedures of Paragraph 14.04.A through D for that part of the Work.

2. Contractor at any time may notify Owner and Engineer in writing that Contractor considers any such part of the Work ready for its intended use and substantially complete and request Engineer to issue a certificate of Substantial Completion for that part of the Work.

3. Within a reasonable time after either such request, Owner, Contractor, and Engineer shall make an inspection of that part of the Work to determine its status of completion. If Engineer does not consider that part of the Work to be substantially complete, Engineer will notify Owner and Contractor in writing giving the reasons therefor. If Engineer considers that part of the Work to be substantially complete, the provisions of Paragraph 14.04 will apply with respect to certification of Substantial Completion of that part of the Work and the division of responsibility in respect thereof and access thereto.

4. No use or occupancy or separate operation of part of the Work may occur prior to compliance with the requirements of Paragraph 5.10 regarding property insurance.

14.06 *Final Inspection*

A. Upon written notice from Contractor that the entire Work or an agreed portion thereof is complete, Engineer will promptly make a final inspection with Owner and Contractor and will notify Contractor in writing of all particulars in which this inspection reveals that the Work is incomplete or defective. Contractor shall immediately take such measures as are necessary to complete such Work or remedy such deficiencies.

14.07 *Final Payment*

A. *Application for Payment:*

1. After Contractor has, in the opinion of Engineer, satisfactorily completed all corrections identified during the final inspection and has delivered, in accordance with the Contract Documents, all maintenance and operating instructions, schedules, guarantees, bonds, certificates or other evidence of insurance, certificates of inspection, marked-up record documents (as provided in Paragraph 6.12), and other documents, Contractor may make application for final payment following the procedure for progress payments.

2. The final Application for Payment shall be accompanied (except as previously delivered) by:

   a. all documentation called for in the Contract Documents, including but not limited to the evidence of insurance required by Paragraph 5.04.B.6;

   b. consent of the surety, if any, to final payment;

   c. a list of all Claims against Owner that Contractor believes are unsettled; and

   d. complete and legally effective releases or waivers (satisfactory to Owner) of all Lien rights arising out of or Liens filed in connection with the Work.

3. In lieu of the releases or waivers of Liens specified in Paragraph 14.07.A.2 and as approved by Owner, Contractor may furnish receipts or releases in full and an affidavit of Contractor that: (i) the releases and receipts include all labor, services, material, and equipment for which a Lien could be filed; and (ii) all payrolls, material and equipment bills, and other indebtedness connected with the Work for which Owner might in any way be responsible, or which might in any way result in liens or other burdens on Owner's property, have been paid or otherwise satisfied. If any Subcontractor or Supplier fails to furnish such a release or receipt in full, Contractor may furnish a bond or other collateral satisfactory to Owner to indemnify Owner against any Lien.

B. *Engineer's Review of Application and Acceptance:*

1. If, on the basis of Engineer's observation of the Work during construction and final inspection, and Engineer's review of the final Application for Payment and accompanying

documentation as required by the Contract Documents, Engineer is satisfied that the Work has been completed and Contractor's other obligations under the Contract Documents have been fulfilled, Engineer will, within ten days after receipt of the final Application for Payment, indicate in writing Engineer's recommendation of payment and present the Application for Payment to Owner for payment. At the same time Engineer will also give written notice to Owner and Contractor that the Work is acceptable subject to the provisions of Paragraph 14.09. Otherwise, Engineer will return the Application for Payment to Contractor, indicating in writing the reasons for refusing to recommend final payment, in which case Contractor shall make the necessary corrections and resubmit the Application for Payment.

C. *Payment Becomes Due:*

1. Thirty days after the presentation to Owner of the Application for Payment and accompanying documentation, the amount recommended by Engineer, less any sum Owner is entitled to set off against Engineer's recommendation, including but not limited to liquidated damages, will become due and will be paid by Owner to Contractor.

14.08 *Final Completion Delayed*

A. If, through no fault of Contractor, final completion of the Work is significantly delayed, and if Engineer so confirms, Owner shall, upon receipt of Contractor's final Application for Payment (for Work fully completed and accepted) and recommendation of Engineer, and without terminating the Contract, make payment of the balance due for that portion of the Work fully completed and accepted. If the remaining balance to be held by Owner for Work not fully completed or corrected is less than the retainage stipulated in the Agreement, and if bonds have been furnished as required in Paragraph 5.01, the written consent of the surety to the payment of the balance due for that portion of the Work fully completed and accepted shall be submitted by Contractor to Engineer with the Application for such payment. Such payment shall be made under the terms and conditions governing final payment, except that it shall not constitute a waiver of Claims.

14.09 *Waiver of Claims*

A. The making and acceptance of final payment will constitute:

1. a waiver of all Claims by Owner against Contractor, except Claims arising from unsettled Liens, from defective Work appearing after final inspection pursuant to Paragraph 14.06, from failure to comply with the Contract Documents or the terms of any special guarantees specified therein, or from Contractor's continuing obligations under the Contract Documents; and

2. a waiver of all Claims by Contractor against Owner other than those previously made in accordance with the requirements herein and expressly acknowledged by Owner in writing as still unsettled.

ARTICLE 15 – SUSPENSION OF WORK AND TERMINATION

15.01 *Owner May Suspend Work*

A. At any time and without cause, Owner may suspend the Work or any portion thereof for a period of not more than 90 consecutive days by notice in writing to Contractor and Engineer which will fix the date on which Work will be resumed. Contractor shall resume the Work on the date so fixed. Contractor shall be granted an adjustment in the Contract Price or an extension of the Contract Times, or both, directly attributable to any such suspension if Contractor makes a Claim therefor as provided in Paragraph 10.05.

15.02 *Owner May Terminate for Cause*

A. The occurrence of any one or more of the following events will justify termination for cause:

1. Contractor's persistent failure to perform the Work in accordance with the Contract Documents (including, but not limited to, failure to supply sufficient skilled workers or suitable materials or equipment or failure to adhere to the Progress Schedule established under Paragraph 2.07 as adjusted from time to time pursuant to Paragraph 6.04);

2. Contractor's disregard of Laws or Regulations of any public body having jurisdiction;

3. Contractor's repeated disregard of the authority of Engineer; or

4. Contractor's violation in any substantial way of any provisions of the Contract Documents.

B. If one or more of the events identified in Paragraph 15.02.A occur, Owner may, after giving Contractor (and surety) seven days written notice of its intent to terminate the services of Contractor:

1. exclude Contractor from the Site, and take possession of the Work and of all Contractor's tools, appliances, construction equipment, and machinery at the Site, and use the same to the full extent they could be used by Contractor (without liability to Contractor for trespass or conversion);

2. incorporate in the Work all materials and equipment stored at the Site or for which Owner has paid Contractor but which are stored elsewhere; and

3. complete the Work as Owner may deem expedient.

C. If Owner proceeds as provided in Paragraph 15.02.B, Contractor shall not be entitled to receive any further payment until the Work is completed. If the unpaid balance of the Contract Price exceeds all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) sustained by Owner arising out of or relating to completing the Work, such excess will be paid to Contractor. If such claims, costs, losses, and damages exceed such unpaid balance, Contractor shall pay the difference to Owner. Such claims, costs, losses, and damages incurred by Owner will be reviewed by Engineer as to their reasonableness and, when

so approved by Engineer, incorporated in a Change Order. When exercising any rights or remedies under this Paragraph, Owner shall not be required to obtain the lowest price for the Work performed.

D. Notwithstanding Paragraphs 15.02.B and 15.02.C, Contractor's services will not be terminated if Contractor begins within seven days of receipt of notice of intent to terminate to correct its failure to perform and proceeds diligently to cure such failure within no more than 30 days of receipt of said notice.

E. Where Contractor's services have been so terminated by Owner, the termination will not affect any rights or remedies of Owner against Contractor then existing or which may thereafter accrue. Any retention or payment of moneys due Contractor by Owner will not release Contractor from liability.

F. If and to the extent that Contractor has provided a performance bond under the provisions of Paragraph 5.01.A, the termination procedures of that bond shall supersede the provisions of Paragraphs 15.02.B and 15.02.C.

15.03 *Owner May Terminate For Convenience*

A. Upon seven days written notice to Contractor and Engineer, Owner may, without cause and without prejudice to any other right or remedy of Owner, terminate the Contract. In such case, Contractor shall be paid for (without duplication of any items):

1. completed and acceptable Work executed in accordance with the Contract Documents prior to the effective date of termination, including fair and reasonable sums for overhead and profit on such Work;

2. expenses sustained prior to the effective date of termination in performing services and furnishing labor, materials, or equipment as required by the Contract Documents in connection with uncompleted Work, plus fair and reasonable sums for overhead and profit on such expenses;

3. all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) incurred in settlement of terminated contracts with Subcontractors, Suppliers, and others; and

4. reasonable expenses directly attributable to termination.

B. Contractor shall not be paid on account of loss of anticipated profits or revenue or other economic loss arising out of or resulting from such termination.

15.04 *Contractor May Stop Work or Terminate*

A. If, through no act or fault of Contractor, (i) the Work is suspended for more than 90 consecutive days by Owner or under an order of court or other public authority, or (ii) Engineer fails to act on any Application for Payment within 30 days after it is submitted, or (iii) Owner fails for 30 days

to pay Contractor any sum finally determined to be due, then Contractor may, upon seven days written notice to Owner and Engineer, and provided Owner or Engineer do not remedy such suspension or failure within that time, terminate the Contract and recover from Owner payment on the same terms as provided in Paragraph 15.03.

B. In lieu of terminating the Contract and without prejudice to any other right or remedy, if Engineer has failed to act on an Application for Payment within 30 days after it is submitted, or Owner has failed for 30 days to pay Contractor any sum finally determined to be due, Contractor may, seven days after written notice to Owner and Engineer, stop the Work until payment is made of all such amounts due Contractor, including interest thereon. The provisions of this Paragraph 15.04 are not intended to preclude Contractor from making a Claim under Paragraph 10.05 for an adjustment in Contract Price or Contract Times or otherwise for expenses or damage directly attributable to Contractor's stopping the Work as permitted by this Paragraph.

ARTICLE 16 – DISPUTE RESOLUTION

16.01 *Methods and Procedures*

A. Either Owner or Contractor may request mediation of any Claim submitted to Engineer for a decision under Paragraph 10.05 before such decision becomes final and binding. The mediation will be governed by the Construction Industry Mediation Rules of the American Arbitration Association in effect as of the Effective Date of the Agreement. The request for mediation shall be submitted in writing to the American Arbitration Association and the other party to the Contract. Timely submission of the request shall stay the effect of Paragraph 10.05.E.

B. Owner and Contractor shall participate in the mediation process in good faith. The process shall be concluded within 60 days of filing of the request. The date of termination of the mediation shall be determined by application of the mediation rules referenced above.

C. If the Claim is not resolved by mediation, Engineer's action under Paragraph 10.05.C or a denial pursuant to Paragraphs 10.05.C.3 or 10.05.D shall become final and binding 30 days after termination of the mediation unless, within that time period, Owner or Contractor:

1. elects in writing to invoke any dispute resolution process provided for in the Supplementary Conditions; or

2. agrees with the other party to submit the Claim to another dispute resolution process; or

3. gives written notice to the other party of the intent to submit the Claim to a court of competent jurisdiction.

ARTICLE 17 – MISCELLANEOUS

17.01 *Giving Notice*

A. Whenever any provision of the Contract Documents requires the giving of written notice, it will be deemed to have been validly given if:

1. delivered in person to the individual or to a member of the firm or to an officer of the corporation for whom it is intended; or

2. delivered at or sent by registered or certified mail, postage prepaid, to the last business address known to the giver of the notice.

17.02 *Computation of Times*

A. When any period of time is referred to in the Contract Documents by days, it will be computed to exclude the first and include the last day of such period. If the last day of any such period falls on a Saturday or Sunday or on a day made a legal holiday by the law of the applicable jurisdiction, such day will be omitted from the computation.

17.03 *Cumulative Remedies*

A. The duties and obligations imposed by these General Conditions and the rights and remedies available hereunder to the parties hereto are in addition to, and are not to be construed in any way as a limitation of, any rights and remedies available to any or all of them which are otherwise imposed or available by Laws or Regulations, by special warranty or guarantee, or by other provisions of the Contract Documents. The provisions of this Paragraph will be as effective as if repeated specifically in the Contract Documents in connection with each particular duty, obligation, right, and remedy to which they apply.

17.04 *Survival of Obligations*

A. All representations, indemnifications, warranties, and guarantees made in, required by, or given in accordance with the Contract Documents, as well as all continuing obligations indicated in the Contract Documents, will survive final payment, completion, and acceptance of the Work or termination or completion of the Contract or termination of the services of Contractor.

17.05 *Controlling Law*

A. This Contract is to be governed by the law of the state in which the Project is located.

17.06 *Headings*

A. Article and paragraph headings are inserted for convenience only and do not constitute parts of these General Conditions.

SUPPLEMENTAL CONDITIONS TO THE GENERAL CONDITIONS

This document is the supplementary conditions to the EJCDC Standard General Conditions of the Construction Contract copyrighted 2007. Under no circumstances shall these conditions be revised without written consent from Cape Fear Public Utility Authority. Supplementary conditions specific to projects shall be either included in the Agreement or within sections of Division 1: General Requirements.

SC – 1.01 Defined Terms

A.14 *Add the following sentence:*

Contract Times shall be measured in consecutive calendar days.

A.44 *Add the following sentence:*

A Substantial Complete date is the date the Owner accepts Substantial Completion in writing.

Add new term:

Soft Costs: Those costs not directly related to the construction, but are required to complete the Work and meet the requirements of this Contract. These costs include, but are not limited to, architect's and engineer's fees, testing and reporting fees, the appraisal fee, attorney's fees, government fees, permitting fees, tapping fees, assessment fees, interest, and loan fees.

SC – 2.01 Delivery of Bonds and Evidence of Insurance

B. *Add the following sentence:*

It is mutually agreed that CONTRACTOR is an independent contractor and not an agent or employee of the Authority nor does this create any type of joint employment relationship with any of the employees of the CONTRACTOR. As such the CONTRACTOR, or any employees thereof, or sub-contractors, or any employees thereof, shall not be entitled to any Authority employment benefits, such as, but not limited to, wages or salary, vacation, sick leave, insurance, workers' compensation, or pension and retirement benefits.

SC – 2.02 Copies of Documents

A. *Replace* "ten printed or hard copies" *with* "up to four printed or hard copies".

SC – 2.03 Commencement of Contract Times; Notice to Proceed

A. *Delete the last sentence of the first paragraph and replace with:*

In no event will the Contract Times commence to run later than the ninetieth day after the day of Bid opening or the thirtieth day after the Effective Date of the Agreement, whichever date is earlier.

SC – 3.03 Reporting and Resolving Discrepancies

A.1 *In the second sentence, replace* "has actual knowledge of" *with* "reasonably should discover,".

A.3 Delete the entire item

SC – 4.04 Underground Facilities

Add item C as follows:

B. Extreme care shall be exercised when excavating with heavy equipment near all existing structures and utilities. This includes, but is not limited to utility lines, utility poles, drainage structures, stability cables, buildings, streets, bridges, and railroads. The Owner will not assume, nor accept, any responsibility for charges assessed by private or public utility companies, the North Carolina Department of Transportation, local municipalities, or any property owners for damages sustained to their property by virtue of action on the part of the Contractor, nor such charges as may be imposed for personnel of these parties to furnish field location of any facilities to temporarily shore these facilities during construction. All such costs are to be borne by the Contractor and shall be included in the unit prices and/or lump sum prices stated in the Bid.

SC – 4.06 Hazardous Environmental Condition at Site

A. Replace entire item with:

Any reports detailing hazardous conditions on the Project Site that have been obtained shall be included in this Project Manual.

G. *Delete the entire item.*

SC – 5 BONDS AND INSURANCE

VOID entire Article 5 of General Conditions and replace with Bonds and Insurance section as follows:

5.01 Bonds: The Contractor shall provide both a Payment Bond and a Performance Bond wherein surety waives notice of any and all modifications, omissions, additions, changes, and advance payments or deferred payments in or about the Contract, and agrees that the obligations undertaken by the Bond shall not be impaired in any manner by reason or any such modifications, omissions, additions, changes, and advance payments or deferred payments. The surety bonds must set forth no requirements that suit be initiated prior to the time stipulated in applicable North Carolina Statutes of Limitation.

The Payment Bond and Performance Bond shall be executed by one or more surety companies legally authorized to do business in the State of North Carolina and shall become effective upon the awarding of the Contract. The attorney-in-fact who executes the required bonds on behalf of the surety shall attach a certified current copy of his or her power of attorney indicating his or her authority to execute the bonds and the monetary limit of such power.

These bonds shall remain in effect until two years after the date when final payment becomes due or until completion of the correction period specified in Paragraph 13.07, whichever is later, except as provided otherwise by Laws or Regulations by the Contract Documents.

The following are the requirements for both the Payment Bond and the Performance Bond for this Contract.

Payment Bond The Contractor shall provide a Payment Bond in the amount of one hundred percent (100%) of the Contract Price, conditioned upon the prompt payment for all labor or materials for which a Contractor or subcontractor is liable. The Payment Bond shall be solely for the protection of the persons furnishing materials or performing labor for which a Contractor or subcontractor is liable.

Performance Bond The Contractor shall provide a Performance Bond in the amount of one hundred percent (100%) of the Contract Price, conditioned upon the plans, specifications, and the Contract. The Performance Bond shall be solely for the protection of the Owner.

5.02 General Insurance: The Owner has listed standard **MINIMUM** insurance coverage in the Supplementary Conditions that the Contractor shall purchase, unless directed otherwise in writing. Additional insurance coverage requirements specific to this Project may be stated in Division I of the Project Manual. It is the responsibility of the Contractor to purchase the minimum required insurance stated in this Project Manual, as well as any other insurance it deems necessary to protect Contractor and the Owner.

5.03 Certificates and Notice of Cancellation: Before commencing Work, Contractor shall furnish Owner with Certificates of Insurance required as part of this Contract. Contractor shall maintain insurance from companies licensed to write business in North Carolina, with an A.M. Best Rating of "A" or higher and acceptable to Owner. The Certificates of Insurance shall indicate the type, amount, class of operations covered, applicable deductibles, effective date and expiration date of all policies.

The Certificates of Insurance, naming the OWNER as an additional insured where specified, shall be further evidenced by an actual endorsement furnished to the Owner before signing the contract between the Contractor and Owner.

The Contractor shall be solely responsible for securing Certificates of Insurance as therefore specified from all Subcontractors engaged in the Work.

5.04 **Workers Compensation and Employers Liability Insurance:** The Contractor shall provide Workers Compensation covering all of the Contractor's employees including officers, owners, and relatives to be engaged in the Work under this Contract, providing the required statutory benefits under North Carolina Workers Compensation Law, as well as Employers Liability Insurance providing limits at least in the amount of $500,000/$500,000/$500,000 applicable claims due to bodily injury by accident or disease and/or property damage.

The insurer shall agree to waive all rights of subrogation against the Cape Fear Public Utility Authority, its officers, officials, and employees for losses arising from work performed by the contractor for Cape Fear Public Utility Authority. Certificate of Insurance shall be further evidenced by an actual endorsement furnished to the Owner before signing the contract between the Contractor and Owner.

5.05 **Commercial General Liability Insurance:** The Contractor shall provide Commercial General Liability Insurance including coverage for the independent contractor operations, contractual liability assumed under the provisions of this Contract, products/completed operations liability, and broad form property damage liability. Exclusions applicable to explosion, collapse, and underground hazards are to be deleted when the Work involves these exposures. The policy shall provide liability limits at least in the amount listed in the table depending on the Contract Price:

Contract Price	Per Occurrence	Aggregate
Under $500,000	$1,000,000	$2,000,000
$500,000 and Above	$3,000,000	$5,000,000

The policy shall provide combined single limits, applicable to claims due to bodily injury and/or property damage evidenced by Endorsement #CG20 10 07 04. Owner shall be named as an additional insured under this policy.

5.06 **Automobile Liability Insurance:** The Contractor shall provide Automobile Liability Insurance covering all owned, non-owned, and hired vehicles to be used upon site or in connection with the Work. Contractor shall

provide liability limits at least in the amount of $1,000,000 per occurrence combined single limits applicable to claims due to bodily injury and/or property damage. Owner shall be named as an additional insured under this policy.

5.07 Umbrella Liability Insurance: The Contractor shall provide Umbrella Liability Insurance as excess coverage above the underlying Employers Liability Insurance, Commercial General Liability Insurance, and Automobile Liability Insurance policies required by this Contract. This coverage shall provide excess liability limits at least in the amount of $3,000,000 per occurrence, combined single limits, applicable to claims arising from bodily injury, personal injury, and/or property damage. The parties named as additional insured under the primary underlying policies are to be included as additional insured under the Umbrella Liability Insurance coverage.

5.08 Builder's Risk Insurance OR Contractors Installation Floater: The Contractor shall provide and maintain either Builder's Risk Insurance or Contractors Installation Floater depending on the type of Work. Contractor shall consult Owner before purchasing either the Builder's Risk Insurance or the Contractors Installation Floater to determine which coverage the Owner will accept as part of this Contract. The following are the **MINIMUM** requirements for both Builder's Risk Insurance and Contractors Installation Floater. Additional requirements specific to this Project may be stated in Division I of the Project Manual. It is the responsibility of the Contractor to purchase the minimum required insurance stated in this Project Manual, as well as any other insurance it deems necessary to protect Contractor and the Owner.

Builder's Risk Insurance The Contractor shall provide Builder's Risk Insurance written in the amount of one hundred percent (100%) of the Contract Price with coverage applicable to all risks of direct physical loss or damage to buildings, structures, machinery, attachments, and all permanent fixtures forming a part of said building or structures during the course of construction to include coverage for flood, windstorm, Boiler and Machinery, earthquake, and collapse. The policy should include coverage for Soft Costs, specifically to include coverage for extra expense incurred by the Owner due to delay in occupancy resulting from damage

to property covered by this policy. The Owner shall be named insured/loss payee as its interest may appear. The Contractor shall be responsible for payment of loss within any deductible applicable to this policy, changes, and advance payments or deferred payments.

Contractors Installation Floater The Contractor shall provide and maintain Contractors Installation Floater or appropriate insurance protecting against loss or damage of the equipment to be installed. Coverage shall be written in the amount of one hundred percent (100%) of the value of the equipment and materials in force until accepted by the Owner. The coverage shall be written in the Contractor's name and shall protect the Owner as its interests may appear. Contractor shall be responsible for any loss within the deductible applicable to this insurance.

5.09 Subcontractors: The Contractor shall be fully responsible for all acts and omissions of its Subcontractors and of persons and organizations employed by it to the same extent that Contractor would be responsible for these acts and omissions.

The Contractor shall either (a) require each of his Subcontractors to procure and to maintain during the life of his subcontract, Subcontractor's Public Liability and Property Damage, and Vehicular Liability of the type and in the same amounts as specified in the preceding paragraph, or (b) insure the activities of his Subcontractors in his own policy.

SC – 6.01 Supervision and Superintendence

A. *Add the following paragraphs:*

At no time during the course of construction shall any of the Contractor's personnel, including Subcontractors and their personnel, behave in a rude or abusive manner on the Project Site, or in any of this Project's meetings on and offsite. This type of behavior shall be grounds for dismissal of such personnel from the Project.

No alcoholic beverages or narcotics of any description will be allowed on the Project Site at any time. Furthermore, anyone under the influence of alcohol or narcotics shall be removed from the Project Site immediately

and shall permanently cease from performing any further Work on the Project.

B. *Replace item B with the following:*

At all times during the progress of the Work, Contractor shall assign a competent resident superintendent who shall not be replaced without written notice and approval by Owner and Engineer, which approval shall not be unreasonably be withheld.

Add the following sentences and items 1 and 2:

The superintendent shall be Contractor's representative at the Project Site and shall have authority to act on behalf of Contractor. All communications given to or received from the superintendent shall be binding on the Contractor.

1. The resident superintendent shall be on Site at all times while construction is in process, and shall be able to speak, read, and comprehend English.

2. The Owner and Engineer shall have the authority to approve or disapprove the Project superintendent and any subcontractors employed on the Project, if the superintendent or any subcontractors fail to meet stated qualifications made part of the bid package. The decision of the Owner and Engineer for approval or disapproval of the superintendent or any subcontractors shall be final and binding.

SC – 6.02 Labor; Working Hours

Add the following items C and D:

C. No Work shall be done between the hours of 7:00 PM and 7:00 AM without the prior written permission of the Owner. However, emergency Work may be done at any hour without prior permission.

D. Work between the hours of 7:00 PM and 7:00 AM may be undertaken as a regular procedure with the prior written permission of the Owner. Such permission, however, may be revoked at any time by Owner, if Contractor

fails to maintain adequate equipment and supervision for the proper execution and control of the Work during such hours.

SC – 6.03 Services, Materials, and Equipment

Add the following items D, E, F, G, H, and I:

D. Unless otherwise written, all work shall meet Owner's standards, which include CFPUA Material Specification Manual, CFPUA Technical Specifications for Construction, and CFPUA Standard Details. CFPUA standards are posted at www.cfpua.org. It shall be the Contractor's responsibility to ensure he/she is referring to the correct versions of these documents.

E. Contractor shall be responsible for all erosion and sediment control practices, both on and offsite.

F. Contractor shall provide any and all construction stakeout services as required to complete the Work.

G. Until the entire Work is accepted by Owner, Contractor shall have responsible charge and care of the Work and of all equipment and material to be used therein, and shall bear the risk of injury, loss, or damage to any part of the Work by action of the elements or from any other cause, whether or not it occurred during execution of the Work.

H. At Contractor's expense, Contractor shall rebuild, repair, restore, and make good all injuries, losses, or damages to any portion of the Work and any materials and equipment damaged or lost before the Work is complete. Contractor, at no additional expense to the Owner, shall provide suitable drainage and suitable structures as necessary to protect the Work or any portion thereof from damage.

I. Suspension of the Work or the granting of an extension of time for any cause shall not relieve Contractor of its responsibilities for the Work specified herein.

SC – 6.05 Substitutes and "Or-Equals"

A. *Remove the following from the 2nd sentence:*

"Unless the specification or description contains or is followed by the words reading that no like, equivalent, or "or-equal" item or no substitution is permitted,"

SC – 6.06 Concerning Subcontractors, Suppliers, and Others

A. *Add the following paragraphs:*

The Contractor may be permitted to subcontract a portion of the Work. If the Contractor decides to subcontract, the Contractor shall perform no less than 50% of the total contract amount and no less than 50% of the total labor within its own organization, unless permission is granted in writing from the Owner detailing an acceptable construction organization. Upon request by the Owner, the Contractor shall furnish sufficient documentation, satisfactory to the Owner, to demonstrate compliance herewith.

A subcontractor shall not subcontract, sell, transfer, assign, or otherwise dispose of its contract with the Contractor, nor any portion thereof, or of its right, title, or interest therein.

SC – 6.08 Permits

Add the following paragraph:

A. Contractor shall contact City of Wilmington, New Hanover County and North Carolina Department of Transportation prior to the start of construction to obtain and confirm all permits have been acquired. This includes but not limited to; Street Cut, Tree Removal, Traffic Control and Building Permits.

SC – 6.09 Laws and Regulations

Add the following items D, E, F, G and H:

D. North Carolina License Requirement: Pursuant to North Carolina General Statutes Section 87-15, Bidders must show evidence of a North Carolina Contractor's License prior to consideration of their Bids. Contractor shall

at all times during the performance of the Work maintain a valid North Carolina General Contractor's License.

E. Discrimination: In accordance with the North Carolina General Statutes Section 143-135.5, any Bidder who has been found guilty of discrimination on the basis of race, gender, religion, national origin, age, physical disability, or any other unlawful basis in its solicitation, selection, hiring, or treatment of other businesses are debarred from bidding on this Work.

F. Contractor shall be in full compliance with Article 2 of Chapter 64 of North Carolina General Statutes. Contractor must ensure compliance of any subcontractors subsequently hired after the bid.

G. The Contractor shall adhere to applicable regulations and standards pertaining to the work including but not limited to the following:

1. CFPUA Standard Details, Specifications, and Ordinances
2. North Carolina Department of Environment and Natural Resources (NCDENR)
3. Division of Coastal Management (CAMA)
4. U.S. Army Corp of Engineers (USACE)
5. City of Wilmington Standard Details, Specifications, and Ordinances
6. North Carolina Department of Transportation (NCDOT)

H. The Contractor shall notify CFPUA in the event that applicable regulations and standards cannot be followed.

SC – 6.10 Taxes

Add item B as follows:

B. Pursuant to North Carolina General Statutes Section 105-164.14, the Owner is eligible for sales and use tax refunds on all materials that become a permanent part of the construction. The Contractor agrees to provide the Owner documentation which meets the requirements of Sales and Use Tax Regulation 42 regarding request for refund of sales and use taxes.

Those requirements are outlined below:

All refund claims must be substantiated by proper documentary proof and only those taxes actually paid by the claimant during the fiscal year covered by the refund claim may be included in the claim.

Any local sales or use taxes included in the claim must be separately stated in the claim for refund. In cases where more than one county's sales and use tax has been paid, a breakdown must be attached to the claim for refund showing the amount of each county's local tax separately.

To substantiate a refund claim for sales and use taxes paid on purchases of building materials, supplies, fixtures, and equipment by its Contractor, the claimant (Owner) must secure from such Contractor certified statements setting forth the cost of the property purchased from each vendor and the amount of state and local sales and/or use taxes paid thereon. Such statement must also include the cost of any tangible personal property withdrawn from the Contractor's warehouse stock and amount of state and local sales or use tax paid therein by the Contractor. Similar certified statements by its Subcontractors must be obtained by the general Contractor and furnished to the claimant. Any local sales or use taxes included in the Contractor's statement must be shown separately from the State sales or use taxes. The Contractor's statements must not contain sales or use taxes paid on purchases of tangible personal property purchased by such Contractors for use in performing the Contract which does not annex to, affix to, or in some manner become a part of the building or structure being erected, altered, or repaired for the governmental entities as defined by North Carolina General Statutes Section 105-164(c). Examples of property on which sales and use tax has been paid by Contractor and which should not be included in the Contractor's statement are scaffolding, forms of concrete, fuel for the operation of machinery and equipment, tools, equipment repair, parts and equipment rentals, blueprints, etc.

NOTE: The State and County of purchase MUST be stated on the statement.

SC – 6.11 Use of Site and Other Areas

B. *Add the following sentence:*

The Contractor shall also be responsible for disposal of all other waste/spoil materials. Means of disposal shall be subject to the Engineer's approval.

E. *Add the following paragraph:*

Site Signage: Prior to any construction activity the Contractor shall erect sign(s) to inform the public work is in progress per sign detail that can be found at www.cfpua.org and per the following guidance:

1. The Contractor shall furnish and install construction sign(s) for identification of the project and shall be constructed in accordance with the following detail.

2. Construction sign(s) shall be located at or near the project site and amenable to public viewing. For work in right-of-ways, there shall be a sign on both ends of the work facing out to on-coming traffic. Sign locations shall be approved by the Owner prior to erection.

3. The sign shall be adequately supported with regard to site conditions and will be an adequate distance above the prevailing grade to permit public viewing.

4. The sign shall be constructed of 3.0 feet by 6.0 feet exterior type high density overlaid plywood or other sign material of equivalent quality and framed, as necessary to protect the sign from deterioration.

5. The sign lettering shall be of professional quality, black and either painted or vinyl on a matt white background. The CFPUA logo shall be strictly painted or vinyl to the color and proportion noted on the following detail.

6. Contractor may add information/logos to the sign with written permission.

7. A draft sign shall be rendered and reviewed and approved by Owner prior to production.

8. Sign(s) shall be maintained in good condition by the Contractor until completion of the construction project.

9. Sign(s) shall be removed and appropriately disposed of when the construction is complete and accepted by Owner.

SC – 6.13 Safety and Protection

A.3 *Add the following:*

Upon completion of the Work, all fences, signs and structures are to be restored to their original location and condition, unless shown differently on the Plans. The Contractor shall purchase new material, if necessary, to replace all materials damaged, lost, or destroyed. Landscape items, such as shrubs, bushes, and plantings, etc., shall be replaced as necessary to the satisfaction of the Owner.

A.4 *Add item 4 as follows:*

Throughout the duration of the Project, the convenience and the protection of the public must be provided for, and interference held to a minimum.

a. The Contractor shall, at all times, conduct the Work in such a manner as to ensure the least practicable obstruction to public travel. The convenience of the general public and the residents along and adjacent to the area of the Work shall be provided for in a satisfactory manner, consistent with the operation and local conditions. Roads and streets must be kept open at all times or suitable detours provided. Detours that are not provided in the Plans shall be preapproved by the Engineer. All detours and detour devices shall meet the Federal Highway Administration's (FHWA) guidelines, which can be found in the FHWA's Manual on Uniform Traffic Control Devices (MUTCD). Local law enforcement, fire, and rescue agencies shall be notified before any street is closed, and again as soon as it is opened. Access to fire hydrants and other fire

extinguishing equipment shall be provided and maintained at all times.

b. When necessary, the Contractor shall provide watchmen and appropriate lighting between twilight and sunrise, and shall erect and maintain barriers and all other necessary protection about the Work at its own expense. The Contractor shall take any other necessary precautions to protect life, limb, and property.

c. WORK NOTIFICATIONS: Contractor shall place a written notification on an accessible door believed to be most used of the residence/business within 48 hours and 72 hours of a disturbance to the property. Disturbance includes, but is not limited to, access to the property/main driveway, utility/telecommunication service disruption, and traffic detours in the area.

B. *Add the following paragraphs:*

The Contractor shall be aware of and abide by all Occupational Safety & Health Administration Laws and Regulations developed under the U.S. Department of Labor.

SC – 6.16 Emergencies

A. *Replace the second sentence with the following:*

The Contractor shall give the Engineer written notice immediately, and in no instance more than 24 hours after the alleged emergency, if Contractor believes that any significant changes in the Work or variations from the Contract Documents are required as a result. Changes in the Work or variations from the Contract Documents shall only be approved by Owner or Engineer if a written Work Change Directive or Change Order regarding such changes or variations is issued.

SC – 6.17 Shop Drawings and Samples

D. *Add new item 4 as follows:*

Contractor shall furnish required submittals with sufficient information and accuracy in order to obtain required approval of an item with no more

than three (3) submittals. Engineer will record Engineer's time for reviewing subsequent submittals of Shop Drawings, Samples, or other items requiring approval and Contractor shall reimburse Owner for Engineer's charges for such time.

In the event that Contractor requests a change of a previously approved item, Contractor shall reimburse Owner for Engineer's charges for its review time unless the need for such a change is beyond the control of the Contractor.

Contractor shall submit to the Owner an electronic copy of all approved submittals prior to final payment.

SC – 6.19 Contractor's General Warranty and Guarantee

Add items D and E as follows:

D. Except as otherwise specified, all Work shall be guaranteed by the Contractor and its sureties against defects resulting from the use of faulty or inferior materials, equipment, or workmanship for one year from the date of Substantial Completion of the Work.

E. A list of warranty start dates for equipment, products, and systems shall be maintained by the Contractor during construction and submitted to the Owner and Engineer prior to closeout.

SC – 6.20 Indemnification

Replace item A with the following:

A. To the fullest extent permitted by Laws and Regulations, Contractor shall hold harmless and indemnify the Authority, its officers, directors, members, partners, employees, of each and any of them from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of the obligations herein undertaken or resulting from the operations conducted, to the extent caused by any negligent act or omission of Contractor, any sub-consultant of Contractor, or any individual or agent

whose negligence is the proximate cause of damages incurred by the Authority.

Add new item as follows:

A.1 The indemnification obligation shall not be limited in any way by any limitation on the amount or type of damages, compensation or benefits payable by or for the Contractor or any Subcontractor under Workmen's Compensation Acts, Disability Benefit Acts or other employee benefits acts.

New Article Section

SC – 7.04 Claims Between Contractors

A. Should Contractor cause damage to the Work or property of any separate contractor at the Site, or should any claim arising out of the Contractor's performance of the Work at the Site be made by any separate contractor against Contractor, Owner, Engineer, or any other person, Contractor shall promptly attempt to settle with such other contractor by agreement, or to otherwise resolve the dispute. Contractor shall, to the fullest extent permitted by Laws and Regulations, indemnify and hold Owner and Engineer harmless from and against all claims, damages, losses and expenses (including, but not limited to, fees of engineers, architects, and other professionals, and fees arising from dispute settlement such as reasonable attorneys, court costs, mediation costs, and arbitration costs) arising directly, indirectly, or consequentially out of any action, legal or equitable, brought by any separate contractor against Owner or Engineer to the extent based on a claim arising out of Contractor's performance of the Work.

Should a separate contractor cause damage to the Work or property of the Contractor or should the performance of the work by a separate contractor at the Site give rise to any other claim, Contractor shall not institute any action, legal or equitable, against Owner or Engineer, or permit any action against either of them to be maintained and continued in its name or for its benefit on any action which seeks to impose liability on, or to recover damages from. Owner or Engineer on account of any such damage or claim. If Contractor is delayed at any time in performing or furnishing the Work by any act or neglect of a separate contractor, the

Owner and Contractor may consider an adjustment on the Contract Time attributable thereto. An extension of the Contract Time shall be Contractor's exclusive remedy with respect to Owner and Engineer for any delay, disruption, interference or hindrance caused by a separate contractor.

SC- 9.02 Visits to Site

A. *Replace the last sentence with the following:*

On the basis of such visits and observations, Engineer will keep Owner informed of the progress of the Work and will use reasonable care to guard Owner against defective Work. If Engineer observes any Work that does not conform to the Contract Documents, Engineer shall immediately make an oral and written report to the Owner detailing such defective Work.

SC-9.05 Rejecting Defective Work

A. *Make the following Modification:*

Add, and shall reject Work, in the first sentence after Engineer will have authority to reject Work.

SC – 9.09 Limitation of Engineer's Authority and Responsibilities

B. & C. *Add the following to the end of Paragraph B and C:*

, provided that Engineer has given prompt notice to the Owner of any deviations from the Contract Document or any defects or deficiencies in the Work of which the Engineer has knowledge, or reasonably should have knowledge.

SC – 10.01 Authorized Changes in the Work

A. *Add the following sentence:*

A change in the Contract Price or Contract Time shall only be accomplished by a written amendment to the Contract Documents, a written Change Order, or a written Work Change Directive.

SC – 10.03 Execution of Change Orders

A. Replace the first sentence with the following:

Owner and Contractor shall execute appropriate Change Orders recommended by Engineering and agreed upon by the parties covering:

SC – 11.01 Cost of the Work

A.1 *Remove the following:*

Remove the word “bonuses” from the fourth sentence.

Add the following:

Add the word “only” to the last sent after “shall be included in the above.”

A.4 *Add the following phrase to the end of the last sentence:*

but only to the extent authorized and approved in writing by the Engineer prior to incurring such costs.

A.5 *Replace item c as follows:*

c. Rentals of all construction equipment and machinery, and the parts thereof in accordance with rental agreements approved by Owner with the advice of Engineer, and the costs of transportation, loading, unloading, assembly, dismantling, and removal thereof. All such costs shall be in accordance with the terms of said rental agreements. The rental of any such equipment, machinery, or parts shall cease when the use thereof is no longer necessary for the Work.

Add item j as follows:

j. Any minor details of the Work not specifically mentioned in the specifications or shown on the plans, but obviously necessary for the proper completion of the Work, which shall be considered incidental as being a part of and included with the Work for which prices are given in the Bid Form.

SC – 11.03 Unit Price Work

D. *Replace the entire item with the following:*

The unit price of an item of Unit Price Work shall be subject to re-evaluation and adjustment under the following conditions:

1. If the total cost of a particular item of Unit Price Work amounts to 10% or more of the Contract Price and the variation in the quantity of that particular item of the Unit Price Work performed by Contractor differs by more than 25% from the estimated quantity of such item indicated in the Agreement; and

2. If there is no corresponding adjustment with respect to any other item of Work; and

3. If Contractor believes that Contractor has incurred additional expense as a result thereof or if Owner believes that the quantity variation entitles Owner to an adjustment in the unit price, either Owner or Contractor may make a Claim for an adjustment in the Contract Price in accordance with Article 11 of the General Conditions if the parties are unable to agree as to the effect of any such variation in the quantity of Unit Price Work performed.

SC – 12.03 Delays

A. *Add the following paragraph:*

Time extensions for abnormal adverse weather delays shall be granted according to the number of days during the month when precipitation exceeds the historical average number of rain events of 0.1 inches of rainfall or greater, as established by the National Oceanic and Atmospheric Administration (NOAA). The evaluation of weather will be based on the total number of such days over the entire Contract Time.

The following is a table created from data obtained by the Climatological Reports prepared between September 2007 and August 2008 by the NOAA National Weather Service Weather Forecast Office of Melbourne, Florida for Wilmington, North Carolina. This table indicates the average

number of calendar days per month with precipitation of 0.1 inches or more as determined between the years 1971 through 2000.

JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
8	6	7	5	6	7	8	7	6	5	5	6

Delays caused by adverse weather shall warrant an extension of Contract Time as specified above; however, no adjustment of Contract Price shall be granted.

A & C. *Add the following:*

After the word "abnormal" and before the word "weather" add the word "adverse".

C. *Add the following at the end of the paragraph:*

In no event shall Contractor be entitled to an adjustment in the Contract Price based on causes beyond control of Owner or Contractor.

E. *Add the following to end of the first sentence:*

, including but not limited to, claims for delay due to adverse weather conditions not of an abnormal nature.

SC – 13.03 Tests and Inspections

A. *Add the following sentence:*

Contractor shall provide Engineer with copies of all testing results and inspection reports.

D. *Add the following paragraph:*

Contractor also shall be responsible for arranging, obtaining, and paying for all costs for compaction tests and proof rolling of subgrade and base for roadway sections.

SC – 14.01 Schedule of Values

A. *Add the following to the end of the first sentence:*

and Owner.

SC – 14.02 Progress Payments

A.1 *replace "*At least 20 days before the date established in the Agreement for each progress payments"*with "*No later than the 30th day of every month"

A. *Add items 4 and 5 as follows:*

4. When the Owner agrees to pay for stored material and/or equipment, payments for stored material and equipment shall be based only upon actual cost to Contractor, and shall not include overhead and profit to Contractor.

5. Applications for Payment shall be accompanied with an accurate and complete updated schedule of operation or progress report, as applicable, and such other schedules and reports (including, without limitation, shop drawing schedule, procurement schedule, values of material, and equipment on hand) as Owner and Engineer may require.

B.5 *Add items e, f, g, h, i, j, and k as follows with the word "or" preceding:*

e. Contractor has failed to make payment to Subcontractors, suppliers or labor;

f. Contractor has failed to make acceptable submittals in accordance with accepted schedules;

g. Contractor has failed to submit an updated schedule of operation or progress report, as indicated above in Paragraph 14.02 A.5, with the Application for Payment;

h. There is reasonable evidence that the Work will not be completed within the Contract Times.

i. Contractor has caused damage to the Owner, separate contractor or a third party to whom the Owner is, or may be, liable;

j. Contractor owes Owner compensation for reimbursement charges incurred with respect to services performed by the Engineer for

submittal review as stated in Supplementary Conditions Section 6.17; or

k. Contractor owes Owner compensation for reimbursement charges incurred with respect to services performed by the Engineer for overtime inspection hours, if required when Contractor works more than 8 hours per day or 40 hours per week.

C.1 *Replace* "Ten days" *with* "Fifteen days".

D.1 *Add the item e as follows with the word "or" preceding*:

e. Owner has actual knowledge of the occurrence of any of the events enumerated in Paragraph 14.02 B.5 of the General and Supplementary Conditions.

SC – 14.07 Final Payment

A.2 *Add item e as follows:*

e. An affidavit stating all payrolls, invoices for materials and equipment, and other liabilities connected with the Work for which the Owner, or the Owner's property, might be responsible have been fully paid or otherwise satisfied.

C.1 *Replace entire item with:*

Final payment shall become due at the time provided in the North Carolina General Statutes Section 143-134.1.

D. *Add paragraph D as follows:*

D. Reduction in Payment:

Owner may refuse to make payment of full amount because:

1. Contractor has incurred liability for liquidated damages; or

2. Owner has actual knowledge of the occurrence of any of the events enumerated in Paragraphs 14.02 B.5 and 14.02 D.1 of the General and Supplementary Conditions.

SC – 14.09 Waiver of Claims

Delete paragraph A.1 in its entirety.

SC – 15.01 Owner may Suspend Work

A. Replace the third sentence with the following and add a fourth sentence:

Contractor shall be granted an extension of the Contract Times directly attributable to any such suspension if Contractor makes a Claim therefor as provided in paragraph 10.05. Contractor shall not be entitled to an adjustment of the Contract Price on account of any suspension of not more than 90 consecutive days.

SC – 15.02 Owner May Terminate for Cause

A.4 *Replace the Following:*

Replace the word "substantial" with word "material."

SC – 15.03 Owner May Terminate For Convenience

Replace the entire section as follows:

A. The Owner may, at any time, terminate the Contract in whole or in part for the Owner's convenience and without cause. Termination by the Owner under this paragraph shall be by written notice of termination delivered to the Contractor specifying the extent of the termination and effective date.

B. Upon receipt of a notice of termination for convenience, the Contractor shall immediately, in accordance with instructions from the Owner, proceed with performance of the following duties regardless of delay in determining or adjusting amounts due under this paragraph:

1. Cease operations as specified in the notice;

2. Place no further orders and enter into no further subcontracts for materials, labor, services, or facilities except as necessary to complete continued portions of the Contract;

3. Terminate all subcontracts and orders to the extent they relate to the Work terminated;

4. Proceed to complete the performance of Work not terminated;

5. Take actions that may be necessary, or that the Owner may direct, for the protection and preservation of the terminated Work; and

6. Transfer title to the Owner of completed or partially completed Work and materials, equipment, parts, fixtures, information, and Contract rights as the Contractor has.

C. Upon such termination, the Contractor shall recover as its sole remedy payment of the percentage of the Contract Price equal to the percentage of the Work performed satisfactorily and not previously paid for as determined by the Engineer. The Contractor hereby waives and forfeits all other claims for payment and damages, including but not limited to anticipated profits or revenue or other economic loss arising out of or resulting from such termination.

D. The Owner shall be credited for:

1. Payments previously made to the Contractor for the terminated portion of the Work;

2. Claims that the Owner has against the Contractor under this Contract; and

3. The value of the materials, supplies, equipment, or other items that are to be disposed of by the Contractor that are part of the Contract Price.

SC – 15.04 Contractor May Stop Work or Terminate

Replace the entire section as follows:

A. If the Work is stopped for a period of ninety (90) days by an order of any court or other public authority, or as a result of an act of the Government, through no fault of the Contractor or any person or entity working directly or indirectly for the Contractor, the Contractor may, upon ten (10) days' written notice to the Owner terminate performance under this Contract

and recover from the Owner payment for the actual reasonable expenditures of the Contractor for all Work executed and for materials, equipment, tools, construction equipment, and machinery actually purchased or rented solely for the Work, less any salvage value of such items.

New Article Section

SC – 16.02 Dispute Resolution Miscellaneous

A. The costs of any mediation shall be divided between parties in the dispute with at least one-third of the cost to be paid by the OWNER, if the OWNER is a party to the dispute.

B. All parties agree that only the North Carolina Courts located in New Hanover County shall have jurisdiction over the Contract, and any controversies arising out of this Contract and this Agreement not resolved by the mediation process shall be governed and construed in accordance with the law of the State of North Carolina.

C. Dispute resolution procedure is available to all parties involved in the construction project, including the architect, the construction manager at risk, the construction manager at risk, and the contractors (including all levels of subcontractors).

D. Any dispute seeking a non-monetary recovery or a monetary recovery of less than $15,000 is not subject to this mediation process.

SC – 17.04 Survival of Obligations

Add paragraph B as follows:

B. Contractor shall obtain from all Suppliers and manufacturers any and all warranties and guarantees of such Suppliers and manufacturers, whether or not specifically required in other areas of the Contract Documents, and shall assign such warranties and guarantees to Owner. Contractor further agrees to perform the Work in such a manner to preserve any and all manufacturer's warranties. With respect thereto, Contractor shall render reasonable assistance to Owner when requested, in order to enable Owner to enforce such warranties and guarantees. The assignment of any

warranties and guarantees shall not affect the correction period or any other provisions of these Contract Documents.

New Article Sections

SC – 17.07 Precedence

Where conflicts exist between these General Conditions, Supplementary Conditions, Division 1 sections of this Project Specification Manual, and the design drawings, the most stringent requirements shall govern.

SC– 17.08 Abiding by Gift Policy

All entities contracted by the AUTHORITY shall abide by the AUTHORITY's policy on Gifts and Favors by not knowingly place any AUTHORITY employee in a position to violate the AUTHORITY's policy on Gifts and Favors, which is as follows:

Authority Policy - Gifts and Favors

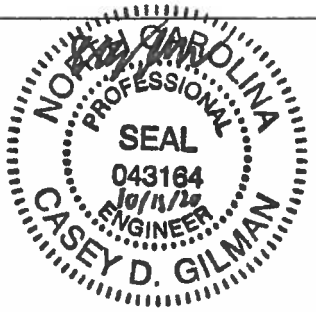
Authority employees are to serve all persons fairly and equitably without regard to personal or financial benefit. Therefore, all Authority employees are prohibited from accepting a non-monetary gift that exceeds a nominal value ($25). Non-monetary gifts may include: advertising items or souvenirs, honoraria for participating in meetings, and meals at banquets. Non-monetary free meals not provided at banquets are prohibited from being accepted by Authority employees. Any non-monetary gift received by an Authority employee must be reported to their respective Department Head. All Authority employees are strictly prohibited from accepting any type of direct or implied cash or monetary payment, gift or reward. All Authority employees are strictly prohibited from soliciting or receiving any gift, reward, promise of reward, or anything of value, directly or indirectly, in exchange of, or consideration for, some action to be taken or not taken in the performance of the employee's duties. All Authority employees are strictly prohibited from disclosing confidential information concerning the property, government, or affairs of the Authority or using such information to advance the financial or other private interest of themselves or others.

SC– 17.09 Advertising

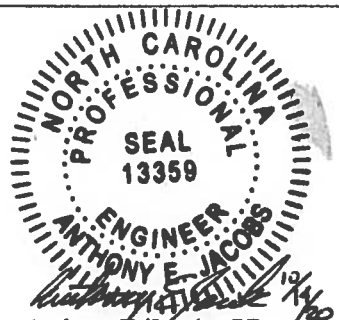
No advertising, sales promotion, other materials or presentations of the Contractor will identify or reference this contract, or the Cape Fear Public Utility Authority's name without the written consent of the Authority. This includes

professional conferences, meetings and other events where the Contractor may be discussing or referencing either verbally or in writing CFPUA and/or the services or products covered under this contract. Exception may be taken to the above with regard to listing the Authority as a job history reference in responses to requests for proposals.

TECHNICAL SPECIFICATIONS
TABLE OF CONTENTS
For
EMD FACILITY HVAC UPGRADES
Cape Fear Public Utility Authority
Wilmington, North Carolina



Casey D. Gilman, PE, LEED AP
Plumbing



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CAPA Project #18093

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DOCUMENT 003100 – AVAILABLE INFORMATION

1.1 SUMMARY

A. This Document with its referenced attachment is made available for Bidder convenience and information, but is not a warranty of existing conditions. This Document and its attachment are not part of the Contract Documents.

1. Roofing Contractor: Baker Roofing Company Contact Information:

Baker Contacts	Office #	Cell #	Email	Listed by Priority
Patrick Poirier Project Manager	910-799-7585	910-604-1701	ppoirier@bakeroofing.com	Baker Main Point of Contact
Mark Cole Foreman		910-340-6197	Mcole.muddycreek@gmail.com	On-Site Foreman
Charles Bergeron Construction Manager	910-799-7585	910-524-1013	cbergeron@bakerroofing.com	CM

2. The following documents are available for viewing as appended to this Document.

a. EMD Laboratory: See attached complete list of SDS for chemicals used in the EMD Laboratory.

END OF DOCUMENT 003100

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Search: All
Binder: EMD Laboratory

SDS ID	Product Name	Manufacturer	Revision Date
100197	0.05mol/l - Sodium Carbonate Solution	Nacalai Tesque, Incorporated	2014-04-10
100072	098AA Germ-X Original Hand Sanitizer - With Fragrance	Vi-Jon, Incorporated	2016-01-12
100360	1.0M KNO3 Solution	Hach Company	2017-10-05
100053	10 mls EPA Method 1664 LCS Sol., 40 mg Total of Stearic Acid and Hexadecane	Organic Standards Solutions International, Limited Liability Company	2015-02-04
100224	1000 µg/mL Manganese	VWR International, Limited Liability Company	2015-08-11
100054	100026-1 Iron (1000µg/mL in 2% HNO3)	High-Purity Standards	2017-03-07
100055	100061-2 Tin (1000µg/mL in 20% HCl) (1000µg/mL Tin in 30% HCl)	High-Purity Standards	2016-08-06
100228	2,3,5-TRIPHENYL-2H-TETRAZOLIUM CHLORIDE	Avantor Performance Materials, Limited Liability Company	2014-11-14
100126	501 Trihalomethane Mix	Restek Corporation	2018-06-15
100163	804AA 91% Isopropyl Alcohol	Vi-Jon, Incorporated	2015-07-07
100097	<0.1 NTU Calibration Solution	Hach Company	2019-10-21
100366	Acetate Buffer (1 M, pH 4.0)	Alfa Aesar	2018-07-13
100363	Acetic Acid Standard, 100 ppm CH3COOH in 10% (v/v) Ethanol	Ricca Chemical Company	2015-05-01
100024	Acetone	VWR International, Limited Liability Company	2015-03-19
100374	Activator Solution for Formaldehyde CHEMets, VACUettes, & Vacu-vials Kits, and for Glycol CHEMets & Vacu-vials Kits (Part Nos.: A-4201, A-4401)	CHEMetrics, Incorporated	2014-08-09
100373	Activator Solution for Glycol Vacu-vials & CHEMets Kits (Part No.: A-4400)	CHEMetrics, Incorporated	2014-09-16
100157	Ag/AgCl Filling Solution	Thermo Scientific	2009-04-08
100028	AJAX CLEANSING POWDER-REGULAR	Colgate-Palmolive Company	2016-01-04

100006	Alcojet	Alconox, Incorporated	2019-01-17
100074	Alkalinity Standard Solution Ampule, 0.5N	Hach Company	2018-02-14
100075	Aluminum Standard Solution, 100 ± 1 mg/l as Al	Hach Company	2017-06-10
100227	Aluminum TNT Reagent A	Hach Company	2018-08-17
100223	Aluminum TNT Reagent B	Hach Company	2014-09-27
100222	Aluminum TNT Reagent Vial	Hach Company	2014-09-27
100221	Aluminum TNT Zero Vial	Hach Company	2018-08-17
100368	AluVer 3 Aluminum Reagent	Hach Company	2018-01-09
100159	Ammonia Electrode Filling Solution	Thermo Scientific	2016-07-12
100158	Ammonia Electrode Storage Solution	Thermo Scientific	2017-10-25
100220	Ammonia Electrode Storage Solution	Hach Company	2017-10-06
100079	Ammonia Standard Solution 1000 mg/l as NH3(N)	Hach Company	2018-02-14
100127	Ammonia Standard, 1000 ppm NH_3 (822 ppm N)	Ricca Chemical Company	2015-05-01
100219	AMMONIUM CHLORIDE	VWR International, Limited Liability Company	2015-02-09
100218	Ammonium Molybdate Tetrahydrate, ACS Reagent Grade	Ricca Chemical Company	2015-05-01
100338	Antifoam B Emulsion	Sigma-Aldrich Incorporated	2019-06-16
100004	Argon (Argon-40; Argon, isotope of mass 40; 40Ar; ARGON; Argon,Welding Quality; ARGON,COMPRESSED)	Airgas USA, LLC and its affiliates	2019-04-11
100217	BBL CRYSTAL Gram-Positive ID Kit	BD Diagnostic Systems	2016-06-04
100369	Bleaching 3 Reagent	Hach Company	2018-03-23
100080	BOD Nutrient Buffer Pillows	Hach Company	2018-01-10
100026	Bon Ami Cleanser	Faultless Starch / Bon Ami Company	2016-11-14
100346	Bromothymol blue 0.04%	VWR International, Limited Liability Company	2016-02-27
100000	Bromothymol Blue, 0.04% Aqueous Solution	Fisher Scientific	2017-05-26
100027	BTF BioBall	BTF - A bioMerieux Company	2016-09-12
100042	Buffer pH 10.0, Blue READY TO USE FOR pH CALIBRATION, pH 10.00 ± 0.01 at 25º C NIST Traceable	EMD Millipore Corporation	2017-06-20
100043	Buffer pH 4.0 Red	EMD Millipore Corporation	2014-09-05
100044	Buffer pH 7.0, Yellow	EMD Millipore	2014-09-05

		Corporation	
100136	Buffer, Reference Standard, pH 10.00 ± 0.01 at 25°C	Ricca Chemical Company	2018-05-14
100137	Buffer, Reference Standard, pH 4.00 ± 0.01 at 25°C (Color Coded Red)	Ricca Chemical Company	2018-05-14
100138	Buffer, Reference Standard, pH 7.00 ± 0.01 at 25°C (Color Coded Green)	Ricca Chemical Company	2018-05-14
100175	CALCIUM CARBONATE (Marble Chips / Boiling Chips / Marble Rocks / Limestone Chips)	Ward's Science	2018-05-14
100345	Calcium chloride (Dowflake; Calpus; Caltac)	Fisher Scientific	2018-01-19
100057	Calcium chloride dihydrate ((Crystals/Powder/Granules/USP/FCC/EP/Certified ACS))	Fisher Scientific	2018-01-17
100128	Calcium Chloride Standard, 1000 ppm CaCO3 (400 ppm Ca), 0.0100 M Ca2+, 0.0200 N Ca2+	Ricca Chemical Company	2017-10-16
100018	CALCIUM CHLORIDE, PELLETS	Avantor Performance Materials, Limited Liability Company	2014-12-11
100361	CARBON CHIPS #501A	Unknown	1950-01-01
100029	Ceramic Marking Ink (Blue Marking Ink, Blue Pen Ink)	CoorsTek	2015-05-15
100087	Chemical Oxygen Demand Standard Solution 1000 mg/l COD	Hach Company	2017-11-02
100216	Chloride Ionic Strength Adjustment Buffer Powder Pillows	Hach Company	2018-01-29
100081	Chloride Reference Standard Solution 0.0282N	Hach Company	2018-08-16
100082	Chloride Standard Solution 0.00282 N	Hach Company	2018-02-27
100215	Chloride Standard, 500 ppm Cl^- (0.0141 Normal)	Ricca Chemical Company	2015-05-01
100007	Citrajet	Alconox, Incorporated	2017-03-03
100008	Citranox	Alconox, Incorporated	2017-03-03
100085	COD2 Mercury-Free COD Reagent 20-1500 mg/l Range	Hach Company	2018-08-17
100086	COD2 Mercury-Free COD Reagent 3-150 mg/l Range	Hach Company	2018-08-17
100110	Colilert Comparator	Idexx Laboratories, Incorporated	2017-03-01
100109	Colilert-18, Colilert-250, Colilert	Idexx Laboratories, Incorporated	2017-09-26
100111	Colisure	Idexx Laboratories, Incorporated	2015-12-29
100213	Colitag Comparator	Hach Company	2017-10-13
100372	COLOR COMPARATOR for CHEMets, ULR CHEMets, and VACUettes Kits (Parts Nos.: C-1805, C-1805E, C-2810, C-2810A, C-2810B, C-2810C, C-2810D, C-3901, C-3902, C-4601, C-4601A, C-4601B, C-4601C, C-4601D, C-4610, C-4610A, C-4610B, C-4610C,	CHEMetrics, Incorporated	2014-11-20

	C-4610D, C-4815, C-6502, C-6502D, C-7501, C-7511, C-7518, C-7540, C-7599, C-9011)		
100088	Color Standard Solution Ampule 500 Platinum Cobalt Color Units	Hach Company	2016-12-28
100130	Conductivity Standard, 10 µS/cm at 25°C (4.7 ppm TDS as NaCl)	Ricca Chemical Company	2018-05-14
100129	Conductivity Standard, 1413 µS/cm at 25°C	Ricca Chemical Company	2018-05-14
100339	Conductivity Standard, 150 µS/cm at 25°C (71 ppm TDS as NaCl)	Ricca Chemical Company	2018-05-14
100212	Conductivity Standard, 50 µS/cm at 25°C (23.6 ppm TDS as NaCl)	Ricca Chemical Company	2018-05-14
100211	Conductivity Standard, 500 µS/cm at 25°C (240 ppm TDS as NaCl)	Ricca Chemical Company	2018-05-14
100031	Conflikt	Decon Laboratories, Incorporated	2018-05-01
100155	Cutter Insect Repellent2	Chemsico Div. of United Industries Corporation	2010-10-18
100154	Cutter Skinsations Insect Repellent1	Chemsico Div. of United Industries Corporation	2016-08-05
100160	D(+)-Glucose (Dextrose)	Fisher Scientific	2018-01-23
100123	Dawn Professional Dish Detergent	Procter & Gamble Company	2018-06-13
100119	Dextrose	Avantor Performance Materials, Limited Liability Company	2019-01-04
100347	di-Potassium hydrogen phosphate ACS	VWR International Limited	2017-12-23
100083	Digestion Solution for COD 20-1500 mg/l Range	Hach Company	2019-03-05
100084	Digestion Solution for COD 3-150 mg/L Range	Hach Company	2019-03-05
100210	Dilution Water Concentrate, APHA	Hach Company	2018-10-08
100030	DOW CORNING HIGH VACUUM GREASE	Dow Corning Corporation	2017-09-13
100089	DPD Free Chlorine Reagent	Hach Company	2018-02-12
100090	DPD Total Chlorine Reagent	Hach Company	2018-05-04
100164	Drierite, Indicating	W. A. Hammond Drierite Co., Limited	2019-03-22
100165	Drierite, Regular Drierite, Non-Indicating Drierite, Commercial Drierite (Calcium Sulfate)	W. A. Hammond Drierite Co., Limited	2019-01-01
100131	EDTA Titrant, 0.0100 Molar (M/100)	Ricca Chemical Company	2018-05-14

100099	Electrode Cleaning Solution	Hach Company	2018-08-30
100112	Enterolert, Enterolert-E, Enterolert-DW, Enterolert-250	Idexx Laboratories, Incorporated	2016-01-15
100208	Environmental Standard Custom 4 - 125mL	PerkinElmer, Incorporated	2019-02-08
100156	EPA 524.2 Fortification Solution	Sigma-Aldrich Incorporated	2017-11-25
100375	Ethanol, Lab Grade	AquaPhoenix Scientific, Incorporated	2014-11-19
100386	ez GGA for BOD Test	Hach Company	2018-01-25
100229	Ferric chloride hexahydrate (Ferric chloride hexahydrate)	Fisher Scientific	2018-01-17
100344	Ferric Chloride Hexahydrate	AquaPhoenix Scientific, Incorporated	2014-12-18
100207	FerroVer Iron Reagent	Hach Company	2018-03-06
100174	Fluoride Standard - 0.1 M NaF	Fisher Scientific	2016-08-09
100206	Fluoride standard 0.1 mg/ml	VWR International, Limited Liability Company	2015-05-28
100132	Fluoride Standard, 100 ppm F^- (3171-1, 3171-16, 3171-32, 3171-4, 3171-5, 3171-8)	Ricca Chemical Company	2018-05-14
100133	Fluoride Standard, 1000 ppm F^-	Ricca Chemical Company	2018-05-14
100371	Formaldehyde Vacu-vials Ampoules and CHEMets & VACUettes Refills; Glycol Vacu-vials Ampoules and CHEMets Refill (K-4203 Ampoules, K-4403 Ampoules, K-4423 Ampoules, R-4605, R-4605A, R-4605B, R-4605C, R-4605D, R-4815)	CHEMetrics, Incorporated	2014-08-10
100343	Fortification Solution	SPEX CertiPrep, Limited Liability Company	2016-04-11
100205	Gelex Turbidity Standard	Hach Company	2018-10-08
100204	Glucose-Glutamic Acid	Environmental Express	2013-01-10
100073	Great Value Bleach 1	KIK International	2015-04-26
100214	Hach Colitag P/A Test	Hach Company	2017-07-19
100226	Hach Colitag P/A Test	Hach Company	2018-01-17
100005	Helium (helium (dot); Helium-4; He; o-Helium; UN 1046,Helium USP)	Airgas USA, LLC and its affiliates	2018-04-23
100014	Helium, Compressed	Arc3 Gases	2015-08-17
100060	Hexanes (Hex)	Fisher Scientific	2018-01-17
100025	Hydrochloric Acid	VWR International,	2015-03-30

		Limited Liability Company	
100036	Hydrochloric Acid 34-37% OmniTrace	EMD Millipore Corporation	2019-01-17
100341	Hydrochloric acid 50% v/v	VWR International, Limited Liability Company	2016-02-27
100038	Hydrochloric Acid GR ACS	EMD Millipore Corporation	2019-01-17
100061	Hydrochloric acid, Trace Metal Grade (Muriatic acid; Hydrogen chloride, HCl)	Fisher Scientific	2018-01-18
100019	HYDROGEN PEROXIDE	Avantor Performance Materials, Limited Liability Company	2016-12-06
100203	Instrument Calibration Standard 2	PerkinElmer, Incorporated	2018-05-02
100202	Ionic Strength Adjustor, pH Indicating and Adjusting, for use with Ammonia Selective Electrode	Ricca Chemical Company	2018-05-14
100062	Iron, reference standard solution 1000 ppm	Fisher Scientific	2019-04-25
100201	Jasco Pure Gum Spirits Turpentine	W. M. Barr	2016-02-12
100116	KRDKUT 6PK CLEANER DEGREASER	Rust-Oleum Corporation	2019-06-13
100063	L-Ascorbic acid (Vitamin C; 3-Keto-L-glucofuranolactone; Ascorbic acid)	Fisher Scientific	2018-04-11
100059	L-Glutamic acid (L-(+)-Glutamic acid; alpha-Aminoglutaric acid; Glutaminol; Glutaton (Crystals/Powder/Certified))	Fisher Scientific	2018-01-17
100377	L-Glutamic acid (alpha-Glutamic acid; 2-Aminopentanedioic acid; alpha-Aminoglutaric acid)	Alfa Aesar	2018-03-16
100378	LEYBONOL LVO 100 (300326932)	Leybold UK Limited	2018-12-18
100200	LEYBONOL LVO 420	Leybold GmbH	2015-09-23
100009	Liquinox	Alconox, Incorporated	2017-05-17
100118	Lysol Disinfectant Spray - All Scents	Reckitt Benckiser	2018-09-25
100358	Lysol IC Quaternary Disinfectant Cleaner	Reckitt Benckiser	2016-02-06
100209	M FC agar for microbiology	EMD Millipore Corporation	2014-06-13
100039	Magnesium Sulfate Heptahydrate GR ACS	EMD Millipore Corporation	2017-11-08
100091	ManVer Hardness Indicator	Hach Company	2018-08-02
100356	McFarland Equivalence Standard	Remel	2016-10-10
100125	MCFARLAND TURBIDITY STANDARD	Remel	2015-03-12
100035	Mechanical Pump Oil - Ultragrade 15, 19, 20, 70 (Ultragrade 15: H110-26-010, H110-26-011, H110-26-012, H110-26-013, H110-26-	Edwards	2017-10-19

	015,, Ultragrade 19: H110-25-010, H110-25-011, H110-25-012, H110-25-013, H110-25-015, H110-25-020, Ultragrade 20: H110-24-010, H110-24-011, H110-24-012, H110-24-013, H110-24-015, Ultragrade 70: H110-28-013, H110-28-011, H110-28-010)		
100022	mEI Agar	BD Diagnostic Systems	2016-05-09
100056	MERCONtainer	Ross Healthcare	2018-01-02
100064	Methanol (Methyl alcohol)	Fisher Scientific	2018-01-18
100198	Method 200.7-26 Element QC Blend	NSI Solutions, Incorporated	2009-08-01
100340	Microcystins Strip Test	Abraxis, Incorporated	2016-05-24
100037	n-Hexane 95% For HPLC, Spectrophotometry and Gas Chromatography OmniSolv	EMD Millipore Corporation	2016-03-29
100195	Nalidixic acid (1,4-Dihydro-1-ethyl-7-methyl-4-oxo-1,8-naphthyridine-3-carboxylic acid)	Fisher Scientific	2018-01-19
100032	neodisher LaboClean A 8	Chemische Fabrik Dr. Weigert GmbH & Co. KG	2017-03-27
100033	neodisher LaboClean UW	Chemische Fabrik Dr. Weigert GmbH & Co. KG	2017-06-08
100034	neodisher Z	Chemische Fabrik Dr. Weigert GmbH & Co. KG	2017-08-23
100384	NEUTRASORB ACID NEUTRALIZER	Avantor Performance Materials, Limited Liability Company	2014-08-15
100122	NexION Dual Detector Calibration Solution	PerkinElmer, Incorporated	2017-01-09
100092	Nitrate LR TNT Reagent A	Hach Company	2018-07-30
100093	Nitrate LR TNT Reagent Vial	Hach Company	2018-01-11
100096	Nitrate Nitrogen Standard Solution	Hach Company	2018-01-31
100094	Nitrate Nitrogen Standard Solution 100 mg/L as (NO3N)	Hach Company	2018-01-15
100095	Nitrate Nitrogen Standard Solution 1000 ± 10 mg/l as N	Hach Company	2018-08-16
100349	Nitrate Nitrogen Standard, 100 ppm N (442.7 ppm NO_3^-)	Ricca Chemical Company	2015-08-24
100041	Nitric Acid 67 - 70% OmniTrace	EMD Millipore Corporation	2018-04-05
100040	Nitric Acid GR ACS	EMD Millipore Corporation	2018-04-05
100135	Nitric Acid, 0.100 Normal (N/10)	Ricca Chemical Company	2018-05-14
100194	Nitric Acid, 20% (v/v)	Ricca Chemical Company	2018-05-14

100359	Nitric acid, Trace Metal Grade (Azotic acid; Engraver's acid; Aqua fortis)	Fisher Scientific	2019-04-29
100076	Nitrogen, Ammonia Standard Solution 1.00 mg/l as NH3-N	Hach Company	2018-02-12
100077	Nitrogen, Ammonia Standard Solution 10 mg/l as NH3	Hach Company	2018-02-08
100078	Nitrogen, Ammonia Standard Solution 100 mg/l as NH3-N	Hach Company	2018-02-13
100015	Nitrogen, Compressed	Arc3 Gases	2015-08-17
100193	Nutrient broth for microbiology	EMD Millipore Corporation	2017-04-14
100045	o-Phosphoric Acid Orthophosphoric Acid 85% (w/w) GR ACS	EMD Millipore Corporation	2017-05-16
100121	OMNI-CLEANER XL	IPC Supply, Incorporated	2015-05-21
100120	OmniPur Sodium Phosphate, Dibasic, Heptahydrate	EMD Millipore Corporation	2014-10-17
100192	Organic Carbon Standard, 1000 ppm C	Ricca Chemical Company	2015-05-01
100098	PAN Indicator Solution 0.1%	Hach Company	2018-08-17
100017	PE SCIEX COOLANT	PerkinElmer, Incorporated	2009-02-24
100355	PE SCIEX COOLANT	Solenis Limited Liability Corporation	2018-03-28
100100	pH Storage Solution	Hach Company	2017-12-29
100139	Phenolphthalein Indicator, 1% (w/v) in 95% (v/v) Alcohol, Neutralized	Ricca Chemical Company	2015-05-01
100108	Phosphate Acid Reagent Vials	Hach Company	2019-01-23
100354	Phosphate Buffer pH 7.2, for BOD (Phosphate Buffer for BOD)	LabChem, Incorporated	2018-01-24
100101	Phosphate Standard Solution 3.00	Hach Company	2018-08-16
100102	Phosphate Standard Solution 50.0 mg/L as PO4	Hach Company	2018-08-16
100379	Phosphate Standard, 100 ppm PO43- (32.6 ppm P)	Ricca Chemical Company	2018-05-14
100103	Phosphorous Standard Solution 1000 mg/l as P	Hach Company	2019-07-22
100140	Phosphorus AA Standard, 1000 ppm P in H2O (AP1KW-100, AP1KW-500)	Ricca Chemical Company	2015-05-01
100353	PhosVer 3 Phosphate Reagent	Hach Company	2019-01-13
100352	Plate Count agar acc. ISO 4833, ISO 17410 and FDA-BAM	EMD Millipore Corporation	2017-08-07
100046	Plate Count Agar, Granulated (This product does not require a Material Safety Data Sheet)	EMD Millipore Corporation	2008-12-08
100114	POLYSEED	InterLab	2017-07-01
100115	POLYSEED NX	InterLab	2017-07-01
100141	Potassium Antimonyl Tartrate, 0.2743% (w/v) (1.3715 g/500 mL)	Ricca Chemical Company	2015-05-01
100351	Potassium Biiodate	EMD Millipore	2006-11-13

		Corporation	
100171	Potassium Biiodate 0.0250N	EMD Millipore Corporation	2003-03-04
100190	POTASSIUM CHLORIDE	VWR International, Limited Liability Company	2015-02-10
100191	Potassium Chloride Conductivity Standard, 2765 µS/cm at 25°C	Ricca Chemical Company	2015-05-01
100189	Potassium Chromate, 5% (w/v), Chloride Free, Indicator for Argentometric Titrations	Ricca Chemical Company	2015-05-01
100001	Potassium hydrogen phthalate (Potassium acid phthalate; Potassium biphthalate)	Fisher Scientific	2018-01-23
100350	Potassium Hydrogen Phthalate	Nacalai Tesque, Incorporated	2014-04-30
100065	Potassium iodide (Knollide; Potide)	Fisher Scientific	2018-01-17
100047	Potassium Iodide Crystals GR ACS	EMD Millipore Corporation	2017-07-28
100104	Potassium Iodide Solution 30 g/l	Hach Company	2017-10-09
100048	Potassium Permanganate GR ACS	EMD Millipore Corporation	2018-02-20
100142	Potassium Permanganate Standard, 89.1 mg/L, equivalent to 100 ppm Cl_2	Ricca Chemical Company	2015-05-01
100380	Potassium Persulfate	Hach Company	2019-01-06
100066	Potassium phosphate, dibasic (Dipotassium hydrogen phosphate)	Fisher Scientific	2018-01-18
100049	Potassium Phosphate, Monobasic [Potassium Dihydrogen Phosphate] GR ACS	EMD Millipore Corporation	2018-09-14
100067	Proguard Professional Hand Cream	Decon Laboratories, Incorporated	2018-05-01
100058	Reagent Alcohol ACS	VWR International, Limited Liability Company	2018-04-05
100166	Repel Insect Repellent Sportsmen Formula 29% DEET	Chemsico Div. of United Industries Corporation	2016-02-10
100002	Rosolic Acid (4-Bis(4-hydroxyphenyl)methylene!-2,5-cyclohexadien-1-one; Aurin; C.I. 43800)	Fisher Scientific	2015-05-22
100050	Rosolic Acid (Aurin; Corralin C.!. #43800)	EMD Millipore Corporation	2013-10-10
100105	RoVer Rust Remover	Hach Company	2018-04-25
100021	Sight Savers brand Anti-Fog Liquid	Bausch & Lomb	2018-12-21
100106	Silicone Oil	Hach Company	2018-02-15
100143	Silver Nitrate, 0.0141 Normal (0.0141 Molar), 1 mL = 0.5 mg Cl^-	Ricca Chemical Company	2018-05-14

100113	SimPlate; Quanti-Disc; HPC	Idexx Laboratories, Incorporated	2016-02-01
100367	Soda Lime	Yoneyama Yakuhin Kogyo Co., Limited	2018-10-29
100107	Sodium Arsenite Solution	Hach Company	2018-08-16
100016	Sodium Bicarbonate (Baking Soda)	Church & Dwight	2018-06-08
100144	Sodium Chloride, 0.5078 Normal, Conductivity = 47,600 µS/cm at 25°C	Ricca Chemical Company	2015-05-04
100124	Sodium Chloride, Purified	REAGENTS, INCORPORATED	2016-08-08
100196	Sodium Hydrogen Carbonate	Nacalai Tesque, Incorporated	2018-10-09
100051	Sodium Hydroxide 0.2N (Caustic soda solution)	EMD Millipore Corporation	2013-07-08
100362	Sodium Hydroxide Solution 0.1N	EMD Millipore Corporation	2014-11-03
100381	Sodium Hydroxide Solution, 1.54N	Hach Company	2019-01-23
100188	Sodium Hydroxide, 0.200 Normal (N/5)	REAGENTS, INCORPORATED	2015-06-23
100187	Sodium Hydroxide, 5.00 Normal	Ricca Chemical Company	2018-05-10
100003	Sodium Persulfate (Sodium peroxydisulfate)	Fisher Scientific	2018-01-19
100152	Sodium persulfate (Sodium peroxodisulfate)	Sigma-Aldrich Incorporated	2014-11-14
100068	Sodium Phosphate Dibasic Heptahydrate (Certified ACS) (Disodium hydrogen phosphate heptahydrate)	Fisher Scientific	2018-01-17
100382	Sodium phosphate, monobasic (Sodium dihydrogen phosphate, anhydrous; Dihydrogen sodium phosphate, anhydrous)	Fisher Scientific	2019-04-25
100161	Sodium phosphate, monobasic monohydrate (Sodium dihydrogen phosphate monohydrate; Dihydrogen sodium phosphate monohydrate)	Fisher Scientific	2018-01-23
100069	Sodium sulfate anhydrous (Disodium sulfate; Sulfuric acid, disodium salt (Granular/Powder/10-60 Mesh/Certified ACS/Low Nitrogen/USP/FCC/EP/BP))	Fisher Scientific	2018-01-18
100010	Sodium sulfite anhydrous ACS	VWR International, Limited Liability Company	2018-09-04
100070	Sodium thiosulfate (Thiosulfuric Acid Disodium Salt; Sodium Oxide Sulfide; Sodium Hyposulfite)	Fisher Scientific	2018-01-17
100145	Sodium Thiosulfate, <50 (w/v) Aqueous Solutions, Terminator Reagent	Ricca Chemical Company	2009-08-18
100153	SOFTSOAP LIQUID HAND SOAP ADVANCED CLEAN B02954920001	Colgate-Palmolive Company	2018-07-20
100234	Somat SPEZIAL-SALZ	Henkel Wasch-und	2012-06-21

		Reinigungsmittel GmbH	
100071	Sparkleen 1	Fisher Scientific	2018-01-18
100011	Spill-X-A Acid Neutralizer	Tyco Fire Protection Products	2019-03-14
100012	Spill-X-C Caustic Neutralizer	Tyco Fire Protection Products	2017-07-28
100013	Spill-X-S Solvent Adsorbent	Tyco Fire Protection Products	2017-08-28
100117	SpillSolv Mercury Spill Kit	EMD Performance Materials Corporation	2015-07-28
100231	STABLCAL FORMAZIN STANDARD 1000 NTU	Hach Company	2019-10-16
100232	STABLCAL FORMAZIN STANDARD 200 NTU	Hach Company	2019-07-31
100230	StablCal Formazin Standard 4000 NTU	Hach Company	2019-10-16
100173	STABLCAL FORMAZIN STANDARD 7500 NTU	Hach Company	2019-10-21
100233	StablCal Standard, 20 NTU	Hach Company	2019-10-21
100186	STD, Bismuth 1000 ppm	PerkinElmer, Incorporated	2018-07-03
100185	STD, Calcium 1000 ppm	PerkinElmer, Incorporated	2018-04-20
100184	STD, Gallium, 1000 ppm	PerkinElmer, Incorporated	2018-06-27
100225	STD, Germanium, 1000 ppm	PerkinElmer, Incorporated	2019-05-06
100183	STD, Indium, 1000 ppm	PerkinElmer, Incorporated	2018-07-03
100182	STD, Internal Standard Mix	PerkinElmer, Incorporated	2018-04-26
100181	STD, Iron, 1000 ppm	PerkinElmer, Incorporated	2018-07-03
100348	STD, Multi-element Internal Standard	PerkinElmer, Incorporated	2018-07-05
100180	STD, Tuning Solution 1	PerkinElmer, Incorporated	2017-01-26
100179	Sterikon plus Bioindicator for checks on autoclaving	EMD Millipore Corporation	2017-12-05
100365	Sulfate Standard Solution 50.0 ± 0.5 mg/l as SO4	Hach Company	2017-09-29
100370	Sulfate standard solution traceable to SRM from NISTna2SO4 in H2O 1000 mg/l SO4 Certipur	EMD Millipore Corporation	2017-06-29
100364	SulfaVer 4 Sulfate Reagent	Hach Company	2018-03-26
100052	Sulfuric Acid GR ACS	EMD Millipore Corporation	2017-06-20

100146	Sulfuric Acid, 0.0200 Normal (N/50)	Ricca Chemical Company	2015-05-01
100178	Sulfuric Acid, 0.100 Normal (N/10)	Ricca Chemical Company	2015-05-04
100147	SULFURIC ACID, 2.01 - 14.6 Normal, 5.6 - 40% (v/v), 9.3 - 50.9% (w/w) Aqueous Solutions	Ricca Chemical Company	2015-01-23
100383	Sulfuric Acid, 5.00 Normal	Ricca Chemical Company	2018-10-25
100148	Sulfuric Acid, 50% (v/v)	Ricca Chemical Company	2019-10-06
100020	TEAM LOW NA+ LIQUID ACID NEUTRALIZER	Avantor Performance Materials, Limited Liability Company	2003-05-08
100149	Total Ionic Strength Adjustment Buffer (TISAB II), with CDTA for Fluoride Analysis using Ion Selective Electrodes	Ricca Chemical Company	2015-05-01
100162	Trihalomethanes Mixture (Trihalomethanes Mixture)	ULTRA Scientific	2017-10-30
100023	Tryptic Soy Agar	BD Diagnostic Systems	2016-06-04
100172	Uranine (Fluorescein sodium salt (Concentrated, Water Soluble/Laboratory))	Fisher Scientific	2017-05-24
100167	Vinegar, all varieties	National Vinegar Company	2015-07-20
100134	Water Hardness Buffer, with Magnesium EDTA	Ricca Chemical Company	2018-05-14
100150	Water Hardness Indicator, 0.5% (w/v) Eriochrome Black T in 2-Methoxyethanol	Ricca Chemical Company	2018-05-14
100177	Water, HPLC Grade, ACS Reagent Grade, Suitable for Liquid Chromatography	Ricca Chemical Company	2015-05-01
100170	WINDEX ORIGINAL	S.C. Johnson & Son, Incorporated	2019-06-20
100168	YSI Oxygen Probe Electrolyte for Model 5204, 5906, 5908, & 5909	YSI Incorporated	2014-03-20
100385	YSI Zobell Solution 061320, 061321, 061322	YSI Incorporated	2013-12-05
100176	Yttrium 1000 PPM A/A standard	PerkinElmer, Incorporated	2018-07-05

SECTION 220000 – PLUMBING

220001 GENERAL

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, apply to this section.

B. These specifications and the accompanying plumbing drawings are intended to provide for all labor, materials and equipment necessary for the installation complete of all

1. Fuel Gas System

and accessories including necessary apparatus, valves and fittings hereinafter described or called for on the plumbing drawings accompanying these specifications.

C. All plumbing work shall be installed in accordance with the following Codes and all Local Ordinances. Materials, equipment and workmanship shall be as hereinafter specified.

1. North Carolina State Plumbing Code
2. North Carolina State Fire Prevention Code
3. North Carolina State Fuel Gas Code

D. This contractor shall secure all required permits and inspection fees necessary for this work. Permits may be secured from the Building Inspections Department.

E. The accompanying drawings are schematic only and are not intended to show all fittings, bolts, connections, offsets, etc., unless specifically dimensioned. Follow drawings as closely as possible, provide all adjustments as necessary to conform to the structural conditions, machinery, equipment, work of other contractors and the intent of the drawings, without additional cost to the Owner. Plumbing drawings should not be scaled. Secure dimensions from Architectural drawings. Refer to drawings of other trades and coordinate with other contractors. All items of equipment shall be installed in accordance with the manufacturer's published installation instructions and diagrams.

220002 SCOPE OF WORK

A. The Contractor shall be required to perform all the following work, in general and provide a complete plumbing system as shown on the plans. The items in general are to be as follows:

1. Furnish and install fuel gas piping system with connections to equipment as noted and/or as shown on the plumbing drawings and here-in specified.

220003 LIST OF MATERIALS, FIXTURES AND EQUIPMENT

A. The Plumbing Contractor shall obtain written approval from the Engineer/Architect for the use of substitute materials claimed as equal to those specified. Such approvals must be obtained as soon after contract awards as possible and before any materials are ordered. Applications for approvals shall be made by the Plumbing Contractor and not by subcontractors or manufacturer's representative. The Plumbing Contractor shall submit within ten days following award of contract and written notice to begin the work a complete list of materials proposed for the job. All like items shall be by the same manufacturer. When this list is approved, no further substitutions will be permitted except in unusual or extenuating circumstances. If no list is submitted, the Contractor shall supply materials specified. *Contractor should note that all items specified in section 220000 shall be submitted independently of other 220000 series sections.* The Plumbing Contractor shall review and stamp the submittals as being in accordance with his bid and these specifications. **Private labeled materials are not acceptable.**

B. The Plumbing Contractor shall submit shop drawings after award of the contract, and before any materials, fixtures, and equipment to be incorporated in the work has been ordered. Shop drawings shall include the name and address of the manufacturer and their catalog numbers and trade names clearly marked. All items shall be referenced to the plans and specifications by **fixture designation or specification paragraph number on an index tab**. One complete set of submittal data shall be manufacturer's original published material. **FAXED COPIES WILL NOT BE ACCEPTABLE**. Approval of materials will be based upon the manufacturer's published ratings. Submit shop drawings and/or catalog data for the following material and equipment:

1. Fuel Gas Piping and Fittings

C. Approval of shop drawings and/or submittal data shall not relieve the Plumbing Contractor of the responsibility to comply with the requirements and intent of the plans and specifications with regard to dimensions, capacities, quality, quantity, performance characteristics, etc. If data submitted deviates from the contract documents, the Plumbing Contractor shall point out such deviations in writing and also state reasons for same. All similar items shall insofar as possible be one make and manufacturer.

D. Where any special make, fixture or materials are specified by plate number, trademark or name, deliver to the building with original labels or other identification marks placed thereon by the manufacturer and do not remove until inspected and approved by the Architect. Similar and equal materials and equipment by other manufacturers will be acceptable, subject to approval.

E. Failure to submit materials, equipment, fixtures, etc., in the time period specified above, the Architect shall assume that all items shall be installed as specified.

220004 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. 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, the 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 Contractor shall carefully survey the existing work and examine the drawings and specifications to determine the extent of work required. The 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.

220005 WORKMANSHIP

A. Layout:

1. Furnish and install all necessary sleeves, inserts, bolts, etc., for concrete floor slabs, roof, walls, and partitions. Failure to install such items in time to avoid delaying the general contractor shall result in the Contractor doing all cutting and repairing at his own expense.

B. Fuel Gas System:

1. Gas piping shall be concealed in walls or above ceilings unless noted otherwise.
2. Gas piping shall be graded 1/4" per 15-feet towards drip legs. Drip legs shall be full size of the main and shall be 6 inches in length.

220006 CUTTING, PATCHING AND CHASING

A. Perform all minor cutting, patching and chasing necessary to complete all work and to install all equipment as required under his contract and shall re-establish all finishes where such occurs to their original condition. There shall be no cutting of the structure.

220007 FUEL GAS SYSTEM

A. Gas Piping:

1. Gas piping above grade and inside the building shall be standard weight schedule 40 black steel conforming to ASTM A-53.

B. Fittings:

1. Fittings for piping 2" and smaller shall be malleable iron threaded fittings conforming to ASME B16.3 with threads conforming to ASME B1.20.1.
2. Fittings for piping 2-1/2" and larger shall be steel.

C. Joints:

1. Joints for threaded piping shall be made using pipe dope applied sparingly to the male thread of pipe. Pipe dope shall be resistant to actions of gas.
2. Joints for steel piping 2-1/2" and larger shall be welded.

D. Gas Valves:

1. Gas valves shall be U.L. or AGA approved bronze construction, full port ball with threaded ends designed for 600-PSI gas working pressure conforming to ASME B16.44.
2. Gas valves controlling each piece of equipment shall be full ported, bronze body, threaded ends, ball valve with gauge tapping.
3. Each valve shall be lubricated and turned during the installation to assure good working order. Plug valves shall be greased again after turning to aid the shut off. All valve boxes shall be encased in 18" square x 6" thick concrete pad at grade level.

E. Connections:

1. Coordination gas piping connections with equipment locations.

220008 HANGERS

A. Hangers for horizontal piping shall be the Clevis type and shall conform to MSS SP-58, Types 1 through 58.

B. Hangers shall be spaced per the NC State Plumbing Code in accordance with the piping material.

C. A hanger shall be provided within one (1) foot of each bend in horizontal piping.

D. Hangers shall be fastened by means of threaded rods to steel beam clamps, center of bar joist, center of trusses, etc. All hangers shall permit adequate adjustment after erection while still supporting the load. All hanger rods attached to bar joist and trusses shall be install between bottom or top cords of the structural member. Structural members to span from building structure to structure shall be provided by the Contractor.

E. Hangers SHALL NOT be fastened to joist bridging or roof deck.

F. Hangers shall only be hung with drilling into the slab with “drop-in” hangers with the approval of the Structural Engineer of record and the Mechanical Engineer of record with complete dead and operating load information provided for each location. Loading information shall be provided by the Plumbing Contractor.

G. Piping supported on a trapeze hanger shall be secured to the trapeze hanger by means of a pipe clamp around the pipe insulation and insulation saddle. Bare piping shall be secured by a pipe clamp and isolated by an isolation cushion.

H. Piping supported from the floor shall be supported using a base plate securely anchored to the floor and be equipped with a pipe riser. Riser shall be a minimum size of one inch. Horizontal piping above the floor shall be anchored and rest on a manufactured saddle. Piping shall be secured to each saddle as approved by the Engineer.

220009 PIPE SLEEVES, PLATES, ESCUTCHEONS, ETC.

A. Pipe sleeves shall be standard weight schedule 40 black steel above slab on grade or cast iron below slab on grade. All sleeves shall be equal to construction thickness except that pipe sleeves passing through floors, other than slab on grade, shall extend 3/4" above the finished floor. Pipe sleeve sizes shall be sized two pipe sizes larger than piping passing thru the sleeve.

B. Piping thru non-fire rated walls, floors above slab on grade or ceilings, piping passing through foundation walls, and piping installed below structural footings shall have sleeves installed concentric and centered on pipe. Ream all sleeves to prevent cutting of piping. The Contractor shall furnish shop drawings to the general contractor and the Architect showing location, dimensions, and sizes of holes required. Sleeves on piping passing through foundation walls shall extend 6” beyond wall footing on both sides. Sleeves on piping installed below structural footings shall extend beyond footing as indicated on contract drawings.

C. Install escutcheons snug against room finish on all exposed pipe passing through walls, floors above slab on grade or ceilings. Use cup type escutcheons at floors where sleeves extend above finished floors. Escutcheons shall be chrome plated steel with spring clip.

D. Sleeves for insulated piping shall be large enough to allow the insulation to pass thru sleeve unbroken.

E. Core drill openings for all floor openings may be utilized in lieu of sleeved openings. All openings shall be sized two pipe sizes larger than pipe passing thru the opening. All cored openings shall be fireproofed as required and shall be made water tight.

F. 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 with a minimum positive pressure differential 0.01 inch w.g. All openings through horizontal fire separations shall be protected by Metacaulk U.L. Systems or approved U.L. listed system by other manufacturers.

G. All openings through floors and vertical fire separations shall be protected by combination water seal and fire stops as manufactured by HoldRite, or approved equal by Proset, Metacaulk, or 3M.

220010 PROTECTION OF WORK AND EQUIPMENT

A. The Contractor shall be responsible for all work damaged by him/her. Any plumbing work damaged by any other contractor shall be replaced by the Contractor and placed in perfect working condition without extra cost to the Owner. All fixtures and fittings shall be adequately protected before, during and after installation.

220011 TESTING

A. The Contractor shall notify the Engineer forty-eight (48) hours in advance of all tests. The Contractor shall make all necessary preliminary tests to insure a tight system. Any joint found to leak under test shall be broken, cleaned and remade.

B. All tests shall be applied before any work is concealed or covered in any manner.

C. All fuel gas piping shall be tested by applying an air pressure of 100-lbs. per square inch and shall be maintained for minimum of eight (8) hours. Air receivers shall be charged with peppermint for odor test and any indication of leakage will be checked by applying a soap and water solution at each joint to determine leaking joint. Test shall be conducted using an eight inch pressure-temperature recorder with a pressure range of 0-150-psi with a 24 hour recording time. Pressure measuring elements shall be heat treated to prevent hysteresis-related inaccuracies. The original chart with copies shall be included in the "Owners and Operating Manuals.

D. The Contractor shall furnish all necessary equipment, materials and labor to perform the above-specified tests.

220012 PLACING IN SERVICE

A. The Contractor shall place the entire system in a satisfactory operating condition and shall furnish all assistance and instructions required by the Owner's representative during initial operating period. The Contractor shall acquaint the Owner's representative with the special parts required for the operation of the flush valves furnished and installed on the project.

220013 PAINTING

A. All exposed gas piping exposed to the exterior and exposed in mechanical rooms shall be cleaned of all rust and painted with one (1) coat of rust inhibitor primer and two (2) coats of oil base Yellow paint.

220014 AS BUILT DRAWINGS

A. The General Contractor and Plumbing Contractor, shall maintain "during the course of the work" a set of drawings marked up to show the work as installed, including dimensions to and elevations of buried work. Both Contractors shall initial and date all changes to the contract drawings. The Architectural Observer may check this set of documents monthly for compliance. Upon completion of the work, return this set of drawings to the Architect.

220015 GUARANTEE

A. Guarantee: The Contractor shall guarantee the entire plumbing system subject to the General Conditions of these specifications.

END OF SECTION 220000

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SECTION 230000 - MECHANICAL

230001 GENERAL

A. General and Supplementary Conditions, Drawings, and these specifications constitute the necessary Documents for the Heating and Air Conditioning Work.

B. The Heating and Air Conditioning Contractor shall co-operate with the contractors of other trades and shall install his work as fast as the progress of the balance of the work will permit. The Heating and Air Conditioning Contractor shall coordinate his work with the work of other trades, prior to demolition or installation and prior to demolition or installation of work by other trades. As part of this coordination, the Contractor shall ensure that proper maintenance access and clearances are available and maintained for all newly installed mechanical equipment.

C. The Heating and Air Conditioning Contractor shall install all fired and unfired pressure vessels and their safety devices in accordance with the requirements of the latest edition of the North Carolina State Boiler Inspection Law Rules and Regulations and 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 54, 70, 90A, 91, 96, and other applicable sections.

D. Permits and Inspection Fees: The Heating and Air Conditioning Contractor shall secure all necessary required permits and inspections for this work. Charges for permits shall be included in the Contractor's bid. 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, 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 site, 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 site before fabricating or 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 Construction Administrator. Trash and rubbish shall not be allowed to accumulate either within or outside the site. Materials and debris that 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 Construction Administrator.

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 the North Carolina State Building 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.

K. All materials and equipment used on this project shall be asbestos free.

L. **Start date for equipment warranties shall commence of the date of Final Acceptance, not from start-up date of equipment.**

M. Equipment and/or systems indicated on the drawings or specified here-in may not be completely described in the Design Documents. The Contractor shall be responsible for understanding and providing the scope of supply of equipment and related items to ensure a complete and operating system is installed. Contractor is responsible for reviewing equipment quotations from vendors to determine the extent of related items and/or system components required for a complete and operating system. Any omission from either the drawings or the specifications is unintentional, and it shall be the responsibility of the Contractor to call to the attention of the Engineer any pertinent omissions before submitting a bid. Complete and operating systems are required, whether every small item, system component, etc. is shown/specified or not.

N. **All equipment shall be provided with factory start-up initial operation by factory trained and authorized technicians.** Costs for factory start-up shall be included in the Mechanical Contractor's bid. Start-up test reports shall be filled out by the start-up technician and shall be included in the operations and maintenance manuals.

O. All HVAC equipment utilizing three phase power shall be provided with phase monitoring on all three phases of incoming power to prevent equipment operation upon phase imbalance, phase loss, phase reversal, under-voltage, and over-voltage conditions. Phase monitoring protection shall be automatic reset type when condition is rectified following user programmable time delay.

230002 SCOPE

The Heating and Air Conditioning Contractor shall provide labor and materials required for demolition of systems or portions of systems, and installation of new or modified systems ready for operation as shown on the drawings and hereinafter specified. This includes all equipment, ductwork, piping, insulation, 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. The Contractor shall provide testing of mechanical systems sub-systems, and equipment/components, to demonstrate integrity, operability, functionality, and conformance with the design intent. The contractor shall document all testing.

230003 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. Unless indicated otherwise, 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.

230004 SHOP DRAWINGS AND SUBMITTAL DATA

The Heating and Air Conditioning Contractor shall submit within thirty (30) 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 retained by the Engineer. It is requested that all submittal data be submitted at one time. Where called for, the Heating and Air Conditioning Contractor shall submit five sets of shop drawings showing the detailed arrangement of 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:

A. Packaged 100% Outside Air Units

B. Laboratory Exhaust Fans

C. Electric Duct Heaters

D. Diffusers, Registers and Grilles

E. Direct Digital Controls

F. Fire Dampers

G. Duct Access Doors

H. Insulation

I. HVAC Testing, Adjusting, and Balancing

230005 APPROVED EQUAL EQUIPMENT

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 or 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.

230006 PACKAGED 100% OUTSIDE AIR UNITS

A. Units shall be factory manufactured, assembled, tested, single package type for dedicated 100 percent outside air roof mounting application with airflow in the horizontal direction and vertical down supply air discharge through the roof within unit base. Duct connections shall be directly to the unit casing. Unit shall be factory assembled, piped, internally wired, fully charged with R-410A and 100% run tested to check full operation, fan and blower rotation, and control sequence before leaving the factory. Wiring

internal to the unit shall be numbered for simplified identification. Units shall be UL or ETL listed and labeled.

B. See GUARANTEE Section 230023 for description of compressor warranty requirements.

C. Unit shall be constructed for outdoor installation:

1. Base shall be minimum 10 gauge galvanized steel rails with 16 gage integral floor pan insulated with 1/2" closed-cell neoprene liner. Base shall have a minimum 4" overhang over the top of a roof curb to prevent water infiltration and raised rib joint floor seams. Only penetrations through the floor of the unit within the perimeter of the curb shall be except for duct openings and utility chases. Penetrations through the floor shall have a ½" raised rib around each opening.
2. Casing shall be constructed with minimum 2-inch, foam-injected, thermally broken, double-wall panels. Interior side of panel shall be 22 gauge stainless steel. Exterior side of panel shall be 22 gauge G90 galvanized steel with factory baked enamel finish rated for 1000 hours salt spray test resistance in accordance with ASTM B117 and ASTM D1654. Insulation shall be 2 lb/ft3 foam insulation with an average R-value of 6 per inch and show "no growth" per ASTM G21 biocide testing. No insulation shall be exposed to the air stream.
3. Access doors shall be provided for access to all components requiring regular maintenance or inspection. Access doors shall be hinged with a minimum of two quarter-turn compression latches with adjustable catches, shall have construction identical to unit casing, and shall be sealed with a full-perimeter gasket constructed of Mylar-encased low-density foam. Door hinges shall be stainless steel.
4. Weather hood with bird screen shall be provided on outside air inlet. Hoods shall have high performance moisture eliminators.
5. Roof shall be pitched with a minimum ½" roof overhang around the perimeter of the unit.
6. All interior components shall be corrosion resistant stainless steel Type 316 including coil casing and coil drain pan.

D. Fan assemblies shall be direct-drive plenum type without the use of belts or adjustable sheaves with manufacturer provided variable frequency drive for each fan section. Variable frequency drives shall be mounted, wired, programmed by the manufacturer, and located in an enclosed compartment outside of the supply or exhaust air stream. Fan wheel shall be tested in accordance to AMCA 210. Fan motors shall be EISA 2007 NEMA premium efficiency inverter duty squirrel cage, drip proof with 1.15 service factor and shall be Model J ball bearing with minimum NEMA MG 1, Part 31, design "B" for 40°C ambient. Efficiency rating shall be stamped on motor nameplate. Where motors are greater than 10 hp, provide shaft grounding rings. Provide factory installed air flow piezo rings mounted to fan air inlet cone.

E. Variable Frequency Drives (VFDs):

1. Variable frequency drives shall be provided, mounted and wired by the AHU manufacturer as indicated on the schedule and drawings. All standard and optional features shall be included within the VFD enclosure, unless otherwise specified. The VFDs shall be UL listed. The listing shall allow mounting in plenum or other air handling compartments.
2. The VFD shall convert incoming fixed frequency three-phase AC power into a variable frequency and voltage for controlling the speed of three-phase AC motors. The motor current shall closely approximate a sine wave. Motor voltage shall be varied with frequency to maintain desired motor magnetization current suitable for centrifugal pump and fan control and to eliminate the need for motor derating.
3. With the motor's rated voltage applied to the VFD input, the VFD shall allow the motor to produce full rated power at rated amps, RMS fundamental volts, and speed without using the motor's service factor. VFDs utilizing sine weighted/coded modulation (with or without 3rd harmonic injection) must provide data verifying that the motors will not draw more than full load current during full load and full speed operation.
4. The VFD shall include an input full-wave bridge rectifier and maintain a fundamental power factor near unity regardless of speed or load.

5. The VFD and options shall be tested to ANSI/UL Standard 508. The complete VFD, including all specified options, shall be assembled by the manufacturer, which shall be UL 508 certified for the building and assembly of option panels. Assembly of separate panels with options by a third-party is not acceptable. The appropriate UL stickers shall be applied to both the VFD and option panel, in the case where these are not contained in one panel.
6. The VFD shall have DC link reactors on both the positive and negative rails of the DC bus to minimize power line harmonics. VFDs without DC link reactors shall provide a minimum 3% impedance line reactor.
7. The VFDs full load amp rating shall meet or exceed NEC Table 430-150. The VFD shall be able to provide full rated output current continuously, 110% of rated current for 60 seconds and 160% of rated current for up to 0.5 second while starting.
8. The VFD shall be able to provide full torque at any selected frequency from 28 Hz to base speed to allow driving direct drive fans without derating.
9. An automatic energy optimization selection feature shall be provided standard in the VFD. This feature shall automatically and continually monitor the motor's speed and load and adjust the applied voltage to maximize energy savings and provide up to an additional 3% to 10% energy savings.
10. Input and output power circuit switching shall be able to be accomplished without interlocks or damage to the VFD. Switching rate may be up to 1 time per minute on the input and unlimited on the output.
11. An automatic motor adaptation test algorithm shall measure motor stator resistance and reactance to optimize performance and efficiency. It shall not be necessary to run the motor or de-couple the motor from the load to run the test.
12. Galvanic and/or optical isolation shall be provided between the VFDs power circuitry and control circuitry to ensure operator safety and to protect connected electronic control equipment from damage caused by voltage spikes, current surges, and ground loop currents. VFDs not including either galvanic or optical isolation on both analog I/O and discrete I/O shall include additional isolation modules.
13. The VFD shall minimize the audible motor noise through the use of an adjustable carrier frequency. The carrier frequency shall be automatically adjusted to optimize motor and VFD efficiencies while reducing motor noise.
14. Protective Features:
    a. Protection shall be provided against input transients, loss of AC line phase, output short circuit, output ground fault, overvoltage, undervoltage, VFD overtemperature and motor overtemperature. The VFD shall display all faults as words. Codes are not acceptable.
    b. The VFD shall be protected from sustained power or phase loss. The VFD shall provide full rated output with an input voltage as low as 90% of the nominal. The VFD shall continue to operate with reduced output with an input voltage as low as 164 V AC for 208/230 volt units, 313 V AC for 460 volt units, and 394 volts for 600 volts units.
    c. The VFD shall incorporate a motor preheat circuit to keep the motor warm and prevent condensation build up in the stator.
    d. The VFD package shall include semi-conductor rated input fuses to protect power components.
    e. To prevent breakdown of the motor winding insulation, the VFD shall be designed to comply with IEC Part 34-17. Otherwise the AHU manufacturer shall ensure that inverter rated motors are supplied.
    f. The VFD shall include a "signal loss detection" circuit to sense the loss of an analog input signal such as 4 to 20 mA or 2 to 10 V DC, and shall be programmable to react as desired in such an instance.
    g. The VFD shall function normally when the keypad is removed while the VFD is running and continue to follow remote commands. No warnings or alarms shall be issued as a result of removing the keypad.
    h. The VFD shall catch a rotating motor operating forward or reverse up to full speed.
    i. The VFD shall be rated for 100,000 amp interrupting capacity (AIC).

j. The VFD shall include current sensors on all three output phases to detect and report phase loss to the motor. The VFD shall identify which of the output phases is low or lost.
k. The VFD shall continue to operate without faulting until input voltage reaches 300 V AC on 208/230 volt units, 539 V AC on 460 volt units, and 690 volts on 600 volt units.

15. Interface Features:

a. Hand/Start, Off/Stop and Auto/Start selector switches shall be provided to start and stop the VFD and determine the speed reference. On units with bypass, a VFD/Off/Bypass selector switch shall be provided.
b. The VFD shall be able to be programmed to provide a 24 V DC output signal to indicate that the VFD is in Auto/Remote mode.
c. The VFD shall provide digital manual speed control. Potentiometers are not acceptable.
d. A lockable, alphanumeric backlit display keypad shall be provided. The keypad shall be remotely mountable up to 10 feet away using standard 9-pin cable.
e. The keypads for all sizes of VFDs shall be identical and interchangeable.
f. To set up multiple VFDs, it shall be possible to upload all setup parameters to the VFDs keypad, place that keypad on all other VFDs in turn and download the setup parameters to each VFD. To facilitate setting up VFDs of various sizes, it shall be possible to download from the keypad only size independent parameters.
g. The display shall be programmable to display in English, Spanish and French at a minimum.
h. A red FAULT light, a yellow WARNING light and a green POWER-ON light shall be provided. These indications shall be visible both on the keypad and on the VFD when the keypad is removed.
i. A quick setup menu with factory preset typical HVAC parameters shall be provided on the VFD eliminating the need for macros.
j. The VFD shall include a standard EIA-485 with BACNET MS/TP Communications Port.
k. At a minimum, the following points shall be controlled and/or accessible:

1) VFD Start/Stop
2) Speed reference
3) Fault diagnostics
4) Meter points:

a) Motor power in HP
b) Motor power in kW
c) Motor kW-hr
d) Motor current
e) Motor voltage
f) Hours run
g) 2 feedback signals
h) DC link voltage
i) Thermal load on motor
j) Thermal load on VFD
k) Heatsink temperature

l. Four additional Form C 230 volt programmable relays shall be available for field installation within the VFD
m. Two set-point control interfaces (PID control) shall be standard in the unit. The VFD shall be able to look at two feedback signals, compare with two set-points and make various process control decisions.
n. Floating point control interface shall be provided to increase/decrease speed in response to contact closures.
o. Four simultaneous displays shall be available. They shall include frequency or speed, run time, output amps and output power. VFDs unable to show these four displays simultaneously shall provide panel meters.

p. Sleep mode shall be provided to automatically stop the VFD when its speed drops below set ¿sleep¿ level for a specified time. The VFD shall automatically restart when the speed command exceeds the set ¿wake¿ level.
q. The sleep mode shall be functional in both follower mode and PID mode.
r. A run permissive circuit shall be provided to accept a ¿system ready¿ signal to ensure that the VFD does not start until dampers or other auxiliary equipment are in the proper state for VFD operation. The run permissive circuit shall also be capable of sending an output signal as a start command to actuate external equipment before allowing the VFD to start.
s. The following displays shall be accessible from the control panel in actual units: Reference Signal Value, Output Frequency in Hz or percent, Output Amps, Motor HP, Motor kW, kWhr, Output Voltage, DC Bus Voltage, VFD Temperature in degrees, and unit CFM.
t. The display shall be programmed to read in inches of water column (in-wg).
u. The VFD shall be able to be programmed to sense the loss of load and signal a no load/broken belt warning or fault.
v. If the temperature of the VFDs heat sink rises to 80°C, the VFD shall automatically reduce its carrier frequency to reduce the heat sink temperature. If the temperature of the heat sink continues to rise the VFD shall automatically reduce its output frequency to the motor. As the VFDs heat sink temperature returns to normal, the VFD shall automatically increase the output frequency to the motor and return the carrier frequency to its normal switching speed.
w. The VFD shall have temperature controlled cooling fans for quiet operation and minimized losses.
x. The VFD shall store in memory the last 10 faults and related operational data.
y. Eight programmable digital inputs shall be provided for interfacing with the systems control and safety interlock circuitry.
z. Two programmable relay outputs, one Form C 240 V AC, one Form A 30 V AC, shall be provided for remote indication of VFD status.
aa. Three programmable analog inputs shall be provided and shall accept a direct-or-reverse acting signal. Analog reference inputs accepted shall include two voltage (0 to 10 V DC, 2 to 10 V DC) and one current (0 to 20 mA, 4 to 20 mA) input.
bb. Two programmable 0 to 20 mA analog outputs shall be provided for indication of VFD status. These outputs shall be programmable for output speed, frequency, current and power. They shall also be programmable to provide a selected 24V DC status indication.
cc. Under fire mode conditions, the VFD shall be able to be programmed to automatically default to a preset speed.

16. Adjustments:

a. The VFD shall have an adjustable carrier frequency in steps of not less than 0.1 kHz to allow tuning the VFD to the motor.
b. A minimum of sixteen preset speeds shall be provided.
c. Four acceleration and four deceleration ramps shall be provided. Accel and decel time shall be adjustable over the range from 0 to 3,600 seconds to base speed. The shape of these curves shall be automatically contoured to ensure no-trip acceleration and deceleration.
d. Four current limit settings shall be provided.
e. If the VFD trips on one of the following conditions, the VFD shall be programmable for automatic or manual reset: undervoltage, overvoltage, current limit and inverter overload.
f. The number of restart attempts shall be selectable from 0 through 20 or infinitely and the time between attempts shall be adjustable from 0 through 600 seconds.
g. An automatic ¿on delay¿ shall be selectable from 0 to 120 seconds.

17. Service Conditions:

a. VFDs shall provide full output in an ambient temperature from -10 to 50°C (14 to 104°F).
b. VFDs shall provide full output in a relative humidity from 0 to 95%, non-condensing.
c. VFDs shall provide full output up to 3,300 feet elevation without derating.
d. VFDs shall provide full output with an AC line voltage variation from -10 to +10% of nominal voltage.

e. No side clearance shall be required for cooling of any units. All power and control wiring shall be done from the bottom.

18. Warranty:

a. The VFD shall be warranted by the manufacturer for a period of 42 months from date of shipment, or 36 months from start-up, whichever occurs first. The warranty shall include parts, labor, travel costs and living expenses incurred by the manufacturer to provide factory-authorized on-site service.

F. Motorized outside air dampers shall feature all stainless steel construction with 16 gage hat-channel frame with flexible stainless steel compression-type jamb seals, 16 gage v-grooved blades with extruded vinyl blade edge seals, and synthetic sleeve-type axle bearings. Damper leakage shall be no more than 3 cfm/sq.ft. at 1 in. wg static pressure. Power to open gear driven spring-return actuators shall be provided by the factory, installed on the damper, and wired to the control center.

G. Air filters shall be 2" thick UL Class 1 pleated panels with Minimum Efficiency Reporting Value of (MERV) rating per ASHRAE Standard 52.2-1999. Pre-filters shall be MERV 8. Secondary filters shall be MERV 13. Contractor shall provide replacement sets of filters as required during construction. At final project acceptance, Contractor shall provide a clean set of replacement filters installed in the unit. Provide factory supplied fixed filter blockoffs to prevent air bypass around filters.

H. Direct expansion (DX) cooling system including, but not necessarily limited to, compressors, air-cooled condenser, evaporator, refrigerant piping, and controls, shall be factory assembled, pre-piped, pre-wired, charged with refrigerant, leak tested and run tested at the factory.

1. Compressors shall be hermetic scroll type with suction and discharge service valves, reverse rotation protection, oil level adjustment, oil filter, rotary dirt trap, short cycling control, high and low pressure limits, and crankcase heaters. Motors shall be suction gas cooled with internal overload protection. Compressors shall be installed in an isolated compartment separate from supply airflow, return airflow, microprocessor controller, non-fused disconnect, compressor relays, fan motor VFD, and all other electrical components inside the unit on manufacturer's recommended rubber vibration isolators. Each refrigeration circuit shall utilize Digital Scroll™ compressor technology capable of variable capacity control with 10:1 turndown.
2. Coils shall be copper tubes with mechanically bonded aluminum plate fins. Coils shall be leak tested at 500 PSIG minimum. Evaporator coils shall utilize equalizing flow distributors and shall be interlaced where multiple circuits are utilized.
3. Air-cooled condenser shall be vertical discharge type utilizing direct drive ECM (electrically commutated) motors capable of full speed modulation based on active head pressure control. Condenser fans shall feature low noise glass fiber reinforced polypropylene blades. Fans shall be statically and dynamically balanced. Condenser shall be provided with hail guards.
4. Evaporator coils and condenser coils shall be coated with a third-party non-metallic, non-bridging corrosion barrier material by a factory trained and authorized applicator. Coating shall meet ASTM B117 3000-hour accelerated salt spray test and shall have negligible (less than 1%) impact on equipment’s capacity/performance.
5. Manufacturer shall provide all refrigeration system components/accessories deemed necessary including, but not necessarily limited to, filter-driers, charging ports, accumulators, service ports, sight glass, expansion valves, etc.
6. Cooling coil condensate drain pan shall be provided with a factory installed high level switch wired to shutdown the unit on high level condition.
7. Provide sound attenuation blanket wrap for all compressors.

I. Gas heating section shall be AGA-certified, induced-draft, 10:1 turndown indirect gas furnace with electronic modulating gas valve, two-speed combustion fan, and stainless steel Type 439 heat exchanger.

1. Combustion fan shall be direct drive high pressure centrifugal type with built-in motor thermal overload protection.

2. Controls shall include initial combustion air flow proof, continuous airflow proof/monitoring following ignition, continuous electronic flame supervision, flame roll-out safeties. High temperature automatic reset safeties with sensors located at combustion blower and in unit supply fan chamber shall shut off gas flow in the event of excessive temperatures (reduced or loss of unit supply air flow).
3. Unit controls shall monitor heat output and shall discontinue all heating attempts and/or unit operation due to ignition failure or failure to maintain supply air temperature setpoint.

J. Units shall be factory wired with a single point through base power connection according to NEC and listed per ETL. All major electrical components shall be UL listed. Unit's integral control center shall be isolated from supply airflow, exhaust airflow, compressors, and heating elements and shall include non-fused disconnect, sub-circuit fusing, single phase and low voltage transformers, control circuit fusing, terminal block, fan motor variable frequency drives, factory supplied, mounted, and wired phase and voltage monitor, and connection for controls. Units shall be provided with powered GFCI convenience outlet.

K. Units shall include factory supplied, mounted, wired, and tested microprocessor controls for discharge air temperature control. Microprocessor controller shall be mounted in a weather-proof enclosure and accessible without exposing the operator to high voltage wiring or having to turn off or circumvent the main disconnect, and shall include local liquid crystal display (LCD) for user interface. Controls shall include resident software, non-volatile memory, and DDC BACnet communications capability integrating I/O to and from all onboard controllers and variable frequency drives to/from the DDC control system. Manufacturers/supplier shall coordinate I/O requirements with the DDC controls system. **All controls I/O, sensors, devices, and HVAC Sequence of Operation directly associated with the unit shall be provided by unit on-board factory installed DDC controller with interface to the building DDC controls system.** The following sensors shall be factory supplied, mounted, and wired inside the unit:

1. Outdoor air humidity sensor.
2. Outdoor air temperature sensor.
3. Evaporator coil leaving air temperature sensor. **Refrigerant system capacity control via use of indirect methods such as head pressure shall not be allowed.**
4. Discharge air temperature sensor (field installed).
5. Filter differential pressure switches
6. Gas heating coil discharge air temperature sensor.
7. Cooling coil condensate pan high level switch.
8. Compressor power conductor status current switch(es).
9. Fan inlet airflow piezo-ring.

L. Roof curbs shall be provided by the unit's supplier. Curbs shall be spring vibration isolation type custom made from 12 gauge or heavier as required galvanized steel with welded one-piece construction and insulated with 1-1/2" thick rigid insulation. Curb height shall be a minimum of 14" high above finished roof height. Secure curb to roof structure and unit to curb per manufacturer's recommendations for site's wind zone loading. Curbs shall have structural cross members.

M. Unit shall be run tested prior to shipment from the factory. Factory run test report shall be provided to the Engineer, Contractor, and Owner and also included with unit. Testing shall include passing a dielectric (hipot) test, all dampers, all fans, energy recovery wheel, and performance of refrigeration systems.

N. Startup and field testing shall be by factory authorized service representative.

O. Units shall be Trane, Valent, AAON, Munters, Semco, Venmar, or approved equal.

230007 LABORATORY EXHAUST FANS

Laboratory Exhaust Fans shall conform to ANSI/AMCA Standards 210 and 300. Fans must be tested in accordance with AMCA 211 and 311 in an AMCA accredited laboratory. Fans shall be licensed to bear the AMCA Ratings Seal for air performance (AMCA 210) and sound performance (AMCA 300). Fans shall be upblast type for exterior roof mounting applications with extension stack and high velocity conical induction discharge nozzle specifically designed for outlet velocities up to 7000 feet per minute. The discharge nozzle shall provide induction of ambient air into the discharge stream to result in approximately 200% minimum dilution of the process air stream as indicated in the equipment schedule. Discharge stack caps, hinged covers, or backdraft style shutters in the discharge exhaust stream are prohibited. Fan assemblies that utilize flexible connectors are prohibited. Where required for variable flow laboratory exhaust systems, or where required for fan performance reasons, a bypass air plenum shall be provided on the inlet side of the fan. Fan assembly shall be provided with a factory fabricated structurally reinforced and insulated roof curb to match the assembly base. The complete fan assembly shall be of all (or a combination of) steel or stainless steel type 316 construction. Joints, seams, and attachments shall be all-welded, or, bolted only where removable items or maintenance access is required. Fan assemblies or components fabricated of polypropylene or fiberglass or other materials that have lower mechanical properties than steel, have rough surfaces in which corrosive and/or hazardous materials can collect, and/or which chalk or structurally degrade due to exposure to corrosive or hazardous materials or the UV component of sunlight are prohibited. Upon final assembly, units shall be coated with a factory two part electrostatically applied and baked corrosion resistant coating. Coating preparation shall include a multi-stage wash and mild acid pickling. The first coat of the two part system shall be a 70% minimum zinc rich epoxy primer heated to a gelatinous consistency (partial cure) followed immediately by a second coat of polyester resin cured at a temperature of 400°F. Final coating thickness shall be 6 mils and shall meet the requirements for a 4000 hour ATM B117 salt spray test. Acceptable manufacturer's: Greenheck Vektor High Plume Dilution Fan or approved equal.

A. Fan housing shall be axial flow tubular bifurcated type allowing all drive components, including the motor, to be serviced without contact of the contaminated airstream. Housing shall feature a drain, and bolted/gasketed impeller access door. Fan shall be AMCA arrangement 9, and AMCA class C spark resistant.

B. Impeller shall be mixed flow design with non-stall characteristics, all-welded construction, electronically statically and dynamically balanced to grade G6.3 minimum per AMCA Standards. Impeller shall feature a secondary fan blade located on the primary impeller back plate to create a negative pressure at the shaft/housing interface preventing hazardous/corrosive/toxic fumes from escaping through the housing shaft opening. Mechanical shaft seals that can wear out or seal systems utilizing hoses or tubes are prohibited.

C. Bypass air plenum shall include an opposed action airfoil blade bypass air damper of stainless steel type 316 construction with stainless steel damper shaft bearings and stainless steel jamb seals. Construction shall be equal to Greenheck HCD-130. Damper blade drive linkage shall be set by the manufacturer and welded to eliminate linkage slippage. Damper shall be provided from the factory with a manual locking operator.

D. Fan assembly shall be provided with a parallel action airfoil blade inlet isolation damper of construction similar to bypass air damper. Damper shall be factory installed with gear driven actuator pre-wired to a step-down transformer, all meeting National Electric Code requirements and housed in a weatherproof enclosure.

E. Motor shall be premium efficiency, VFD rated with class F insulation, standard NEMA frame with TEFC enclosure, industrial duty with service factor of 1.15 with factory motor/drive cover. Factory mounted motor electrical disconnect shall be NEMA 4X stainless steel. Fan shaft shall be turned and polished stainless steel type 316 with corrosion resistant coating. Fan shaft bearings shall be ball or roller pillow block sized for and L-10 life of 200,000 hours minimum. All shaft bearings and non-permanently lubricated motors shall have stainless steel braided extended lubrications lines with Zerk fittings. Drive shall be belt type with service factor of 2.0.

F. Variable Frequency Drives (VFDs) for Remote Mounting:

1. Variable frequency drives shall be provided, mounted and wired by the AHU manufacturer as indicated on the schedule and drawings. All standard and optional features shall be included within the VFD enclosure, unless otherwise specified. The VFDs shall be UL listed. The listing shall allow mounting in plenum or other air handling compartments.
2. The VFD shall convert incoming fixed frequency three-phase AC power into a variable frequency and voltage for controlling the speed of three-phase AC motors. The motor current shall closely approximate a sine wave. Motor voltage shall be varied with frequency to maintain desired motor magnetization current suitable for centrifugal pump and fan control and to eliminate the need for motor derating.
3. With the motor's rated voltage applied to the VFD input, the VFD shall allow the motor to produce full rated power at rated amps, RMS fundamental volts, and speed without using the motor's service factor. VFDs utilizing sine weighted/coded modulation (with or without 3rd harmonic injection) must provide data verifying that the motors will not draw more than full load current during full load and full speed operation.
4. The VFD shall include an input full-wave bridge rectifier and maintain a fundamental power factor near unity regardless of speed or load.
5. The VFD and options shall be tested to ANSI/UL Standard 508. The complete VFD, including all specified options, shall be assembled by the manufacturer, which shall be UL 508 certified for the building and assembly of option panels. Assembly of separate panels with options by a third-party is not acceptable. The appropriate UL stickers shall be applied to both the VFD and option panel, in the case where these are not contained in one panel.
6. The VFD shall have DC link reactors on both the positive and negative rails of the DC bus to minimize power line harmonics. VFDs without DC link reactors shall provide a minimum 3% impedance line reactor.
7. The VFDs full load amp rating shall meet or exceed NEC Table 430-150. The VFD shall be able to provide full rated output current continuously, 110% of rated current for 60 seconds and 160% of rated current for up to 0.5 second while starting.
8. The VFD shall be able to provide full torque at any selected frequency from 28 Hz to base speed to allow driving direct drive fans without derating.
9. An automatic energy optimization selection feature shall be provided standard in the VFD. This feature shall automatically and continually monitor the motor’s speed and load and adjust the applied voltage to maximize energy savings and provide up to an additional 3% to 10% energy savings.
10. Input and output power circuit switching shall be able to be accomplished without interlocks or damage to the VFD. Switching rate may be up to 1 time per minute on the input and unlimited on the output.
11. An automatic motor adaptation test algorithm shall measure motor stator resistance and reactance to optimize performance and efficiency. It shall not be necessary to run the motor or de-couple the motor from the load to run the test.
12. Galvanic and/or optical isolation shall be provided between the VFDs power circuitry and control circuitry to ensure operator safety and to protect connected electronic control equipment from damage caused by voltage spikes, current surges, and ground loop currents. VFDs not including either galvanic or optical isolation on both analog I/O and discrete I/O shall include additional isolation modules.
13. The VFD shall minimize the audible motor noise through the use of an adjustable carrier frequency. The carrier frequency shall be automatically adjusted to optimize motor and VFD efficiencies while reducing motor noise.
14. Protective Features:

    a. Protection shall be provided against input transients, loss of AC line phase, output short circuit, output ground fault, overvoltage, undervoltage, VFD overtemperature and motor overtemperature. The VFD shall display all faults as words. Codes are not acceptable.
    b. The VFD shall be protected from sustained power or phase loss. The VFD shall provide full rated output with an input voltage as low as 90% of the nominal. The VFD shall continue to

operate with reduced output with an input voltage as low as 164 V AC for 208/230 volt units, 313 V AC for 460 volt units, and 394 volts for 600 volts units.

c. The VFD shall incorporate a motor preheat circuit to keep the motor warm and prevent condensation build up in the stator.
d. The VFD package shall include semi-conductor rated input fuses to protect power components.
e. To prevent breakdown of the motor winding insulation, the VFD shall be designed to comply with IEC Part 34-17. Otherwise the AHU manufacturer shall ensure that inverter rated motors are supplied.
f. The VFD shall include a "signal loss detection" circuit to sense the loss of an analog input signal such as 4 to 20 mA or 2 to 10 V DC, and shall be programmable to react as desired in such an instance.
g. The VFD shall function normally when the keypad is removed while the VFD is running and continue to follow remote commands. No warnings or alarms shall be issued as a result of removing the keypad.
h. The VFD shall catch a rotating motor operating forward or reverse up to full speed.
i. The VFD shall be rated for 100,000 amp interrupting capacity (AIC).
j. The VFD shall include current sensors on all three output phases to detect and report phase loss to the motor. The VFD shall identify which of the output phases is low or lost.
k. The VFD shall continue to operate without faulting until input voltage reaches 300 V AC on 208/230 volt units, 539 V AC on 460 volt units, and 690 volts on 600 volt units.

15. Interface Features:

a. Hand/Start, Off/Stop and Auto/Start selector switches shall be provided to start and stop the VFD and determine the speed reference. On units with bypass, a VFD/Off/Bypass selector switch shall be provided.
b. The VFD shall be able to be programmed to provide a 24 V DC output signal to indicate that the VFD is in Auto/Remote mode.
c. The VFD shall provide digital manual speed control. Potentiometers are not acceptable.
d. A lockable, alphanumeric backlit display keypad shall be provided. The keypad shall be remotely mountable up to 10 feet away using standard 9-pin cable.
e. The keypads for all sizes of VFDs shall be identical and interchangeable.
f. To set up multiple VFDs, it shall be possible to upload all setup parameters to the VFDs keypad, place that keypad on all other VFDs in turn and download the setup parameters to each VFD. To facilitate setting up VFDs of various sizes, it shall be possible to download from the keypad only size independent parameters.
g. The display shall be programmable to display in English, Spanish and French at a minimum.
h. A red FAULT light, a yellow WARNING light and a green POWER-ON light shall be provided. These indications shall be visible both on the keypad and on the VFD when the keypad is removed.
i. A quick setup menu with factory preset typical HVAC parameters shall be provided on the VFD eliminating the need for macros.
j. The VFD shall include a standard EIA-485 with BACNET MS/TP Communications Port.
k. At a minimum, the following points shall be controlled and/or accessible:

1) VFD Start/Stop
2) Speed reference
3) Fault diagnostics
4) Meter points:

a) Motor power in HP
b) Motor power in kW
c) Motor kW-hr
d) Motor current
e) Motor voltage
f) Hours run
g) 2 feedback signals

h) DC link voltage
i) Thermal load on motor
j) Thermal load on VFD
k) Heatsink temperature

l. Four additional Form C 230 volt programmable relays shall be available for field installation within the VFD
m. Two set-point control interfaces (PID control) shall be standard in the unit. The VFD shall be able to look at two feedback signals, compare with two set-points and make various process control decisions.
n. Floating point control interface shall be provided to increase/decrease speed in response to contact closures.
o. Four simultaneous displays shall be available. They shall include frequency or speed, run time, output amps and output power. VFDs unable to show these four displays simultaneously shall provide panel meters.
p. Sleep mode shall be provided to automatically stop the VFD when its speed drops below set ¿sleep¿ level for a specified time. The VFD shall automatically restart when the speed command exceeds the set ¿wake¿ level.
q. The sleep mode shall be functional in both follower mode and PID mode.
r. A run permissive circuit shall be provided to accept a ¿system ready¿ signal to ensure that the VFD does not start until dampers or other auxiliary equipment are in the proper state for VFD operation. The run permissive circuit shall also be capable of sending an output signal as a start command to actuate external equipment before allowing the VFD to start.
s. The following displays shall be accessible from the control panel in actual units: Reference Signal Value, Output Frequency in Hz or percent, Output Amps, Motor HP, Motor kW, kWhr, Output Voltage, DC Bus Voltage, VFD Temperature in degrees, and unit CFM.
t. The display shall be programmed to read in inches of water column (in-wg).
u. The VFD shall be able to be programmed to sense the loss of load and signal a no load/broken belt warning or fault.
v. If the temperature of the VFDs heat sink rises to 80°C, the VFD shall automatically reduce its carrier frequency to reduce the heat sink temperature. If the temperature of the heat sink continues to rise the VFD shall automatically reduce its output frequency to the motor. As the VFDs heat sink temperature returns to normal, the VFD shall automatically increase the output frequency to the motor and return the carrier frequency to its normal switching speed.
w. The VFD shall have temperature controlled cooling fans for quiet operation and minimized losses.
x. The VFD shall store in memory the last 10 faults and related operational data.
y. Eight programmable digital inputs shall be provided for interfacing with the systems control and safety interlock circuitry.
z. Two programmable relay outputs, one Form C 240 V AC, one Form A 30 V AC, shall be provided for remote indication of VFD status.
aa. Three programmable analog inputs shall be provided and shall accept a direct-or-reverse acting signal. Analog reference inputs accepted shall include two voltage (0 to 10 V DC, 2 to 10 V DC) and one current (0 to 20 mA, 4 to 20 mA) input.
bb. Two programmable 0 to 20 mA analog outputs shall be provided for indication of VFD status. These outputs shall be programmable for output speed, frequency, current and power. They shall also be programmable to provide a selected 24V DC status indication.
cc. Under fire mode conditions, the VFD shall be able to be programmed to automatically default to a preset speed.

16. Adjustments:

a. The VFD shall have an adjustable carrier frequency in steps of not less than 0.1 kHz to allow tuning the VFD to the motor.
b. A minimum of sixteen preset speeds shall be provided.

c. Four acceleration and four deceleration ramps shall be provided. Accel and decel time shall be adjustable over the range from 0 to 3,600 seconds to base speed. The shape of these curves shall be automatically contoured to ensure no-trip acceleration and deceleration.
d. Four current limit settings shall be provided.
e. If the VFD trips on one of the following conditions, the VFD shall be programmable for automatic or manual reset: undervoltage, overvoltage, current limit and inverter overload.
f. The number of restart attempts shall be selectable from 0 through 20 or infinitely and the time between attempts shall be adjustable from 0 through 600 seconds.
g. An automatic ¿on delay¿ shall be selectable from 0 to 120 seconds.

17. Service Conditions:

a. VFDs shall provide full output in an ambient temperature from -10 to 50°C (14 to 104°F).
b. VFDs shall provide full output in a relative humidity from 0 to 95%, non-condensing.
c. VFDs shall provide full output up to 3,300 feet elevation without derating.
d. VFDs shall provide full output with an AC line voltage variation from -10 to +10% of nominal voltage.
e. No side clearance shall be required for cooling of any units. All power and control wiring shall be done from the bottom.

18. Warranty:

a. The VFD shall be warranted by the manufacturer for a period of 42 months from date of shipment, or 36 months from start-up, whichever occurs first. The warranty shall include parts, labor, travel costs and living expenses incurred by the manufacturer to provide factory-authorized on-site service.

230008 DUCT ELECTRIC HEATING COIL

A. Unit shall be factory fabricated, flanged or insertion type for duct mounting applications. Heating coil units shall comply with National Electric Code requirements. Unit shall be U.L. Listed and labeled.

B. Element assembly shall be open coil type modular design with each module independently and easily removable. Elements shall be of high grade 80/20 nickel/chromium Grade A resistance wire with ceramic supports. Elements shall be arranged to eliminate shadowing or stacking and blank areas.

C. Housing and element racks shall be of galvanized steel construction with multiple breaks and ribs for stiffness and rigidity.

D. Units shall feature NEMA 1 control cabinet with automatic reset thermal cut-outs, manual reset thermal cut-outs, ultra-low range (0.02” SP), air flow switch, door interlocked fused disconnect switch with fuses, overcurrent protection, control power transformer, and pilot light indicating power is on. Provide incoming power phase monitoring for unit as specified here-in before. For SCR-fired heaters, provide integral SCR power controller featuring heat sink, electronic controls, status LED, and capable of accepting a 0-10 VDC or 4-20 mA control signal from the DDC control system.

230009 DIFFUSERS, REGISTERS AND GRILLES

Diffusers, registers and grilles shall be heavy gauge sheet metal construction, factory fabricated, rattle free, with published performance data including airflow, throw, noise level, and pressure drop per A.S.H.R.A.E. Standard 70. All diffusers and registers shall be provided with face-accessible opposed blade dampers and factory off-white baked enamel finish, unless otherwise noted in the mechanical schedule or specifications. All grilles shall be provided as specified for diffusers and registers as above and as follows less opposed blade dampers.

A. Lay in Supply Air Diffusers: Shall be aluminum construction, with hinged, flat perforated face (51% free area minimum), factory back pan with round duct connection, panel border to drop in 24" x 24" "T" bar ceiling grid, with neck-mounted radial sliding blade dampers.

B. Lay in Ceiling and Duct Mounted Return Exhaust/Air Registers: Shall be aluminum 1/2" x 1/2" x 1" egg crate with panel border, and designed to lay in an inverted "T" bar ceiling grid. Registers shall be full flow across the entire face with plenum or tapered transition up to neck size.

230010 DIRECT DIGITAL CONTROLS

A. General:

1. Work Included:

a. The existing DDC controls system is JOHNSON CONTROLS METASYS. DDC controls installed and/or modified under this project shall be JOHNSON CONTROLS or approved equal. Furnish a totally native BACnet-based system to include software/programming updates to the latest available version. All building controllers, application controllers, and all input/output devices shall communicate using the protocols and network standards as defined by ANSI/ASHRAE Standard 135-2008, BACnet. Gateways may only be used for communication to existing systems or to equipment controllers provided by the equipment manufacturer. Gateways shall provide full read/write interface as required to enable BAS points monitoring, points command, setpoint resets, etc. for a fully functional two-way communication integration. All existing controls shall be migrated to upgraded engine(s)/controllers, and, the latest version of DDC controls software/programming shall be provided. The Owner will provide existing input/output requirements and sequences of operation for incorporation of appropriate programming into the DDC controls system.

b. Integration and associated costs shall be provided along with connectivity software licenses. Licenses shall allow specified BAS point information to be broadcast out of the BAS expansion to the existing JOHNSON CONTROLS system. All gateway appliances, integration panels, switches, media converters, routers, etc. necessary for the interface/integration shall be provided as necessary for a fully functional control system. Database creation and/or updates shall be provided to maintain the existing JOHNSON CONTROLS METASYS database integrity and point naming standards. HVAC system graphics, floor plan graphics, etc. shall be generated and implemented consistent with Owner's JOHNSON CONTROLS METASYS standards. BACnet data points shall be bound to the graphics in the METASYS user interface.

c. Provide all necessary BACnet-compliant hardware and software to meet the system's functional specifications. Provide Protocol Implementation Conformance Statement (PICS) for Windows-based control software and every controller in system, including unitary controllers.

d. Prepare individual hardware layouts, interconnection drawings, and software configuration from project design data.

e. Implement the detailed design for all analog and binary objects, system databases, graphic displays, logs, and management reports based on control descriptions, logic drawings, configuration data, and bid documents.

f. Design, provide, and install all equipment cabinets, panels, data communication network cables needed, and all associated hardware.

g. Provide and install all interconnecting cables between supplied cabinets, application controllers, and input/output devices.

h. Provide and install all interconnecting cables between all operator's terminals and peripheral devices (such as printers, etc.) supplied under this section.

i. Provide complete manufacturer's specifications for all items that are supplied. Include vendor name of every item supplied.

j. Provide supervisory specialists and technicians at the job site to assist in all phases of system installation, integration, startup, and commissioning.

k. Provide a comprehensive operator and technician training program as described herein.
l. Provide as-built documentation, operator's terminal software, diagrams, and all other associated project operational documentation (such as technical manuals) on approved media, the sum total of which accurately represents the final system.
m. Provide new sensors, dampers, valves, and install only new electronic actuators. No used components shall be used as any part or piece of installed system.

2. System Description:

a. A distributed logic control system complete with all software and hardware functions shall be provided and installed. System shall be completely based on ANSI/ASHRAE Standard 135-2008, BACnet and achieved listing under the BACnet Testing Laboratories BACnet - Advanced Workstation Software (B-AWS). This system is to control all mechanical equipment, including all unitary equipment such as VAV boxes, heat pumps, fan-coils, AC units, etc., and all air handlers, boilers, chillers, and any other listed equipment using native BACnet-compliant components. Non-BACnet-compliant or proprietary equipment or systems (including gateways) shall not be acceptable and are specifically prohibited.
b. BAS system architecture shall include a **remote virtual Application and Data Server (ADS)** with all necessary resident software, database(s), configuration tools, etc. necessary for operation. The ADS shall provide for use of mobile user interface for user friendly access to system information and graphics, associated application components, system configuration tool controller configuration and programming, repository of all graphics files for the complete system. The server platform shall be capable of managing the collection and presentation of large amounts of trend data, event messaging, operator transactions, system configuration, advanced network security (encrypted communications, HTTPS with Transport Level Security support), and support for twenty five (25) minimum simultaneous web browser client users. **The BAS Contractor shall be responsible for coordination with the Owner's IT staff to ensure proper server installation at Owner-designated location, ensure IT security requirements are met, and ensure that BAS performance does not adversely affect the Owner's LAN operating environment.** Acceptable manufacturers: Johnson Controls ADS or approved equal.
c. BAS shall be designed for use on the Internet, or intranets, using industry standard technology compatible with Owner's network(s). System generally consists of, but is not limited to, network engines, equipment controllers, input/output modules, local display devices, portable operator terminals, distributed user interfaces, network processing, data storage, and communications equipment. Installing contractor shall confirm with the Owner to ensure any of Owner's existing portable terminals such as Microsoft Surface Pro, are usable.
d. Where required, operator's workstation software shall use Windows 10 Professional, as the computer operating system. The Energy Management and Control System (EMCS) application program shall be written to communicate specifically utilizing BACnet protocols. Software functions delivered on this project shall include password protection, scheduling (including optimum start), alarming, logging of historical data, full graphics including animation, after-hours billing program, demand limiting, and a full suite of field engineering tools including graphical programming and applications. Systems using operating systems other than that described above are strictly prohibited. All software required to program application specific controllers and all field level devices and controllers will be left with the owner. All software passwords required to program and make future changes to the system will also become the property of the owner. All software required to make any program changes anywhere in the system, along with scheduling and trending applications, will be left with the owner. All software passwords required to program and make future changes to schedules, trends and related program changes will also become the property of the owner. All software required for all field engineering tools including graphical programming and applications will be left with the owner. All software passwords required to program and make future changes to field engineering tools, including graphical programming and applications will be left with the owner.
e. Building controllers shall include complete energy management software, including scheduling building control strategies with optimum start and logging routines. All energy

management software and firmware shall be resident in field hardware and shall not be dependent on the operator's terminal. Operator's terminal software is to be used for access to field-based energy management functions only. Provide zone-by-zone direct digital logic control of space temperature, scheduling, runtime accumulation, equipment alarm reporting, and override timers for after-hours usage.

f. Room sensors shall be provided with digital readout that allow the user to view room temperature, view outside air temperature, adjust the room setpoint within preset limits and set desired override time. User shall also be able to start and stop unit from the digital sensor. Include all necessary wiring and firmware such that room sensor includes field service mode. Field service mode shall allow a technician to balance VAV zones and access any parameter in zone controller directly from the room sensor. Field service mode shall have the ability to be locked out.

g. All application controllers for every terminal unit (VAV, HP, UV, etc.) air handler, all central plant equipment, and any other piece of controlled equipment shall be fully programmable. Application controllers shall be mounted next to controlled equipment and communicate with building controller through BACnet LAN.

h. All control equipment used to perform any or all of the specified smoke control sequences shall be UL-864 UUKL listed. This includes all field controllers and global control devices. Non-UUKL rated equipment shall not be networked to any devices on the network performing smoke control sequences unless isolated by a UUKL-rated device. See drawings for actual sequence of operations.

3. Quality Assurance:

a. The Building Automation System (BAS) shall be designed, installed, commissioned, and serviced by manufacturer authorized and trained personnel. The manufacturer of BAS controls systems shall be a recognized national company. Installation of the BAS shall be by a primary manufacturer-owned office that is regularly engaged in the engineering, programming, installation and service of total integrated HVAC DDC controls systems.

1) The contractor shall provide full-time, on-site, experienced project manager for this work, responsible for direct supervision of the design, installation, start-up and commissioning of the BAS system.

2) The BAS controls contractor shall be regularly engaged in the design, installation and maintenance of BAS systems and shall have demonstrated technical expertise and experience in the design, installation and maintenance of BAS systems similar in size and complexity to this project. The BAS controls contractor must have been in business for at least the last ten (10) years and have successfully completed total projects of at least ten (10) times the value of this contract in each of the preceding five (5) years.

b. Materials and equipment shall be manufacturer's latest standard design that complies with the specification requirements.

c. All BAS peer-to-peer network controllers, central system controllers and local user displays shall be UL Listed under Standard UL 916, category PAZX.

d. All electronic equipment shall conform to the requirements of FCC Regulation, Part 15, Governing Radio Frequency Electromagnetic Interference and be so labeled.

e. Control system shall be engineered, programmed and supported completely by BAS Controls Contractor's local office that must be within 100 miles of project site and supplying complete maintenance and support services on a 24-hour per day, 7-day per week basis. The BAS local office shall have, at this office, a trained directly employed full time technical staff, spare parts inventory, and all test and diagnostic equipment.

4. Reference Standards:

a. The latest edition of the following standards and codes in effect and amended as of supplier's proposal date, and any applicable subsections thereof, shall govern design and selection of equipment and material supplied:

1) American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE).
2) ANSI/ASHRAE Standard 135-2008, BACnet.
3) Uniform Building Code (UBC), including local amendments.
4) UL 916 Underwriters Laboratories Standard for Energy Management Equipment. Canada and the US.
5) National Electrical Code (NEC).
6) FCC Part 15, Subpart J, Class A.
7) EMC Directive 89/336/EEC (European CE Mark).
8) UL-864 UUKL listing for Smoke Controls for any equipment used in smoke control sequences.

b. City, county, state, and federal regulations and codes in effect as of contract date.
c. Except as otherwise indicated, the system supplier shall secure and pay for all permits, inspections, and certifications required for his work, and arrange for necessary approvals by the governing authorities.

5. Submittals:

a. Drawings:

1) The system supplier shall submit engineered drawings, control sequence, and bill of materials for approval.
2) Drawings shall be submitted in the following standard sizes: 8.5” x 11”
3) Eight (8) complete sets (copies) of submittal drawings shall be provided.
4) Drawings shall be available on digital media.

b. System Documentation: Include the following in submittal package:

1) System configuration diagrams in simplified block format.
2) All input/output object listings and an alarm point summary listing.
3) Electrical drawings that show all system internal and external connection points, terminal block layouts, and terminal identification.
4) Complete bill of materials, valve schedule and damper schedule.
5) Manufacturer's instructions and drawings for installation, maintenance, and operation of all purchased items.
6) Overall system operation and maintenance instructions—including preventive maintenance and troubleshooting instructions.
7) For all system elements—operator’s workstation(s), building controller(s), application controllers, routers, and repeaters—provide BACnet Protocol Implementation Conformance Statements (PICS) as per ANSI/ASHRAE Standard 135-2001.
8) Provide complete description and documentation of any proprietary (non-BACnet) services and/or objects used in the system.
9) A list of all functions available and a sample of function block programming that shall be part of delivered system.

c. Project Management:

1) The vendor shall provide a detailed project design and installation schedule with time markings and details for hardware items and software development phases. Schedule shall show all the target dates for transmission of project information and documents, and shall indicate timing and dates for system installation, debugging, and commissioning.

d. BACnet Device Object Naming Conventions:

1) The BAS manufacturer’s representative shall submit a BACnet Device Object Naming Convention Plan (DONCP) to the owner and consulting engineer during the submittal process. The plan must be approved by the owner and consulting engineer prior to

implementation. It is the responsibility of the BAS contractor to coordinate the DONCP with the owner and consulting engineer.

2) The DONCP shall be designed to eliminate any confusion between individual points in a facility/campus wide EMCS system. It will also be designed to allow for future expansion and consistency. Each device on a BACnet internetwork (including other manufacturer's devices) must have a unique device instance. This is a major consideration when adding to an existing system or interconnecting networks. Thorough and accessible site documentation is critical.

3) A consistent object (point) naming convention shall be used to facilitate familiarity and operational ease across an eventual large campus or inventory of facilities. The following section is designed as recommendations only. It is the responsibility of the BAS contractor to coordinate the DONCP with the owner and consulting engineer.

   a) BACnet requires that all devices have a Device object name that is unique throughout the entire internetwork. To comply with this requirement all BACnet devices should be configured with a Device Object Name that is based on the naming conventions described in this section. This includes all physical devices as well as any logical BACnet devices that are represented by gateways. The vendor shall coordinate with the owner's staff to ensure that the correct names are used. Device Object Name properties shall support strings of at least 50 characters in length.

   b) Every system device has addresses by which any other BACnet device can identify it and route information to and from it. Although there are a number of addresses to consider, the scheme is fairly straightforward. It can become complicated, however, if addresses have not been documented adequately or there is no logical addressing scheme.

   c) When you set up and plan a BACnet network or add to an existing network, considering and documenting your addressing scheme is of the utmost importance. Adopt a hierarchical and uniform addressing scheme for device instances to help you quickly identify the function and location of different devices when troubleshooting. Additionally, it's very important to document every element of your addressing scheme and update the site documentation with any changes.

   d) This section first covers the important addressing issues with respect to BACnet LANs and it gives a practical application you can use to check your understanding.

      BACnet Addressing: Three types of addresses are important in any BACnet system: network numbers, media access control (MAC) addresses, and device instances. Each BACnet device has these addresses associated with it. Though all three can be thought of as addresses, they are all very different both in how they function and how they are assigned.

      Network Numbers: Identifies the network to which a BACnet device belongs. Every network on a BACnet LAN has a unique numerical identifier—a network number. This network number is used by BACnet devices only; it does not rely on nor does it affect any other network protocols. LANs connected by a router must have different network numbers. No interconnected BACnet networks can have the same network number. Network number range is 1–65,534, for a maximum of 65,534 interconnected BACnet networks.

      IMPORTANT: BACnet reserves network numbers 0 and 65,535 for special purposes. Don't use network 0 or 65,535.

      MAC Addresses: Hardware-oriented. The MAC address uniquely identifies a device on its particular network. Each network type—Ethernet and MS/TP—has its own MAC addressing scheme. A device that exists on two or more networks will have a MAC address for each one. Devices can have the same

MAC addresses as long as they are on networks with different network numbers.

Note: It's helpful to think of the MAC address as a house number and the network number as the street number. Two houses can have the same house number (MAC address) as long as they are on different streets (networks).

Ethernet Devices: For Ethernet LANs, the IEEE assigns a certain range of MAC addresses to manufacturers of Ethernet products. The manufacturer then assigns a unique MAC address to each of its Ethernet devices.

MS/TP Devices: For devices on an MS/TP LAN, you assign the MAC address for each controller. For BACtalk VLCs, these are assigned with DIP switches. Devices on an MS/TP LAN are designated as either masters or slaves, which affects how they can be addressed. This is a requirement of the BACnet specification. All BACtalk MS/TP devices are masters.

IMPORTANT: BACnet reserves MS/TP MAC address 255 for special purposes. Don't use MS/TP MAC 255.

Device Instances: Software-oriented. The device instance identifies the device to the BACnet software and is the address most often encountered. The device instance is a shortcut to having to specify a MAC address and network number each time an operation is performed. Device instances range from 0–4194302.

Note: BACnet reserves device instance 4194303 for special purposes. Don't use device instance 4194303.

6. Warranty:
   a. Warranty shall cover all costs for parts, labor, associated travel, and expenses for a period of one (1) year from completion of system acceptance.
   b. Hardware and software personnel supporting this warranty agreement shall provide on-site or off-site service in a timely manner after failure notification to the vendor. The maximum acceptable response time to provide this service at the site shall be 24 hours, Monday through Friday, and 48 hours on Saturday and Sunday.
   c. This warranty shall apply equally to both hardware and software.
7. Related Work in Other Sections:
   a. Refer to Mechanical Drawings and Specifications.
   b. Refer to Electrical Drawings and Specifications.

B. Products:

1. Operator's Workstation (where a virtual remote Application and Data Server is specified, an Operator's Workstation shall not be required):
   a. A Windows 10 based business class operator work station machine shall host the EMCS server software. Minimum specs for the computer shall be:
      1) 27 in monitor
      2) Core i5-8500
      3) 16GB ram
      4) 750MB 7200 rpm HD
      5) Windows 10 Professional
      6) MS Visio
      7) Keyboard and Optical mouse
      8) 1000va sinewave UPS
   b. All function listed below shall be accessible via any computer connected the network using only a web browser.

c. Displays:

1) Operator's workstation shall display all data associated with project as called out on drawings and/or object type list supplied. Graphic files shall be created using digital, full color photographs of system installation, AutoCAD or Visio drawing files of field installation drawings and wiring diagrams from as-built drawings. Operator's workstation shall display all data using three-dimensional graphic representations of all mechanical equipment. System shall be capable of displaying graphic file, text, and dynamic object data together on each display and shall include animation. Information shall be labeled with descriptors and shall be shown with the appropriate engineering units. All information on any display shall be dynamically updated without any action by the user. Workstation shall allow user to change all field-resident EMCS functions associated with the project, such as setpoints, weekly schedules, exception schedules, etc., from any screen, no matter if that screen shows all text or a complete graphic display. This shall be done without any reference to object addresses or other numeric/mnemonic indications.
2) All displays and programming shall be generated and customized by the local EMCS supplier and installer. Systems requiring factory development of graphics or programming of DDC logic are specifically prohibited.
3) Binary objects shall be displayed as ACTIVE/INACTIVE/NULL or with customized text such as Hand-Off-Auto. Text shall be justified left, right or center as selected by the user. Also, allow binary objects to be displayed as individual change-of-state graphic objects on the display screen such that they overlay the system graphic. Each binary object displayed in this manner shall be assigned up to three (3) graphic files for display when the point is ON, OFF or in alarm. For binary outputs, toggle the object's commanded status when the graphic item is selected with the system mouse. Similarly, allow the workstation operator to toggle the binary object's status by selecting with the mouse, for example, a graphic of a switch or light, which then displays a different graphic (such as an "ON" switch or lighted lamp. Additionally, allow binary objects to be displayed as an animated graphic. Animated graphic objects shall be displayed as a sequence of multiple graphics to simulate motion. For example, when a pump is in the OFF condition, display a stationary graphic of the pump. When the operator selects the pump graphic with the mouse, the represented object's status is toggled and the graphic of the pump's impeller rotates in a time-based animation. The operator shall be able to click an animated graphical object or switch it from the OFF position to ON, or ON to OFF. Allow operator to change graphic file assignment and also create new and original graphics online. System shall be supplied with a library of standard graphics, which may be used unaltered or modified by the operator. Systems that do not allow customization or creation of new graphic objects by the operator (or with third-party software) shall not be allowed.
4) Analog objects shall be displayed with operator modifiable units. Analog input objects may also be displayed as individual graphic items on the display screen as an overlay to the system graphic. Each analog input object may be assigned a minimum of five (5) graphic files, each with high/low limits for automatic selection and display of these graphics. As an example, a graphic representation of a thermometer would rise and fall in response to either the room temperature or its deviation from the controlling setpoint. Analog output objects, when selected with the mouse, shall be displayed as a prompted dialog (text only) box. Selection for display type shall be individual for each object. Analog object values may be changed by selecting either the "increase" or "decrease" arrow in the analog object spinner box without using the keypad. Pressing the button on the right side of the analog object spinner box allows direct entry of an analog value and accesses various menus where the analog value may be used, such as trendlogs.
5) Analog objects may also be assigned to a system graphic, where the color of the defined object changes based on the analog object's value. For example, graphical thermostat device served by a single control zone would change color with respect to

the temperature of the zone or its deviation from setpoint. All editing and area assignment shall be created or modified online using simple icon tools.

6) A customized menu label (pushbutton) shall be used for display selection. Menu items on a display shall allow penetration to lower level displays or additional menus. Dynamic point information and menu label pushbuttons may be mixed on the same display to allow sub-displays to exist for each item. Each display may be protected from viewing unless operator has appropriate security level. A security level may be assigned to each display and system object. The menu label shall not appear on the graphic if the operator does not have the appropriate security level.
7) The BAS displays shall have the ability to link to content outside of the BAS system. Such content shall include but is not limited to: Launching external files in their native applications (for example, a Microsoft Word document) and launching a web browser resolving to a specified web address.
8) The BAS system shall have the ability to run multiple, concurrent displays windows showing continuously updated data.

d. Password Protection:

1) Provide security system that prevents unauthorized use unless operator is logged on. Access shall be limited to operator's assigned functions when user is logged on. This includes displays as outlined above.
2) Each operator's terminal shall provide security for a minimum of 200 users. Each user shall have an individual User ID, User Name, and Password. Entries are alphanumeric characters only and are case sensitive (except for User ID). User ID shall be 0–8 characters, User Name shall be 0–29 characters, and Password shall be 4–8 characters long. Each system user shall be allowed individual assignment of only those control functions, menu items, and user specific system start display, as well restricted access to *discrete BACnet devices* to which that user requires access. All passwords, user names, and access assignments shall be adjustable online at the operator's terminal. Users should have the capability to be assigned to specific user type "groups" that can share the same access levels to speed setup. Users who are members of multiple "groups" shall have the ability to activate/deactivate membership to those groups while using the BAS (without logout). Users shall also have a set security level, which defines access to displays and individual objects the user may control. System shall include 10 separate and distinct security levels for assignment to users.
3) System shall include an Auto Logout Feature that shall automatically logout user when there has been no keyboard or mouse activity for a set period of time. Time period shall be adjustable by system administrator. Auto Logout may be enabled and disabled by system administrator. Operator terminal shall display message on screen that user is logged out after Auto Logout occurs.
4) The system shall permit the assignment of an effective date range, as well as an effective time of day, that the User IDs are permitted to authenticate.

e. Operator Activity Log:

1) Operator Activity Log that tracks all operator changes and activities shall be included with system. System shall track what is changed in the system, who performed this change, date and time of system activity, and value of the change before and after operator activity. Operator shall be able to display all activity, sort the changes by user and also by operation. Operator shall be able to print the Operator Activity log display.
2) Log shall be gathered and archived to hard drive on operator's workstation as needed. Operator shall be able to export data for display and sorting in a spreadsheet.
3) Any displayed data that is changeable by the operator may be selected using the right mouse button and the operator activity log shall then be selectable on the screen. Selection of the operator activity log using this method shall show all operator changes of just that displayed data.

f. Scheduling:

1) Operator's workstation shall show all information in easy-to-read daily format including calendar of this month and next. All schedules shall show actual ON/OFF times for day based on scheduling priority. Priority for scheduling shall be events, holidays and daily, with events being the highest.
2) Holiday and special event schedules shall display data in calendar format. Operator shall be able to schedule holidays and special events directly from these calendars.
3) Operator shall be able to change all information for a given weekly or exception schedule if logged on with the appropriate security access.
4) System shall include a Schedule Wizard for set up of schedules. Wizard shall walk user through all steps necessary for schedule generation. Wizard shall have its own pull-down selection for startup or may be started by right-clicking on value displayed on graphic and then selecting Schedule.
5) Scheduling shall include optimum start based on outside air temperature, current heating/cooling setpoints, indoor temperature and history of previous starts. Each and every individual zone shall have optimum start time independently calculated based on all parameters listed. User shall input schedules to set time that occupied setpoint is to be attained. Optimum start feature shall calculate the startup time needed to match zone temperature to setpoint. User shall be able to set a limit for the maximum startup time allowed.
6) Any displayed data that is changeable by the operator may be selected using the right mouse button and the schedule shall then be selectable on the screen. Selection of the schedule using this method shall allow the viewing of the assigned schedule or launch the Schedule Wizard to allow the point to be scheduled.

g. Alarm Indication and Handling:

1) Operator's workstation shall provide audible, visual, printed, and email means of alarm indication. The alarm dialog box shall always become the top dialog box regardless of the application(s) currently running. Printout of alarms shall be sent to the assigned terminal and port. Alarm notification can be filtered based on the User ID's authorization level.
2) System shall provide log of alarm messages. Alarm log shall be archived to the hard disk of the system operator's terminal. Each entry shall include a description of the event-initiating object generating the alarm. Description shall be an alarm message of at least 256 characters in length. Entry shall include time and date of alarm occurrence, time and date of object state return to normal, time and date of alarm acknowledgment, and identification of operator acknowledging alarm.
3) Alarm messages shall be in user-definable text (English or other specified language) and shall be delivered either to the operator's terminal, client or through remote communication using email (Authenticated SMTP supported).
4) System shall include an Alarm Wizard for set up of alarms. Wizard shall walk user through all steps necessary for alarm generation. Wizard shall have its own pull-down selection for startup or may be started by right-clicking on value displayed on graphic and then selecting alarm setup.
5) Any displayed data that is changeable by the operator may be selected using the right mouse button and the alarm shall then be selectable on the screen. Selection of the alarm using this method shall allow the viewing of the alarm history or launch the Alarm Wizard to allow the creation of a new alarm.

h. Trendlog Information:

1) Software that is capable of graphing the trend logged object data shall be included. Software shall be capable of creating two-axis (X, Y) graphs that display up to 10 object types at the same time in different colors. Graphs shall show object values relative to time. Each trendlog shall support a custom scale setting for the graph view

that is to be stored continuously. System shall be capable of trending on an interval determined by a polling rate, or change-of-value.

2) Operator shall be able to change trendlog setup information. This includes the information to be logged as well as the interval at which it is to be logged. All input, output, and value object types in the system may be logged. All operations shall be password protected. Setup and viewing may be accessed directly from any and all graphics on which object is displayed.
3) System shall include a Trend Wizard for setup of logs. Wizard shall walk user through all necessary steps. Wizard shall have its own pull-down selection for startup, or may be started by right-clicking on value displayed on graphic, and then selecting Trendlogs from the displayed menu.
4) System shall be capable of using Microsoft SQL as the system database.
5) Any displayed data that is changeable by the operator may be selected using the right mouse button and the trendlog shall then be selectable on the screen. Selection of the trendlog using this method shall allow the viewing of the trendlog view or launch the Trendlog wizard to allow the creation of a new trend.

i. Energy Log Information:

1) System shall be capable of periodically gathering energy log data stored in the field equipment and archive the information. Archive files shall be appended with new data, allowing data to be accumulated. Systems that write over archived data shall not be allowed unless limited file size is specified. Display all energy log information in standard engineering units.
2) All data shall be stored in database file format for direct use by third-party programs. Operation of system shall stay completely online during all graphing operations.
3) Operator shall be able to change the energy log setup information as well. This includes the meters to be logged, meter pulse value, and the type of energy units to be logged. All meters monitored by the system may be logged. System shall support using flow and temperature sensors for BTU monitoring.
4) System shall display archived data in tabular format form for both consumption and peak values. Data shall be shown in hourly, daily, weekly, monthly and yearly formats. In each format, the user shall be able to select a specific period of data to view.

j. Demand Limiting:

1) System shall include demand limiting program that includes two types of load shedding. One type of load shedding shall shed/restore equipment in binary fashion based on energy usage when compared to shed and restore settings. The other type of shedding shall adjust operator selected control setpoints in an analog fashion based on energy usage when compared to shed and restore settings. Shedding may be implemented independently on each and every zone or piece of equipment connected to system.
2) Binary shedding shall include minimum of five (5) priority levels of equipment shedding. All loads in a given priority level shall be shed before any loads in a higher priority level are shed. Load shedding within a given priority level shall include two methods. In one, the loads shall be shed/restored in a “first off-first on” mode, and in the other the loads are just shed/restored in a “first off-last on” (linear) fashion.
3) Analog shed program shall generate a ramp that is independently used by each individual zone or individual control algorithm to raise the appropriate cooling setting and lower appropriate heating setting to reduce energy usage.
4) Status of each and every load shed program shall be capable of being displayed on every operator terminal connected to system. Status of each load assigned to an individual shed program shall be displayed along with English description of each load.

2. Mobile, Web Based, User Interface (MUI):

   a. General:

      1) The mobile, web-based, user interface shall be part of the Server software, HTML5-compliant and provide access to the system from smartphones, tablets, portable and desktop computers. User Interfaces that require software installation on the client device (e.g. Java, MicrosoftSilverlight®, Adobe® Flash®), or software downloads from an online app store shall not be acceptable for these purposes.
      2) The mobile user interface shall provide system operators with a simple location-based navigation approach to finding information, including the ability to search for any location by name and to bookmark a location in a standard browser.
      3) The mobile user interface shall organize and display information using customer specific locations and spaces. At a minimum, the user interface shall provide:

         - Organization of all space, equipment and point information in a familiar way (using standard equipment names and location descriptions), reducing the need for extensive training prior to use.
         - A navigation mechanism or tree for users to select the specific location or space for accessing information – only spaces and locations in the navigation tree or equipment serving that space, nothing more.
         - The ability to search for and/or bookmark any location, space, or equipment by name for quick access to critical or troublesome areas.
         - Application of the same navigation mechanisms across any client device (e.g. Smart phone, tablet, personal computer) for consistency and ease of use.

      4) The same user interface elements shall be accessible from any type of personal computer or mobile device running any type of operating system supported (e.g. iOS, Android, Windows®). It shall automatically adapt and optimize the display for the screen size and touch screen navigation.
      5) The user interface shall provide support for up to 50 concurrent users from individuals with defined access to the system.

   b. Navigation Trees:

      1) A dedicated location based navigation tree shall be provided as part of the user interface in order to navigate to specific places within the facility on a hierarchical basis (typ. Facility, Building, Wing, Floor, Room).
      2) The location-based tree shall use place names familiar to the operator without training or familiarization regarding special codes and conventions utilized in the generation of the BMS.
      3) Clicking or tapping on a location name in the tree shall display the home page associated with the space and simultaneously expand the tree to display the next level of spaces below the one selected.
      4) It shall be possible for qualified users to view a navigation tree of devices connected to the BMS network in order to enable troubleshooting of equipment and communications. Clicking or tapping on the Network Icon at the top of the Navigation Tree will access this alternate view. Users without the necessary access rights shall not see the Network Icon.
      5) A click or tap on a device in the network tree shall display a dashboard for that device including information regarding related equipment and access to a separate focus view of commandable points associated with the piece of hardware. A click or tap on such a point shall display a control dialogue box allowing the user to modify or command that point as indicated. The dialog box shall contain an annotation box for describing why the action was taken or special circumstances that apply.
      6) Specific hardware and software types in the Network tree shall also include access to one or more the following views in their dashboard depending on hardware type or network element (e.g. MS/TP trunk):

- Summary View
- Diagnostic View
- Network View
- Trend View

7) It shall be possible to hide the Network Tree and return to the Spaces Tree at any time by clicking on the Spaces Icon above the tree.
8) It shall be possible to restrict user access to any space in the Spaces Tree and thereby prevent manipulation of equipment associated with the space.

c. Dashboard Displays:

1) The user interface shall provide the ability to view equipment visualizations, floor plans, and/or other graphics on mobile or desktop client devices in a browser environment, without the need for additional plugins or software. Graphics shall be accessible via a space (for floorplans, campus maps, etc.) or equipment dashboard.
2) Standard dashboards shall be configured for each defined space including one of the following predefined or custom elements:

- Equipment Serving Space
- Potential Problem Areas
- Equipment Summary
- Graphic Display (if specified)
- Schedule

3) Standard dashboards shall be configured for each system or device (typ. mechanical or electrical equipment) including the following predefined or custom elements:

- Trend
- Equipment Activity Summary
- Equipment Relationships Summary
- Equipment Data
- Graphic Display (if specified)
- Schedule

4) Users with appropriate permissions shall have access to a Dashboards Manager that can change the display order of Summaries and Data elements, add or remove elements and apply custom dashboards layouts to equipment and space by type.
5) Dashboard Manager shall apply dashboards to spaces or equipment based on the viewing platform (Desktop/Tablet or Phone) in order to tailor the user experience to the needs of the specific user base.
6) Default dashboard displays by space and equipment type shall be created per the guidelines in this specification or by mutual agreement with the owner's representative.

d. Alarm Management:

1) The user interface shall provide a single display of all potential issues in a facility including items currently in alarm, warning, override, out-of-service and offline.
2) The user interface shall provide notification of new alarms, visually and audibly.
3) The user interface shall provide the ability to view a summary of alarms, including a chart of the number of alarms in each of the defined alarm priority ranges. The priority ranges should be filterable.
4) The user interface shall provide the capability to view multiple occurrences of the same alarm, ultimately providing the ability to acknowledge or discard all occurrences of the alarm in a single action.

5) The user interface shall provide the capability to view, and filter on, all alarms present in a well-defined mechanical system using the equipment serving equipment relationships.
6) The user interface shall provide the capability to acknowledge and discard all occurrences of at least 1000 alarms in one operation.
7) The user interface shall provide the user with the understanding of what physical space is being affected when an alarm occurs. The user interface shall provide the ability to filter alarms by physical space affected when the alarm occurred.
8) The user interface shall provide the capability to monitor alarms 24/7 without requiring an active login to the system, accessible via segregated web page. The user interface shall provide the capability to enabled or disable the 24/7 alarm monitor mode if desired.
9) The user interface shall provide the capability to annotate alarms using a pre-defined selection list or by providing custom text.
10) The user interface shall provide the capability to filter down alarm list and bookmark the filtered list, allowing automatic filtering to be applied when the bookmark is accessed.
11) It shall be possible to export a .csv or .pdf copy of the currently displayed alarm list.
12) If an alarm is not acknowledged or discarded by recipients within a user-selected time, the alarm shall be sent to an additional set of recipients.

e. Equipment Activity Summary:

1) The user interface shall provide a filterable, single display, of all activity related to a specific piece of equipment including user changes, discarded user changes, pending alarms, discarded alarms, and acknowledged alarms for at least one year of historical data.
2) Items shall be listed in timed order with the latest activity at the top of the list.
3) Filters shall allow only specific activities for specific data points occurring within a specific time and date window to be displayed.
4) It shall be possible to export a .csv copy of the currently displayed summary by clicking or tapping on the export icon.
5) It shall be possible to create a custom trend graph containing the data shown in the currently displayed summary by tapping or clicking on the trend icon in the header bar and selecting the specific points to trend in the resulting selection panel.
6) Clicking on the information icon in front of any displayed activity listed in the summary shall expand the display to include the name of the user, server time, value prior to the activity, the ability to annotate the activity and a user selectable icon for displaying a trend graph of the point.

f. Equipment Relationships Summary:

1) The user interface shall provide a summary of all equipment and spaces related to the operation of the system or device currently selected for viewing.
2) The user interface shall include the capability to navigate to the home page of any related piece of equipment or space with a single click or tap on the desired element.

g. Equipment Data Summary:

1) The user interface shall provide a summary of all data pertaining to a particular piece of mechanical or electrical equipment in a tabular format.
2) Clicking or tapping on any value in the summary shall display a related command panel allowing the user to command, override, or change service condition of the point selected and to annotate such actions for future reference.
3) It shall be possible to export a .pdf copy of the report with a single click on the associated export icon.

h. Equipment Serving Space Summary:

1) The user interface shall provide a summary of all mechanical and electrical equipment as defined in the points list that serves a selected space from the navigation tree.
2) The summary shall be capable of including a subset of the viewable points for each system representing the key elements of interest to operators without subjecting them to long lists of points irrelevant to basic operation.
3) Clicking or tapping on any item in the summary shall navigate to the item's assigned home page in the user interface.
4) It shall be possible to view a custom trend of information contained in the summary with a single click of the trend icon residing in the title header.
5) It shall be possible to display specific systems and points by filtering equipment types desired.
6) Because the data is intended to be a snapshot of the current conditions in the space it shall not dynamically update but a click or tap on the update icon at any time performs that function.

i. Potential Problem Areas

1) The user interface shall provide a summary of all points in the system related to the space that are not operating correctly (e.g. alarm, off normal or not communicating correctly) in order to provide the operator with a quick update on current conditions.
2) The information shall include:

- Point status (via color)
- Point name
- Value of the point when the summary was taken
- Equipment that contains the offending point
- Space that is served by that equipment

3) Data points in the summary may be filtered by one or more types of off-normal condition (e.g. above setpoint, offline and overridden).
4) The summary may be exported in .csv format for inclusion in spreadsheets or other documents.

j. Equipment Summary:

1) The user interface shall provide a summary that allows the user to compare all similar equipment that serves the space as well as downstream (child) spaces in order to evaluate conditions quickly and determine patterns for troubleshooting purposes.
2) Each unique equipment type shall be selectable and display a representative set of values along with the space(s) being served by the device. Equipment types can be selected from a dropdown menu in the summary.
3) Clicking or tapping on a selected device in the summary shall navigate to the home page for that piece of equipment while clicking or tapping a data point shall display the command panel for that point.
4) It shall be possible to export a .pdf copy of the currently displayed summary by clicking or tapping on the export icon.
5) It shall be possible to create a custom trend graph containing the data shown in the currently displayed summary by clicking on the trend icon in the header bar and selecting the specific points to trend in the resulting selection panel.

k. User Defined Summaries:

1) Provide the capability to view, command, and modify large quantities of similar data in summaries without the use of a secondary application (e.g. a spreadsheet). These summaries shall be generated automatically or user defined. User defined summaries shall allow up to seven user defined columns describing attributes to be displayed including custom column labels with up to 100 rows per summary.

l. Trend:

1) The user interface shall provide the capability to view historical trend data from multiple pieces of equipment in both bar and line formats.
2) The user shall have the ability to navigate to a selection list of frequently viewed trends.
3) Trend graphs shall have to ability to be smartly auto-generated based on equipment and space relationships.
4) The user shall have the ability to view up to 3 graphs in a single screen and select which data points to plot on each to help with readability.
5) Each graph shall include a dedicated selection icon to export a copy of the graphic and data in .pdf format or the data only as a .csv file.

m. Operator Access:

1) The user interface shall provide the ability to segment access to building data based on the space(s) or location(s) the user is physically located in and/or manages. The user interface shall provide the capability to assign "inherited" space permissions and the ability to assign user's space based access in bulk.
2) The user interface shall provide the ability to segment access to building data based on the space(s) or location(s) the user is physically located in and/or manages. The user interface shall provide the capability to assign "inherited" space permissions and the ability to assign user's space based access in bulk.

n. Graphics:

1) Individual graphics shall be provided as follows:

a) Site plan or building profile with links to each building/floor
b) Each floorplan with larger floorplans divided up in to logical areas
c) Each individual piece of mechanical equipment (AHU, FCU, terminal unit, fan)
d) Each central plant system (chilled water, heating water)
e) Data tables for integrated 3rd party equipment

2) The user interface shall display an equipment visualization or graphic within the context of its associated space (building, floor, room, etc.) or equipment dashboard.
3) Graphics shall include the ability to define individual information layers for operator selection in order to clarify systems status and simplify operation on mobile devices. Where desired a master layer may be defined to include important information about the facility on all graphic screens.
4) Graphics shall support the use of photo-realistic symbols as well as color change and animation to match the status of the related system control point.
5) It shall be possible to export a time stamped .pdf file of the graphic being viewed in order to communicate the current conditions in the space or the equipment being viewed and to provide a historic record.

o. Scheduling:

1) The user interface shall provide the capability to display, in a singular view, all of the effective schedules in the context of the space (building/floor/room, etc.) or equipment that the schedule effects. The software should have the ability to display an effective schedule, for the present, or a future date.
2) The user interface shall provide a report of all schedules affecting a space or equipment. The report shall provide the user details of events that comprise the weekly schedule and exception schedule(s). The report shall provide a means of viewing individual breakout scheduling elements for Weekly Schedule, Exceptions and Default Commands.
3) The user interface shall provide the capability to efficiently change or modify schedules in mass quantities. This includes the capability to add, in bulk, exceptions to schedules, in addition to assigning, in bulk, weekly schedules.

p. Command and Control:

1) It shall be possible to command system analog and binary points via a dropdown menu accessed by clicking or tapping on the value shown in any equipment summary or graphic display and completing the task in the resultant menu including an optional annotation.
2) Commanding multiple points shall be possible on displays where multiple like system elements can be chosen.
3) The user interface shall support users adding notes on their commands.
4) The user interface shall support a choice of either permanent or temporary commands.

q. Cyber Health Dashboard:

1) The Cyber Health Dashboard shall provide a centralized view of potential cybersecurity related issues or system issues, grouped into critical issues, potential risks, and informational items.
2) The Cyber Health Dashboard shall identify user account information, including:

a) Total number of users
b) Dormant users
c) Active users
d) Locked users
e) Temporary users
f) Disabled users
g) Users with Administrator role
h) Policy related information

3) The Cyber Health Dashboard shall indicate out-of-date software.
4) The Cyber Health Dashboard shall identify when security certificates are set to expire.
5) The Cyber Healthy Dashboard shall provide insight into user activity such as number of successful logins, unsuccessful logins, and locked out accounts.

r. Search:

1) Typing a text string in the Search box shall display a list of all occurrences of that string in the mobile user interface. When a string is represented in the description of a space or network element, selecting it shall display its default dashboard.
2) Clicking or tapping on the Advanced Search Icon shall display the Advanced Search dialog box permitting the following:

- Search by Space and Equipment, Equipment Definition or Network Reference.
- Filter the search by wildcard name or object type.
- Multi-selection of objects for commanding or the creation of reports including Trend, Alarm, Audit and Activity for a specific period of time.

s. Offline Operation:

1) The mobile user interface shall have the ability to operate in an offline mode in order to create or edit graphics and dashboard elements.
2) Content created offline shall be available to all authorized users for inclusion of an operating user interface later.

3. Building Controller:

a. General Requirements:

1) BACnet Conformance:

a) Please refer to section 22.2, BACnet Functional Groups, in the BACnet standard, for a complete list of the services that must be directly supported to provide each of the functional groups listed above. All proprietary services, if used in the system, shall be thoroughly documented and provided as part of the

submittal data. All necessary tools shall be supplied for working with proprietary information.

2) Building controller shall be of scalable design such that the number of trunks and protocols may be selected to fit the specific requirements of a given project.
3) The controller shall be capable of panel-mounted on DIN rail and/or mounting screws.
4) The controller shall be capable of providing global control strategies for the system based on information from any objects in the system, regardless if the object is directly monitored by the building controller module or by another controller.
5) The controller shall be capable of running up to six (6) independent control strategies simultaneously. The modification of one control strategy does not interrupt the function or runtime others.
6) The software program implementing the DDC strategies shall be completely flexible and user-definable. All software tools necessary for programming shall be provided as part of project software. Any systems utilizing factory pre-programmed global strategies that cannot be modified by field personnel on-site, using a wide area network (WAN) or downloaded through remote communications are not acceptable. Changing global strategies using firmware changes is also unacceptable.
7) Programming shall be object-oriented using control function blocks and support DDC functions. All flowcharts shall be generated and automatically downloaded to controller. Programming tool shall be supplied and be resident on workstation. The same tool shall be used for all controllers.
8) The programming tool shall provide means to graphically view inputs and outputs to each program block in real-time as program is executing. This function may be performed using the operator's workstation or field computer.
9) Controller shall have 6,000 Analog Values and 6,000 Binary Values.
10) Controller IP configuration can be done via a direct USB connect with an operator's workstation or field computer.
11) Controller shall have at a minimum a Quad Core 996Ghz processor to ensure fast processing speeds. If controller does not have listed processor as a minimum then a maximum of 30 devices shall be connected to the Global controller's field bus to ensure proper throughput.
12) Global control algorithms and automated control functions shall execute using a 64-bit processor.
13) Controller shall have a minimum of 1 GB of DDR3 SDRAM on a 533Mhz bus to ensure high speed data recording, large data storage capacity and reliability. If controller does not have listed memory as a minimum then a maximum of 30 devices shall be connected to the Global controller's field bus to ensure proper throughput.
14) Controller shall support two (2) on-board EIA-485 ports capable of supporting various EIA-485 protocols including, but not limited to BACnet MS/TP and Modbus.
    a) Ports are capable of supporting various EIA-485 protocols including, but not limited to BACnet MS/TP and Modbus.
15) Controller shall support two (2) ports—each of gigabit speed—Ethernet (10/100/1000) ports.
    a) Ports are capable of supporting various Ethernet protocols including, but not limited to BACnet IP, FOX, and Modbus.
16) All ports shall be capable of having protocol(s) assigned to utilize the port's physical connection.
17) The controller shall have at a minimum four (4) onboard inputs, two (2) universal inputs and two (2) binary inputs.
18) Schedules:
    a) Building controller modules shall provide normal seven-day scheduling, holiday scheduling and event scheduling.

b) Each building controller shall support a minimum of 380 BACnet Schedule Objects and 380 BACnet Calendar Objects.

19) Logging Capabilities:

a) Each building controller shall log as minimum 2,000 objects at 15-minute intervals. Any object in the system (real or calculated) may be logged. Sample time interval shall be adjustable at the operator's workstation.
b) Logs may be viewed both on-site or off-site using WAN or remote communication.
c) Building controller shall periodically upload trended data to networked operator's workstation for long-term archiving if desired.
d) Archived data stored in database format shall be available for use in third-party spreadsheet or database programs.

20) Alarm Generation:

a) Alarms may be generated within the system for any object change of value or state (either real or calculated). This includes things such as analog object value changes, binary object state changes, and various controller communication failures.
b) Each alarm may be dialed out as noted elsewhere.
c) Alarm log shall be provided for alarm viewing. Log may be viewed on-site at the operator's terminal or off-site using remote communications.
d) Controller must be able to handle up to 2,000 alarm setups stored as BACnet event enrollment objects, with system destination and actions individually configurable.

21) Demand Limiting:

a) Demand limiting of energy shall be a built-in, user-configurable function. Each controller module shall support shedding of up to 1,200 loads using a minimum of two types of shed programs.
b) Load shedding programs in building controller modules shall operate as defined in section 2.1.J of this specification.

22) Tenant Activity Logging:

a) Tenant Activity logging shall be supported by a building controller module. Each independent module shall support a minimum of 380 zones.
b) Tenant Activity logging shall function as defined in section 2.1.K of this specification.

b. BACnet MS/TP:

1) BACnet MS/TP LAN must be software-configurable from 9.6 to 115.4Kbps

a) Each BACnet MS/TP LAN shall support 64 BACnet devices at a minimum.
b) All proprietary object types, if used in the system, shall be thoroughly documented and provided as part of the submittal data. All necessary tools shall be supplied for working with proprietary information.

c. BACnet IP:

1) The building controller shall comply with Annex J of the BACnet specification for IP connections. This device shall use Ethernet to connect to the IP internetwork, while using the same Ethernet LAN for non-IP communications to other BACnet devices on the local area network (LAN).
2) Must support interoperability on WANs and campus area networks (CANs), and function as a BACnet Broadcast Management Device (BBMD).
3) Each controller shall support at a minimum 128 BBMD entries.
4) BBMD management architecture shall support 3,000 subnets at a minimum.

5) Shall support BACnet Network Address Translation.
6) All proprietary object types, if used in the system, shall be thoroughly documented and provided as part of the submittal data. All necessary tools shall be supplied for working with proprietary information.

d. Expansion Ports:

1) Controller shall support two (2) expansion ports.

a) Combining the two on-board EIA-458 ports with fully loaded expansion ports, the controller shall support six (6) EIA-485 trunks simultaneously.

2) Expansion cards that mate to the expansion ports shall include:

a) Dual port EIA-485 card.
b) LON network card.

e. Niagara Framework (where required for functionality):

1) Controller shall utilize the Tridium Niagara Framework.

a) Niagara Framework shall be version 3.8 or newer.
b) All Niagara licensing shall be stored on a removable MicroSD card for fast in-field replacement of controller.

2) The Niagara License for the controllers shall be an open license.

a) The controller shall be programmable via Niagara Workplace programming tool.
b) The controller shall be programmable via a Niagara embedded Workplace programming tool.

3) If the global controller does not have the ability to store all configurations, including the controllers licensing, then a spare controller shall be provided for all global controllers and it shall be loaded, configured and licensed exactly the same as the online unit including same IP addresses so that in the event of failure the spare can be installed and put into operation by the site Operators at any time. By anytime we refer to afterhours, weekends, and holidays. Worst case would be 2am December 25th.

f. Power Supply:

1) Input for power shall accept between 17 and 30VAC, 47 and 63Hz.
2) Optional rechargeable battery for shutdown of controller including storage of all data in flash memory.
3) On-board capacitor will ensure continuous operation of real-time clocks for minimum of 14 days.
4) If the global controller does not have the ability to be powered by a conventional 24Vac source, then the dedicated DIN rail power supply shall be provided for the building controller and shall be connected to the proprietary power connector. One additional power supply shall be provided as a spare for every 10th global controller.

g. Controller shall be in compliance with the following:

1) UL 916 for open energy management
2) FCC Class B
3) ROHS
4) IEC 60703
5) C-Tick Listed

h. Controller shall operate in the following environmental conditions:

1) -4 to 149 °F (-20 to 65 °C) without optional battery, or 32 to 122 °F (0 to 50 °C) with optional battery.
2) 0 to 95% relative humidity (RH), non-condensing.

4. Central Plant and Air Handler Application Controllers:

   a. Provide one or more native BACnet application controllers for each air handler and provide native BACnet application controllers as needed for central plant control that adequately cover all objects listed in object list. All controllers shall interface to building controller through either MS/TP LAN using BACnet protocol, or Ethernet LAN using BACnet over Ethernet or BACnet TCP/IP. No gateways shall be used. Controllers shall include input, output and self-contained logic program as needed for complete control of units. Controllers shall be fully programmable using graphical programming blocks. Programming tool shall be resident on operator workstation and be the same tool as used for the building controller. No auxiliary or non-BACnet controllers shall be used.

   b. BACnet Conformance:

      1) Application controllers shall be approved by the BTL as meeting the BACnet Advanced Application Controller requirements.
      2) Please refer to section 22.2, BACnet Functional Groups, in the BACnet standard, for a complete list of the services that must be directly supported to provide each of the functional groups listed above. All proprietary services, if used in the system, shall be thoroughly documented and provided as part of the submittal data. All necessary tools shall be supplied for working with proprietary information.
      3) Standard BACnet object types supported shall include, as a minimum, Analog Input, Analog Output, Analog Value, Binary Input, Binary Output, Binary Value, Multi-state Values, Device, File, and Program object types. All proprietary object types, if used in the system, shall be thoroughly documented and provided as part of the submittal data. All necessary tools shall be supplied for working with proprietary information.

   c. Application controllers shall include universal inputs with 12-bit resolution that accept 3K and 10K thermistors, 0–10VDC, Platinum 1000 Ohm RTD, 0–5VDC, 4–20mA and dry contact signals. Any input on a controller may be either analog or digital with a minimum of three (3) inputs that accept pulses. Controller shall also include support and modifiable programming for interface to intelligent room sensor with digital display. Controller shall include binary and analog outputs on board. Analog outputs with 12-bit resolution shall support either 0–10VDC or 0–20mA. Binary outputs shall have LED indication of status. Software shall include scaling features for analog outputs. Application controller shall include 20VDC voltage supply for use as power supply to external sensors.

   d. All program sequences shall be stored on board application controller in EEPROM. No batteries shall be needed to retain logic program. All program sequences shall be executed by controller up to 20 times per second (minimum of 10 times per second) and capable of multiple PID loops for control of multiple devices. All calculations shall be completed using floating-point math and system shall support display of all information in floating-point nomenclature at operator's terminal.

      1) The following control blocks shall be supported:

         a) Natural Log
         b) Exponential
         c) Log base 10
         d) X to the power of Y
         e) Nth square root of X
         f) 5^{th} Order Polynomial Equations
         g) Astronomical Clock (sunrise/sunset calculation)
         h) Time-based schedules

   e. Programming of application controller shall be completely modifiable in the field over installed BACnet LANs or remotely using modem interface. Operator shall program logic sequences by graphically moving function blocks on screen and tying blocks together on

screen. Application controller shall be programmed using programming tools as described in operator's terminal section.

f. Application controller shall include support for intelligent room sensor (see Section 2.9.B.) Display on intelligent room sensor shall be programmable at application controller and include an operating mode and a field service mode. All button functions and display data shall be programmable to show specific controller data in each mode, based on which button is pressed on the sensor. See sequence of operation for specific display requirements at intelligent room sensor.

g. Schedules:

1) The controller shall support a minimum of three (3) BACnet Schedule Objects and have a real-time clock on board with battery backup to maintain time through a power loss.

h. Logging Capabilities:

1) Controller shall support a minimum of 50 trendlogs. Any object in the controller (real or calculated) may be logged. Sample time interval shall be adjustable at the operator's workstation.
2) Controller shall periodically upload trended data to system server for long-term archiving if desired. Archived data stored in (MS Jet Database or SQL) database form and shall be available for use in third-party spreadsheet or database programs.

i. Alarm Generation:

1) Alarms may be generated within the controller for any object change of value or state (either real or calculated). This includes things such as analog object value changes, and binary object state changes.
2) Alarm log shall be provided for alarm viewing. Log may be viewed on-site at the operator's terminal or off-site using remote communications.
3) Controller must be able to handle up to 25 alarm setups stored as BACnet event enrollment objects, with system destination and actions individually configurable.

j. The controller processor shall be a 32-bit processor.

k. The packaging of the controller shall provide operable doors to cover the terminals once installation is complete. The housing of the controller shall provide for DIN rail mounting and also fully enclose circuit board.

5. Terminal Unit Application Controllers (Heat Pumps, AC Units, Fan-Coils):

a. Provide one (1) native BACnet application controller for each piece of unitary mechanical equipment that adequately covers all objects listed in object list for unit. All controllers shall interface to building controller through MS/TP LAN using BACnet protocol. No gateways shall be used. Controllers shall include input, output and self-contained logic program as needed for complete control of unit.

b. BACnet Conformance:

1) Application controllers shall, as a minimum, support MS/TP BACnet LAN types. They shall communicate directly using this BACnet LAN at 9.6, 19.2, 38.4 and 76.8 Kbps, as a native BACnet device. Application controllers shall be approved by the BTL as meeting the BACnet Application Specific Controller requirements and support all BACnet services necessary to provide the following BACnet functional groups:

a) Files Functional Group
b) Reinitialize Functional Group
c) Device Communications Functional Group

2) Please refer to Section 22.2, BACnet Functional Groups in the BACnet standard, for a complete list of the services that must be directly supported to provide each of the functional groups listed above. All proprietary services, if used in the system, shall be

thoroughly documented and provided as part of the submittal data. All necessary tools shall be supplied for working with proprietary information.

3) Standard BACnet object types supported shall include, as a minimum, Analog Input, Analog Output, Analog Value, Binary Input, Binary Output, Binary Value, Device, File, and Program Object Types. All proprietary object types, if used in the system, shall be thoroughly documented and provided as part of the submittal data. All necessary tools shall be supplied for working with proprietary information.

c. Application controllers shall include universal inputs with 10-bit resolution that can accept 3K and 10K thermistors, 0–5VDC, 4–20mA, dry contact signals and a minimum of three (3) pulse inputs. Any input on controller may be either analog or digital. Controller shall also include support and modifiable programming for interface to intelligent room sensor. Controller shall include binary outputs on board with analog outputs as needed.

d. All program sequences shall be stored on board controller in EEPROM. No batteries shall be needed to retain logic program. All program sequences shall be executed by controller 10 times per second and shall be capable of multiple PID loops for control of multiple devices. Programming of application controller shall be completely modifiable in the field over installed BACnet LANs or remotely through modem interface. Operator shall program logic sequences by graphically moving function blocks on screen and tying blocks together on screen. Application controller shall be programmed using same programming tools as building controller and as described in operator workstation section. All programming tools shall be provided and installed as part of system.

e. Application controller shall include support for intelligent room sensor (see Section 2.9.B.) Display on room sensor shall be programmable at controller and include an operating mode and a field service mode. All button functions and display data shall be programmable to show specific controller data in each mode based on which button is pressed on the sensor. See sequence of operation for specific display requirements at intelligent room sensor.

6. VAV Box Controllers - Single Duct:

a. Provide one (1) native BACnet application controller for each VAV box that adequately covers all objects listed in object list for unit. All controllers shall interface to building controller through MS/TP LAN using BACnet protocol. No gateways shall be used. Controllers shall include on board CFM flow sensor, inputs, outputs and programmable, self-contained logic program as needed for control of units.

b. BACnet Conformance:

1) Application controllers shall, at a minimum, support MS/TP BACnet LAN types. They shall communicate directly through this BACnet LAN at 9.6, 19.2, 38.4 and 76.8 Kbps, as a native BACnet device. Application controllers shall be approved by the BTL as meeting the BACnet Application Specific Controller requirements.

2) Please refer to Section 22.2, BACnet Functional Groups, in the BACnet standard, for a complete list of the services that must be directly supported to provide each of the functional groups listed above. All proprietary services, if used in the system, shall be thoroughly documented and provided as part of the submittal data. All necessary tools shall be supplied for working with proprietary information.

3) Standard BACnet object types supported shall include, as a minimum, Analog Input, Analog Output, Analog Value, Binary Input, Binary Output, Binary Value, Device, File, and Program Object Types. All proprietary object types, if used in the system, shall be thoroughly documented and provided as part of the submittal data. All necessary tools shall be supplied for working with proprietary information.

c. Application controllers shall include universal inputs with 10-bit resolution that can accept 3K and 10K thermistors, 0–5 VDC, and dry contact signals. Inputs on controller may be either analog or digital. Controller shall also include support and modifiable programming for interface to intelligent room sensor with digital display. Controller shall also include binary outputs on board. For applications using variable speed parallel fans, provide a single analog output selectable for 0–10 V or 0–20 mA control signals. Application controller shall include

microprocessor driven flow sensor for use in pressure independent control logic. All boxes shall be controlled using pressure-independent control algorithms and all flow readings shall be in CFM (LPS if metric).

d. All program sequences shall be stored on board application controller in EEPROM. No batteries shall be needed to retain logic program. All program sequences shall be executed by controller 10 times per second and shall be capable of multiple PID loops for control of multiple devices. Programming of application controller shall be completely modifiable in the field over installed BACnet LANs or remotely using modem interface. Operator shall program logic sequences by graphically moving function blocks on screen and tying blocks together on screen. Application controller shall be programmed using the same programming tool as Building Controller and as described in operator's workstation section. All programming tools shall be provided as part of system.

e. Application controller shall include support for intelligent room sensor (see Section 2.9.B.) Display on room sensor shall be programmable at application controller and include an operating mode and a field service mode. All button functions and display data shall be programmable to show specific controller data in each mode based on which button is pressed on the sensor. See sequence of operations for specific display requirements for intelligent room sensor.

f. On-board flow sensor shall be microprocessor-driven and pre-calibrated at the factory. Pre-calibration shall be at 16 flow points as a minimum. All factory calibration data shall be stored in non-volatile memory. Calibration data shall be field adjustable to compensate for variations in VAV box type and installation. All calibration parameters shall be adjustable through intelligent room sensor. Operator's workstation, portable computers, and special hand-held field tools shall not be needed for field calibration.

g. Provide duct temperature sensor at discharge of each VAV box that is connected to controller for reporting back to operator's workstation.

7. Auxiliary Control Devices:

   a. Temperature Sensors:

      1) All temperature sensors to be solid-state electronic, interchangeable with housing appropriate for application. Wall sensors to be installed as indicated on drawings. Mount 48 inches above finished floor. Duct sensors to be installed such that the sensing element is in the main air stream. Immersion sensors to be installed in wells provided by control contractor, but installed by mechanical contractor. Immersion wells shall be filled with thermal compound before installation of immersion sensors. Outside air sensors shall be installed away from exhaust or relief vents, not in an outside air intake, and in a location that is in the shade most of the day.

   b. Intelligent Room Sensor with LCD Readout:

      1) Sensor shall contain a backlit LCD digital display and user function keys along with temperature sensor. Controller shall function as room control unit and allow occupant to raise and lower setpoint, and activate terminal unit for override use—all within limits as programmed by building operator. Sensor shall also allow service technician access to hidden functions as described in sequence of operation.
      2) The intelligent room sensor shall simultaneously display room setpoint, room temperature, outside temperature, and fan status (if applicable) at each controller. This unit shall be programmable, allowing site developers the flexibility to configure the display to match their application. The site developer should be able to program the unit to display time-of-day, room humidity and outdoor humidity. Unit must have the capability to show temperatures in degrees Fahrenheit or Centigrade.
      3) Override time may be set and viewed in half-hour increments. Override time countdown shall be automatic, but may be reset to zero by occupant from the sensor. Time remaining shall be displayed. Display shall show the word "OFF" in unoccupied mode unless a function button is pressed.

4) See sequence of operation for specific operation of LCD displays and function keys in field service mode and in normal occupant mode. Provide intelligent room sensors as specified in point list.
5) Field service mode shall be customizable to fit different applications. If intelligent room sensor is connected to VAV controller, VAV box shall be balanced and all air flow parameters shall be viewed and set from the intelligent room sensor with no computer or other field service tool needed.

c. Wall Sensor:

1) Standard wall sensor shall use solid-state sensor identical to intelligent room sensor and shall be packaged in aesthetically pleasing enclosure. Sensor shall provide override function, warmer/cooler lever for set point adjustment and port for plug-in of Field Service Tool for field adjustments. Override time shall be stored in controller and be adjustable on a zone-by-zone basis. Adjustment range for warmer/cooler lever shall also be stored in EEPROM on controller. All programmable variables shall be available to field service tool through wall sensor port.

8. Electronic Actuators and Valves:

a. Quality Assurance for Actuators and Valves:

1) UL Listed Standard 873 and C.S.A. Class 4813 02 certified.
2) NEMA 2 rated enclosures for inside mounting, provide with weather shield for outside mounting.
3) Five-year manufacturer's warranty. Two-year unconditional and three-year product defect from date of installation.

b. Execution Details for Actuators and Valves:

1) Furnish a Freeze-stat and install "Hard Wire" interlock to disconnect the mechanical spring return actuator power circuit for fail-safe operation. Use of the control signal to drive the actuators closed is not acceptable.
2) Each DDC analog output point shall have an actuator feedback signal, independent of control signal, wired and terminated in the control panel for true position information and troubleshooting. Or the actuator feedback signal may be wired to the DDC as an analog input for true actuator position status.
3) VAV box damper actuation shall be floating type or analog (2–10 VDC, 4–20 mA).
4) Booster-heat valve actuation shall be floating type or analog (2–10 VDC, 4–20 mA).
5) Primary valve control shall be analog (2–10 VDC, 4–20 mA).

c. Actuators for damper and control valves 0.5–6 inches shall be electric unless otherwise specified, provide actuators as follows:

1) UL Listed Standard 873 and Canadian Standards Association Class 481302 shall certify actuators.
2) NEMA 2 rated actuator enclosures for inside mounting. Use additional weather shield to protect actuator when mounted outside.
3) Five-year manufacturer's warranty. Two-year unconditional and three-year product defect from date of installation.
4) Mechanical spring shall be provided when specified. Capacitors or other non-mechanical forms of fail-safe are not acceptable.
5) Position indicator device shall be installed and made visible to the exposed side of the actuator. For damper short shaft mounting, a separate indicator shall be provided to the exposed side of the actuator.
6) Overload Protection: Actuators shall provide protection against actuator burnout by using an internal current limiting circuit or digital motor rotation sensing circuit. Circuit shall insure that actuators cannot burn out due to stalled damper or mechanical and electrical paralleling. End switches to deactivate the actuator at the end of rotation are acceptable only for butterfly valve actuators.

7) A pushbutton gearbox release shall be provided for all non-spring actuators.
8) Modulating actuators shall be 24 VAC and consume 10 VA power or less.
9) Conduit connectors are required when specified and when code requires it.

d. Damper Actuators:

1) Outside air and exhaust air damper actuators shall be mechanical spring return. capacitors or other non-mechanical forms of fail-safe are not acceptable. The actuator mounting arrangement and spring return feature shall permit normally open or normally closed positions of the damper as required.
2) Economizer actuators shall utilize analog control 2–10 VDC; floating control is not acceptable.
3) Electric damper actuators (including VAV box actuators) shall be direct shaft-mounted and use a V-bolt and toothed V-clamp causing a cold weld effect for positive gripping. Single bolt or set-screw type fasteners are not acceptable.
4) One (1) electronic actuator shall be direct shaft-mounted per damper section. No connecting rods or jackshafts shall be needed. Small outside air and return air economizer dampers may be mechanically linked together if one (1) actuator has sufficient torque to drive both and damper drive shafts are both horizontal installed.
5) Multi-section dampers with electric actuators shall be arranged so that each damper section operates individually. One (1) electronic actuator shall be direct shaft-mounted per damper section. (See below execution section for more installation details.)

e. Valve Actuators 0.5 - 6 Inches:

1) Mechanical spring shall be provided on all actuators for pre-heat coil and actuators for AHU heating or cooling coil when units are mounted outside. See plans for fail-safe flow function: Normal Open or Normal Closed. Capacitors or other non-mechanical forms of fail-safe are not acceptable.
2) All zone service actuators shall be non-spring return unless otherwise specified.
3) The valve actuator shall be capable of providing the minimum torque required for proper valve close-off for the required application.
4) All control valves actuators shall have an attached 3-foot cable for easy installation to a junction box.
5) Override handle and gearbox release shall be provided for all non-spring return valve actuators.

f. Control Dampers:

1) The BAS contractor shall furnish and size all automatic control dampers unless provided with packaged equipment. The sheet metal contractor shall install all dampers unless provided with packaged equipment.
2) All dampers used for modulating service shall be opposed blade type and arranged for normally open or normally closed operation as required. The damper is to be sized so that, when wide open, the pressure drop is a sufficient amount of its close-off pressure drop for effective throttling.
3) All dampers used for two-position or open-close control shall be parallel blade type arranged for normally open or closed operation as required.
4) Damper linkage hardware shall be constructed of aluminum or corrosion-resistant zinc and nickel-plated steel and furnished as follows:

a) Bearing support bracket and drive blade pin extension shall be provided for each damper section. Sheet metal contractor shall install bearing support bracket and drive blade pin extension. Sheet metal contractor shall provide permanent indication of blade position by scratching or marking the visible end of the drive blade pin extension.
b) Drive pin may be round only if V-bolt and toothed V-clamp is used to cause a cold weld effect for positive gripping. For single bolt or set-screw type actuator

fasteners, round damper pin shafts must be milled with at least one side flat to avoid slippage.

5) Damper manufacturer shall supply alignment plates for all multi-section dampers.

g. Control Valves 0.5 - 6 Inches:

1) The BAS contractor shall furnish all specified motorized control valves and actuators. BAS contractor shall furnish all control wiring to actuators. The plumbing contractor shall install all valves. Equal percentage control characteristic shall be provided for all water coil control valves. Linear valve characteristic is acceptable for 3-way valves that are 2.5 inches and above.

2) Characterized control valves shall be used for hydronic heating or cooling applications and small to medium AHU water-coil applications to 100GPM. Actuators are non-spring return for terminal unit coil control unless otherwise noted. If the coil is exposed to the outside air stream, see plans for spring return requirement.

a) Leakage is 0% (zero percent), close-off is 200psi, maximum differential is 30psi; rangeablity is 500:1.
b) Valves 0.5–2 inches shall be nickel-plated forged brass body, NPT screw type connections.
c) Valves 0.5–1.25 inches shall be rated for ANSI Class 600 working pressure. Valves 1.5 and 2 inches shall be rated for ANSI Class 400 working pressure.
d) The operating temperature range shall be 0–250 degrees F.
e) Stainless steel ball and stem shall be furnished on all modulating valves.
f) Seats shall be fiberglass reinforced Teflon.
g) Two-way and three-way valves shall have an equal percentage control port. Full stem rotation is required for maximum flow to insure stable BTU control of the coil.
h) Three-way valve shall be applicable for both mixing and diverting.
i) The characterizing disc is made of TEFZEL and shall be keyed and held secure by a retaining ring.
j) The valves shall have a blow-out proof stem design.
k) The stem packing shall consist of two (2) lubricated O-rings designed for on-off or modulating service and require no maintenance.
l) The valves shall have an ISO type, 4-bolt flange for mounting actuator in any orientation parallel or perpendicular to the pipe.
m) A non-metallic thermal isolation adapter shall separate valve flange from actuator.
n) One (1) fastening screw shall secure the direct coupling of the thermal isolation adapter between the actuator and the valve. This will prevent all lateral or rotational forces from affecting the stem and its packing O-rings.

3) Globe valves 0.5–2 inches shall be used for steam control or water flow applications.

a) Valves shall be bronze body, NPT screw type, and shall be rated for ANSI Class 250 working pressure.
b) Valves 0.5 inches (DN15) through 2 inches (DN50) with spring return actuators shall close off against 50 psi pressure differential with Class III leakage (0.1%).
c) The operating temperature range shall be 20–280 degrees F.
d) Spring loaded TFE packing shall protect against leakage at the stem.
e) Two-way valves shall have an equal percentage control port.
f) Three-way valves shall have a linear control and bypass port.
g) Mixing and diverting valves must be installed specific to the valve design.

4) Globe Valves 2.5 - 6 Inches:

a) Valves 2.5 inches (DN65) through 6 inches (DN50) shall be iron body, 125 lb. flanged with Class III (0.1%) close-off leakage at 50 psi differential.

b) Valves with spring return actuators shall close off against 50 psi pressure differential with Class III leakage (0.1%).
c) Flow type for two-way valves shall be equal percentage. Flow type for three-way valves shall be linear.
d) Mixing and diverting valves must be installed specific to the valve design.

h. Butterfly Valves:

1) Butterfly valves shall be sized for modulating service at 60–70 degree stem rotation. Isolation valves shall be line-size. Design velocity shall be less than 12 feet per second when used with standard EPDM seats.

a) Body is cast iron.
b) Disc is aluminum bronze standard.
c) Seat is EPDM standard.
d) Body Pressure is 200 psi, -30–275 degrees F.
e) Flange is ANSI 125/250.
f) Media Temperature Range is -22–240 degree F.
g) Maximum Differential Pressure is 200 psi for 2- to 6- inch size.

i. Butterfly Valve Industrial Actuators:

1) Actuators shall be approved under Canadian Standards Association or other Nationally Recognized Testing Laboratory to UL standards. CSA Class 4813 02 or equal. Enclosure shall be NEMA 4 (weatherproof) enclosure and will have an industrial quality coating.

a) Actuator shall have a motor rated for continuous duty. The motor shall be fractional horsepower; permanent split capacitor type designed to operate on a 120 VAC, 1pH, 60 Hz supply. Two (2) adjustable cam-actuated end travel limit switches shall be provided to control direction of travel. A self-resetting thermal switch shall be imbedded in the motor for overload protection.
b) Reduction gearing shall be designed to withstand the actual motor stall torque. Gears shall be hardened alloy steel, permanently lubricated. A self-locking gear assembly or a brake shall be supplied.
c) Actuator shall have a 6-foot wiring harness provided for ease in field wiring (above 1500 in-lbs). Two (2) adjustable SPDT cam-actuated auxiliary switches, rated at 250 VAC shall be provided for indication of open and closed position. Actuator shall have heater and thermostat to minimize condensation within the actuator housing.
d) Actuator shall be equipped with a hand wheel for manual override to permit operation of the valve in the event of electrical power failure or system malfunction. Hand wheel must be permanently attached to the actuator and when in manual operation electrical power to the actuator will be permanently interrupted. The hand wheel will not rotate while the actuator is electrically driven.
e) The actuator shall be analog, floating, or two position as called out in the control sequence of operation. All Analog valves shall be positive positioning, and respond to a 2–10 VDC, 4-20 mA, or adjustable signal as required. Analog actuators shall have a digital control card allowing any voltage input for control and any DC voltage feedback signal for position indication.

2) Performance Verification Test:

a) Control loops shall cause productive actuation with each movement of the actuator and actuators shall modulate at a rate that is stable and responsive. Actuator movement shall not occur before the effects of previous movement have affected the sensor.
b) Actuator shall have capability of signaling a trouble alarm when the actuator Stop-Go Ratio exceeds 30%.

3) Actuator mounting for damper and valve arrangements shall comply with the following:

   a) Damper actuators: Shall not be installed in the air stream.
   b) A weather shield shall be used if actuators are located outside. For damper actuators, use clear plastic enclosure.
   c) Damper or valve actuator ambient temperature shall not exceed 122 degrees F through any combination of medium temperature or surrounding air. Appropriate air gaps, thermal isolation washers or spacers, standoff legs, or insulation shall be provided as necessary.
   d) Actuator cords or conduit shall incorporate a drip leg if condensation is possible. Water shall not be allowed to contact actuator or internal parts. Location of conduits in temperatures dropping below dew point shall be avoided to prevent water from condensing in conduit and running into actuator.
   e) Damper mounting arrangements shall comply to the following:

      i. The ventilation subcontractor shall furnish and install damper channel supports and sheet metal collars.
      ii. No jack shafting of damper sections shall be allowed.
      iii. Multi-section dampers shall be arranged so that each damper section operates individually. One (1) electronic actuator shall be direct shaft mounted per section.

   f) Size damper sections based on actuator manufacturer's specific recommendations for face velocity, differential pressure and damper type. In general:

      i. Damper section shall not exceed 24 ft-sq. with face velocity >1500 FPM.
      ii. Damper section shall not exceed 18 ft-sq. with face velocity > 2500 FPM.
      iii. Damper section shall not exceed 13 ft-sq. with face velocity > 3000 FPM.

   g) Multiple section dampers of two or more shall be arranged to allow actuators to be direct shaft mounted on the outside of the duct.
   h) Multiple section dampers of three or more sections wide shall be arranged with a 3-sided vertical channel (8 inches wide by 6 inches deep) within the duct or fan housing and between adjacent damper sections. Vertical channel shall be anchored at the top and bottom to the fan housing or building structure for support. The sides of each damper frame shall be connected to the channels. Holes in the channel shall allow damper drive blade shafts to pass through channel for direct shaft-mounting of actuators. Open side of channel shall be faced downstream of the airflow, except for exhaust air dampers.
   i) Multiple section dampers to be mounted flush within a wall or housing opening shall receive either vertical channel supports as described above or sheet metal standout collars. Sheet metal collars (12-inch minimum) shall bring each damper section out of the wall to allow direct shaft-mounting of the actuator on the side of the collar.

4) Valve Sizing for Water Coil:

   a) On/Off control valves shall be line-size.
   b) Modulating control valve body size may be reduced, at most, two (2) pipe sizes from the line size or not less than half the pipe size. The BAS contractor shall size all water coil control valves for the application as follows:

      i. Booster-heat valves shall be sized not to exceed 4–9psi differential pressure. Size valve for 50% valve authority. Valve design pressure drop is equal to the sum of coil drop plus the balance valve drop.

ii. Primary valves shall be sized not to exceed 5–15psi differential pressure. Size valve for 50% valve authority. Valve design pressure drop is equal to the sum of coil drop plus the balance valve drop.
iii. Butterfly valves shall be sized for modulating service at 60–70 degree rotation. Design velocity shall be 12 feet per second or less when used with standard EPDM seats.

c) Valve mounting arrangements shall comply with the following:

i. Unions shall be provided on all ports of two-way and three-way valves.
ii. Install three-way equal percentage characterized control valves in a mixing configuration with the "A" port piped to the coil.
iii. Install 2.5 inches and above, three-way globe valves, as manufactured for mixing or diverting service to the coil.

9. Enclosures:

a. All controllers, power supplies and relays shall be mounted in enclosures.
b. Enclosures may be NEMA 1 when located in a clean, dry, indoor environment. Indoor enclosures shall be NEMA 12 when installed in other than a clean environment.
c. Enclosures shall have hinged, locking doors.
d. Provide laminated plastic nameplates for all enclosures in any mechanical room or electrical room. Include location and unit served on nameplate. Laminated plastic shall be 0.125 inches thick and appropriately sized to make label easy to read.

C. Execution:

1. Examination:

a. Prior to starting work, carefully inspect installed work of other trades and verify that such work is complete to the point where work of this section may properly commence.
b. Notify the owner's representative in writing of conditions detrimental to the proper and timely completion of the work.
c. Do not begin work until all unsatisfactory conditions are resolved.

2. Installation (General):

a. Install in accordance with manufacturer's instructions.
b. Provide all miscellaneous devices, hardware, software, interconnections, installation, and programming required to ensure a complete operating system in accordance with the sequences of operation and point schedules.

3. Location and Installation of Components:

a. Locate and install components for easy accessibility; in general, mount 48 inches above floor with minimum three (3) feet of clear access space in front of units. Obtain approval on locations from owner's representative prior to installation.
b. All instruments, switches, transmitters, etc., shall be suitably wired and mounted to protect them from vibration, moisture, and high or low temperatures.
c. Identify all equipment and panels. Provide permanently mounted tags for all panels.
d. Provide stainless steel or brass thermowells suitable for respective application and for installation under other sections, and sized to suit pipe diameter without restricting flow.

4. Interlocking and Control Wiring:

a. Provide all interlock and control wiring. All wiring shall be installed neatly and professionally, in accordance with Specification Division 26 and all national, state and local electrical codes.
b. Provide wiring as required by functions as specified and as recommended by equipment manufacturers, to serve specified control functions. Provide shielded low capacitance wire for all communications trunks.

c. Control wiring shall not be installed in power circuit raceways. Magnetic starters and disconnect switches shall not be used as junction boxes. Provide auxiliary junction boxes as required. Coordinate location and arrangement of all control equipment with the owner's representative prior to rough-in.
d. Provide auxiliary pilot duty relays on motor starters as required for control function.
e. Provide power for all control components from nearest electrical control panel or as indicated on the electrical drawings; coordinate with electrical contractor.
f. All control wiring in the mechanical, electrical, telephone and boiler rooms to be installed in raceways. All other wiring to be installed neatly and inconspicuously per local code requirements. If local code allows, control wiring above accessible ceiling spaces may be run with plenum-rated cable (without conduit).

5. DDC Object Type Summary:

a. Provide all database generation.
b. Displays:

1) System displays shall show all analog and binary object types within the system. They shall be logically laid out for easy use by the owner. Provide outside air temperature indication on all system displays associated with economizer cycles.

c. Run Time Totalization:

1) At a minimum, run time totalization shall be incorporated for each monitored supply fan, return fan, exhaust fan, hot water and chilled water pumps. Warning limits for each point shall be entered for alarm and or maintenance purposes.

d. Trendlog:

1) All binary and analog object types (including zones) shall have the capability to be automatically trended.

e. Alarm:

1) All analog inputs (High/Low Limits) and selected binary input alarm points shall be prioritized and routed (locally or remotely) with alarm message per owner's requirements.

f. Database Save:

1) Provide backup database for all standalone application controllers on disk.

6. Field Services:

a. Prepare and start logic control system under provisions of this section.
b. Start up and commission systems. Allow sufficient time for startup and commissioning prior to placing control systems in permanent operation.
c. Provide the capability for off-site monitoring at control contractor's local or main office. At a minimum, off-site facility shall be capable of system diagnostics and software download. Owner shall provide phone line for this service for one (1) year or as specified.
d. Provide owner's representative with spare parts list. Identify equipment critical to maintaining the integrity of the operating system.

7. Project Training:

a. Provide application engineer to instruct owner in operation of systems and equipment.
b. Provide offsite lab based system operator’s training to include (but not be limited to) such items as the following: modification of data displays, alarm and status descriptors, requesting data, execution of commands and request of logs. Provide this training to a minimum of three persons.
c. Provide on-site training above as required, up to 16 hours as part of this contract.

8. Demonstration:

   a. Demonstrate complete operating system to owner's representative.
   b. Provide certificate stating that control system has been tested and adjusted for proper operation.

230011 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 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 specifications. Termination of electrical power wiring to mechanical equipment shall be as detailed on the drawings and per the Electrical Specifications.

B. Starters shall have integral 120V Control power transformer. Starters shall have holding coil for 120V control with hand-off-auto switch. The starters shall be inoperative if the thermal unit is removed. All magnetic starters shall be NEMA sized with applicable melting alloy overload relays and applicable enclosure. Starters shall be G.E. or approved equals by Allen-Bradley, Square D, Siemens or Cutler-Hammer.

C. All three phase motors shall be provided with phase loss protection.

D. Fused disconnect switches shall be heavy duty industrial type. Switches shall be Siemens, General Electric Company, Square D or Cutler-Hammer fusible type mounted so handle is approximately 4 feet 0 inches above floor or grade. Switches shall have a factory applied standard finish and the usage or designation shall be indicated on cover with engraved plastic laminated labels with 1/2" high contrasting letters. Each switch for motor circuits shall have a complete set of time delay fuses.

E. Motor Starters and Fused Disconnect Switches shall be neatly arranged, and securely fastened to walls with expansion bolts, lead shields, etc. Each starter or switch shall have its usage or letter designation indicated on its cover with engraved plastic laminated labels with 1/2" high contrasting letters. Where connections are made to motors not near walls or columns, a vertical conduit attached to floor and ceiling shall be installed and the wiring carried in and out of this conduit by means of condulets. An 18-inch length of flexible metallic conduit shall be installed in the circuit to each connection to a motor. Liquid tight shall be used in all wet locations. Grounding wire shall run inside of flexible conduit.

230012 DUCTWORK

A. Mechanical drawings are schematic only and do not show all offsets, connections, bolting, hangers, etc., required. Mechanical 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. Duct systems including ductwork, hangers, HVAC equipment, etc., shall be installed in a workmanlike manner with mains run true horizontal, vertical, parallel, and perpendicular to building lines unless indicated otherwise. Duct systems shall be installed without sag, twist, bending, bowing, or other similar deformation, whether considered in regard to the entire system or to the individual duct system components such as fittings, branches, transitions, HVAC equipment, etc. Where round duct is contemplated for use in lieu of rectangular duct indicated, it shall be pre-approved by the Engineer. Round duct sizes to be used in lieu of rectangular sizes shall be based on ASHRAE size equivalency tables.

B. Ductwork shall be of high quality construction with gauges, reinforcement, construction details, etc., in accordance with SMACNA duct construction standards. Turning vanes shall be used in all rectangular 90-degree elbows. Rectangular ductwork shall be beaded at 1'-0" intervals. Reinforcement and joint bracing must be continuous with intersecting corners securely fastened. **Snap lock type joints and seams are prohibited.**

C. Materials of construction shall be as follows:

1. Lab area supply air ductwork shall be G-60 galvanized steel.
2. Lab area exhaust air ductwork serving hoods and room air exhaust shall be stainless steel Type 316. All joints and seams shall be welded.
3. Standard supply air, return air, and exhaust air ductwork serving office areas and other similar spaces shall be G-60 galvanized steel.

D. All duct joints, seams, and fasteners shall be sealed airtight using 3M EC-800 sealant, United McGill duct sealer, or approved equal before insulation is applied. All sealants shall meet the provisions of UL181. All ductwork shall meet seal Class "A" requirements of SMACNA.

E. Unless specified or indicated otherwise, all ductwork shall be **low-pressure** classification.

1. Duct construction shall meet the requirements of SMACNA low pressure duct construction standards for 2" water column static positive or negative pressure. Galvanized steel duct wall thickness shall be 24-gauge minimum. Stainless steel duct wall thickness shall be 22 gauge minimum. Duct reinforcement shall be external to duct system.
2. Branch ducts connecting to main ducts shall be made with factory or field fabricated low loss branch fittings utilizing 45° lead-in throat and separate manual balancing damper with infinitely adjustable locking operator. Insulated ductwork shall be provided with standoff bracket for operator.
3. **Supply air flexible ductwork shall be limited to the last five (5) feet of runout to the air supply air outlet (register, grille, etc.).** The flexible duct shall comply with NFPA Standard 90A and UL 181 and be air tight for factory test when bent to full recommended radius and under not less than 15" water gage internal pressure, and shall be supported at intervals not exceeding 4' 0". The Contractor may provide factory fabricated preinsulated flexible ducts or the flexible ducts shall be insulated as specified in the insulation section of the specifications.
4. Exhaust air duct attachments to hoods shall be rigid with sealed fasteners. Exhaust air duct attachments to room exhaust air grilles/registers shall be rigid or, alternatively, shall utilize a flexible duct connector consisting of woven fiberglass with Hypalon coating and Type 316 stainless steel end connectors. Acceptable manufacturers: Duro Dyne DDFDC or approved equal.

F. The Mechanical Contractor shall provide duct hangers and supports of same material as duct to prevent sag, vibration, overstressing, etc. Rectangular duct hangers shall be trapeze type with threaded rod hangers and turnbuckles for vertical adjustment. Trapeze member shall be 1-1/2" x 1/8" angle minimum, sized by the Mechanical Contractor for the imposed load. Round duct hangers may be 1-1/2"x18 gauge strap type in accordance with SMACNA requirements. See design drawings for specific requirements for exposed round duct hangers. Hangers shall be installed with hanger rods or straps in the true vertical position. Hanger rods or straps shall not be bent.

G. Supplementary steel shall be provided by the Mechanical Contractor in common structural shapes to accommodate the location of hangers, supports, etc. The supplementary steel shall be pre-approved by the Engineer prior to installation. Supplementary steel shall only be connected to major building structural elements including steel columns, steel framing beams, structural masonry walls, roof joists, and structural concrete floors. **Connections to roof decking, bar joist bridging, stud framed walls, and other non-structural elements is prohibited.** Connections shall be made by welding per AWS D1.1 requirements, structural bolting, or suitable anchoring to concrete floors.

230013 DAMPERS

Dampers shall be factory made, tested, and U.L. listed and labeled (as appropriate to the application) as specified hereinafter. Unless otherwise noted in the drawings or specifications, dampers shall be of reinforced galvanized steel construction per NFPA 90A. **Provide duct access doors adjacent to all manual, motorized, fire, and smoke dampers.**

A. Manual and motorized control/isolation dampers shall be low leakage multi-blade type with blade edge and jamb seals. Unless noted otherwise, dampers shall feature opposed blade action with linkage out of airstream. Dampers shall be tested and rated per AMCA publication 500 for airflow, pressure drop, and leakage. Dampers shall bear the AMCA Certified Ratings Seal. Dampers shall feature infinitely adjustable locking lever operator with insulation standoff bracket.

1. Low pressure rectangular dampers shall be opposed blade type rated for 2.5" water column and 2000 feet per minute air velocity. Acceptable manufacturers: Ruskin CD36 or approved equal.
2. Low pressure round dampers for HVAC supply air applications shall be single blade butterfly type with 20 gauge frame, 3/8" diameter axle, less seals, and intended for manual balancing only. Acceptable manufacturers: Ruskin MDRS25 or approved equal.
3. Round dampers for Lab area exhaust balancing and isolation applications shall be flanged, stainless steel Type 316, rated for 4” water column static pressure minimum. Shaft bearings shall be stainless steel. Operator shall be manual lever with infinite slot adjustment and locking capability.

B. Fire dampers shall by **dynamic** rated multi-leaf style with fusible link and spring closure mechanism suitable for vertical or horizontal mounting. Dampers shall be U.L. 555 listed and labeled as 1-1/2 hour for installation in assemblies rated at less than three (3) hours, and as 3-hour for installation in assemblies rated at three (3) hours or more (up to four [4] hours). Fire dampers shall be installed in accordance with their U.L. listing/labeling instructions.

C. Motorized dampers shall have 120V gear driven electric operators with position indication, manual override, and shall be spring return to normally de-energized position. Wiring to operators shall be by the Heating and Air Conditioning Contractor. Dampers shall be installed according to the manufacturer’s recommendations.

D. Manufacturer’s installation instructions for all dampers shall be furnished at time of final inspection. Installation instructions shall be affixed to damper access doors.

230014 ACCESS DOORS

A. Access doors shall be provided for access to all fire and motorized dampers, duct mounted smoke detectors, and duct systems.

B. Duct mounted access doors shall be constructed of No. 22 US gauge sheet steel and shall be gasketed, air tight and provided with not less than two (2) cam type latches. Access door sheet steel shall be galvanized steel or stainless steel to match duct system in which installed. Rectangular duct doors shall be square and shall be 12" x 12" or two inches less than the height of the duct. Round duct doors shall be oval type conforming to curvature 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.

230015 PIPING

Drawings are schematic only and do not show all offsets, fittings, bends, connections, hangers, etc., required. Mechanical Contractor shall familiarize himself with the complete contract documents and site conditions before

fabricating and installing piping systems. Any changes to piping systems found necessary to accommodate conditions at the site shall be made without additional cost to the Owner and as directed by the Engineer. Piping systems shall be installed in a workmanlike manner with mains run true horizontal, vertical, parallel, and perpendicular to building lines unless indicated or required otherwise. Piping systems shall be installed without sag, twist, bending, bowling, or other similar deformation whether considered in regard to the entire system or to individual piping system components.

A. Refrigerant piping shall be capped and dehydrated type "L" hard copper per ASTM B88 with wrought fittings. Joints shall be brazed with inert gas purge per manufacturer's recommendations. System shall utilize custom refrigerant distribution fittings supplied by the equipment manufacturer as recommended for proper operation. Piping system shall be evacuated/dried per manufacturer's recommendations with a written test report of satisfactory testing submitted to the Owner.

B. Refrigerant piping shall be installed in individual runs. Piping shall not be bundled or ganged. Control system wiring shall not be bundled with any refrigerant piping run.

C. Gravity drain and pumped condensate piping shall be type "L" hard copper per ASTM B88 with wrought fittings. Joints shall be soldered with 95-5 tin/'antimony solder. Install piping with 1/8" per foot slope minimum in direction of flow. Provide unions on inlet and outlet side of condensate traps. Provide dielectric unions where piping system material changes. Provide cleanouts as indicated consisting of branch fitting with female adapter and threaded plug.

D. For pumped condensate piping systems, provide a 1/2” low cracking pressure glass filled polypropylene ball check valve immediately adjacent to HVAC equipment.

E. Welding/brazing material and labor shall be in accordance with welding/brazing procedures of the American Standards Code for Pressure Piping ASA B31.9. Welders and brazers shall be fully qualified in the procedure, tested, and so certified by an approved Testing Authority. Brazing shall comply with the AWS Brazing Handbook using copper-phosphorus filler metal per AWS A5.8.

F. Pipe supports and hangers shall be provided by the Mechanical Contractor using commercially available materials. All materials shall be corrosion resistant paint grip galvanized steel or primed and painted mild steel. The Mechanical Contractor shall provide supplementary steel in common structural shapes secured to structure by approved means and sized appropriately for the imposed load. The preferred method of securing support/hanger components to the structure is by qualified welding. Where welding is not practical, Contractor shall propose alternative means of attachment and shall obtain written approval from the Engineer prior to fabrication and installation. Dissimilar metals contact is prohibited; where dissimilar metals conditions exist; suitable cathodic protection shall be provided while maintaining the load capacity of the installation.

G. Pressure Testing: The Mechanical Contractor shall notify the Engineer of pressure testing a minimum of forty eight (48) hours in advance of testing.

1. Refrigerant piping systems shall be pressure tested by the Mechanical Contractor as required by the NCBC Mechanical Code. Piping systems shall be pressurized for a minimum hold time of eight (8) hours and shall demonstrate no loss of pressure. Mechanical Contractor shall record time, date, system tested, test pressure, shall sign and certify completion of acceptable pressure testing, and shall submit final pressure test reports part of project closeout.
2. Gravity flow condensate piping systems shall be pressure tested by the Mechanical Contractor by filling the system with water and placing the system under a static head of 7' of water at the highest point in the system. The piping system shall be maintained in this condition for a minimum hold time of eight (8) hours and shall demonstrate no loss of water via leakage. Mechanical Contractor shall record time, date, system tested, test pressure, shall sign and certify completion of acceptable pressure testing, and shall submit final pressure test report as part of project closeout.
3. Pumped condensate piping system shall be pressure tested by the Mechanical Contractor with compressed air or water at a pressure of 100 psig. Test pressure shall be maintained for eight (8)

hours minimum with no loss of pressure and no addition of pressurizing medium. Mechanical Contractor shall record time, date, system tested, test pressure, shall sign and certify completion of acceptable pressure testing, and shall submit final pressure test report as part of project closeout.

230016 INSULATION

A. General: All piping shall be inspected and tested before insulation is applied. All insulation shall be UL approved and shall meet NFPA 90 flame spread and smoke generation requirements of 25/50 per ASTM E84 and shall comply with the latest edition of the NC Building Code.

B. All air conditioning supply ducts concealed above a ceiling and the back of all diffusers and grilles shall be externally insulated with 2" thick 1 lb. density foil scrim kraft vapor barrier 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 the underside 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. Condensate and refrigerate pipe/tube insulation shall be flexible closed cell elastomeric type in tubular form for piping and/or tubing. Insulation shall have a maximum thermal conductivity of 0.27 Btu-in/hr-ft2-ºF at mean temperature of 75ºF. Adhesives, coatings, and mastics shall be by insulation manufacturer. Insulation installation shall be per manufacturer's recommendations with all seams butted tightly and fully adhered.

D. Condensate piping insulation thickness shall be 1". Refrigerant piping insulation thickness shall be as recommended by the equipment manufacturer for operating refrigerant temperatures anticipated and surrounding environmental conditions of 90ºF and 80% relative humidity. Insulated piping in exterior applications exposed to weather shall be finished with smooth stainless steel jacket with stainless steel band straps at 1’-0” centers. Fittings shall be stainless steel, two piece, pre-formed. Joints and seams shall overlap and shall be sealed with non-hardening silicone sealant.

E. Do not insulate duct access doors or maintenance items such as site glass, service valves, etc.

230017 CUTTING AND PATCHING

A. Unless required otherwise elsewhere in the Contract Documents, the Heating and Air Conditioning Contractor shall do all cutting and patching necessary to install all systems or equipment as required under his contract in accordance with the General Conditions of these specifications and shall re-establish all finishes to their original condition where cutting and patching occur. The Heating and Air Conditioning Contractor shall coordinate any cutting and patching work with the General Contractor prior to performing the work. 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.

B. Do not cut and patch building elements that would result in reducing their capacity to perform as intended. Where unavoidable, appropriate alternate means shall be provided to restore intended functionality or capacity.

C. Do not cut and patch any materials or equipment that would result in increased maintenance requirements or decreased operational life or safety.

D. Do not cut and patch any exposed items, whether exterior to building or in occupied spaces that would reduce aesthetic qualities. Remove and replace any cutting and patching construction that does not match adjacent construction, is visually unsatisfactory, and does not meet industry workmanship standards.

E. Replace, patch, and repair material and surfaces cut or damaged by methods and with materials in such a manner as not to void any warranties required or existing.

F. Provide temporary supports and bracing, protect existing construction to remain, avoid interferences, and use cutting methods least likely to damage adjacent construction for cutting and patching work. In general, use hand or small power tools for sawing or grinding in lieu of hammering or chopping.

G. For cutting through concrete or masonry, use a cutting or boring machine specifically designed for this purpose with carborundum or diamond tipped cutting blades.

H. Patching shall result in restored exposed finishes equivalent to adjacent construction in a manner that eliminates evidence of cutting, patching, and refinishing work.

230018 LABELING

All HVAC equipment, including but not limited to, air handlers, condensing units, power ventilators, etc. shall be furnished with engraved plastic laminated labels permanently attached to the equipment. Label shall include equipment number, area served, Final Acceptance date, number and size of filters, and capacities. Final Acceptance date may be on a separate label so as to allow equipment nameplates to be installed prior to Final Acceptance. **The equipment label identification symbol shall correspond to the symbol used on the design drawings.** The following are examples of labeling to be used:

Air Handling Units:	AHU #1
	F.A.: 11/16/94
	Filters: 2 @ 24 in. x 24 in. x 1 in.
	Capacity: 2000 CFM @ 0.5" ESP
Condensing Units:	CU #1
	F.A.: 11/16/94 (5 Year Warranty)
	Capacity: 5 Tons
Fans:	EF #1 (Toilets 110 & 112)
	F.A.: 11/16/94
	Capacity: 500 CFM @ 0.3" ESP
Valve Boxes:	VAV 1-1
	F.A.: 11/16/94
	Cooling CFM: 500
	Heating CFM: 350

230019 HVAC TESTING AND BALANCING

A. General:

1. The Mechanical Contractor shall provide (subcontract) all testing and balancing of the heating, ventilating, and air conditioning system. Scope shall include all initial tests, adjust, and balance (T.A.B.) at completion of the installation with a summary report. Following the initial T.A.B., a second follow-up T.A.B. with summary report shall be conducted. The second follow-up T.A.B. will be mutually scheduled between Owner and T.A.B. Contractor on a date/time up to three (3) months following the initial T.A.B./Summary Report. Revised performance criteria, if any, generally regarding supply air and exhaust air quantities, will be provided to the T.A.B. Contractor prior to the second follow-up T.A.B. effort.
2. All instruments used shall be accurately calibrated and in good working order. Testing, adjusting, and balancing (T.A.B.) shall be completed by an independent company certified by AABC or NEBB. The T.A.B. Contractor shall be a sub-contractor to the Heating and Air Conditioning Contractor. The T.A.B. Contractor shall test in strict accordance to the Standards of AABC or NEBB.

3. 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 the operation until balancing is completed. All operational cost shall be borne by the Heating and Air Conditioning Contractor. The Architect and Engineer shall be given advance notice of when time tests are to be made.
4. Upon completion of the heating, ventilating, and air conditioning systems, the Heating and Air Conditioning Contractor shall compile the test data and submit three copies of the completed test data to the Engineer for evaluation and approval. At final inspection, 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. Final payment to the Contractor shall be withheld until the test and balance data has been approved.
5. T.A.B. Contractor shall provide sheave changes for fans and pump impeller changes as required to obtain air and water flow requirements without undue pressure drop. For pumps with motors 10 Hp and greater, balance valve throttling shall equate to no greater than 5% of the nameplate horsepower, or 3 Hp, whichever is greater, above that required if the impeller was trimmed.

B. Testing Procedure (Air):

1. Test and adjust air handling unit fan's RPM and CFM to design requirements. Perform a static pressure profile across all air handling unit components. Record all data.
2. Test and record motor full load amperes on all motors.
3. Adjust all main supply, exhaust, return, and outside air ducts to proper design CFM using duct traverse. Record exhaust 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. Provide a static pressure profile across the fan and set exhaust CFM using duct traverse. 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.

C. Testing Procedure (Water):

1. All air systems shall be balanced prior to water balance.
2. Open all valves to full open position.
3. Clean all strainers.
4. Set mixing valves to full coil flow.
5. Check expansion/compression tanks to determine that they are not air bound.
6. Check all air vents at high points of water systems to insure their installation and operation.
7. Set water pumps to proper gallons per minute delivery. Record all data.
8. Check and record motor full load amperes.
9. Check and record coil inlet water temperature for both full heating and full cooling.
10. Record all temperature drops or rises across coils during full cooling and full heating.
11. Test and adjust each water balancing item to within 5% of design requirements. Record all data.

230020 INSTRUCTIONS

The Heating and Air Conditioning Contractor shall provide classroom and field instruction in the operation and maintenance of the HVAC systems and equipment to the persons who will be in charge of the system. Contractor shall document instructions and training provided with attendance sign-in sheets, date of training, and duration of training, as a minimum. Submit documentation at project closeout.

A. The Heating and Air Conditioning Contractor and the respective equipment manufacturers shall provide instruction on the operation/maintenance of HVAC equipment.

B. The DDC Control Contractor shall provide instruction and demonstration on the use and operation of the DDC controls system.

230021 OPERATION AND MAINTENANCE DATA

For all items requiring maintenance, the Heating and Air Conditioning Contractor shall furnish two weeks prior to pre-final inspection and deliver to the Owner's representative on the job (4) 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 have equipment model numbers, etc. indicated and referenced with the same mark as shown on equipment on the drawings. Provide filter schedules for all equipment requiring filters. Manuals shall have index with page numbers, Contractor's certificate of Final Acceptance, copy of all warranties, list of all subcontractors and suppliers with names, addresses, and phone numbers, certified test and balance report, complete start-up, operation, and shut-down procedures for each system, equipment factory start-up test reports, lubrication schedules and types of lubricates, equipment summary showing all capacities and ratings, and all submittal data and shop drawings.

230022 AS-BUILT DRAWINGS

The Heating and Air Conditioning Contractor shall maintain "during the course of the work" a set of drawings marked up to show the work as installed. Upon completion of the work, return this set of drawings to the Owner.

230023 GUARANTEE

The Heating and Air Conditioning Contractor shall guarantee the entire heating and air conditioning system subject to the General Conditions of these specifications, except refrigeration compressors, shall have a four year minimum extended warranty for the compressors only. Labor, freight, refrigerant and other required parts shall be provided or paid for by the Owner. At project closeout, Contractor shall install a replacement clean set of filters in air handling equipment installed under this project. Contractor shall submit a letter certifying filter replacement. Replacement filter costs and installation costs shall be the Contractor's responsibility.

END OF SECTION 230000

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.

G. Physical sizes of equipment used in the design layout are those of reputable equipment manufacturers. The CONTRACTOR is responsible for providing equipment that will fit the space available. If the CONTRACTOR elects to use equipment that results in conflicts with space clearance or codes, it shall be the responsibility of the CONTRACTOR to correct at his expense. The CONTRACTOR shall assume responsibility for providing code clearances. Where equipment is designated for existing space, the CONTRACTOR shall make necessary field measurements to ascertain space requirements, including

those for connections; and shall furnish and install such sizes and shapes of equipment that the final installation shall suit the intent and meaning of the drawings and specifications.

H. Catalog Data for OWNER

1. The CONTRACTOR shall provide compilations of catalog data, bound in suitable loose-leaf binders, for each manufactured item of equipment used in the electrical work. These shall be presented to the Engineer for transmittal to the OWNER before the final inspection is made. Data shall include printed installation, operation, and maintenance instructions for each item, indexed by product with heavy sheet dividers and tabs. All warranties shall be included with each item. Each manufacturer's name, address, and telephone number shall be clearly indicated. Generally, shop drawings and submittal data alone are not adequate for catalog data.

I. Record Documents for OWNER

1. Conductor and cable megger test results.
2. Circuit breaker trip settings.

1.8 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.

1.9 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.

   The CONTRACTOR shall do all cutting, patching, finishing, repairing, painting, etc., necessary 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 Engineer. Routing and locations shall be firmly established and approved before proceeding with any phase of the work.

4. 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.
5. 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. Electrical Work Coordinated with Other Disciplines:

1. Heating, Ventilating and Air Conditioning Equipment:

   a. The electrical contractor shall provide a source of power for all mechanical equipment. "Source" shall include conductors, raceways, circuit breakers, junction boxes, panelboards and/or wiring troughs as required by conditions and codes and/or as shown on the contract drawings.
   b. In general, individual disconnecting means and circuitry for each mechanical equipment unit will be furnished and installed by the electrical contractor. Line side and load side connections at the disconnect shall be made by the electrical contractor. Load side wiring from the disconnect shall be installed by the EC, and equipment connections shall be made by the Mechanical Contractor.

I. 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. 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.

J. 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. Where working under a subcontract for a General Contractor, the electrical contractor shall give sufficient information (marked and located) to the General Contractor in time for proper placement in the construction schedule. Should the electrical contractor delay or fail to provide sufficient information in time, the electrical contractor shall cut and patch construction as necessary and required to install electrical work, with finishes completed to the satisfaction of the Owner, and Engineer.

K. 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 Owner and Engineer.

L. 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.

M. 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.

N. 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.

O. 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. When all the requirements of the plans and specifications have been met, the CONTRACTOR shall then arrange to instruct the OWNER's operating and maintenance personnel in the correct and proper procedures for the operation and maintenance of the systems

END OF SECTION 260000

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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. Firestopping

1.3 SUBMITTALS

A. Product Data:

1. For materials to firestop cable and raceway penetrations of fire-rated floor and wall assemblies.

B. Shop Drawings: UL details for firestopping cable and raceway penetrations of fire-rated floor and wall assemblies.

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 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: Stainless 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. Outside: Stainless steel wedge or sleeve type.

F. Toggle Bolts:

1. Inside: All steel springhead type. Outside: Stainless 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.

2.3 FIRESTOPPING

A. Penetration Firestopping Systems: Systems that resist spread of fire, passage of smoke and other gases, and maintain original fire-resistance rating of construction penetrated. Penetration firestopping systems shall be compatible with one another, with the substrates forming openings, and with penetrating items if any.

PART 3 - EXECUTION

3.1 COORDINATION

A. Coordinate chases, slots, inserts, sleeves, and openings with general construction work and arrange during progress of construction to facilitate the electrical installations that follow.

1. Set inserts and sleeves in poured-in-place concrete, masonry work, and other structural components as they are constructed.

B. Sequence, coordinate, and integrate installing electrical materials and equipment for efficient flow of the Work. Coordinate installing large equipment requiring positioning before closing in the building.

C. Coordinate location of access panels and doors for electrical items that are concealed by finished surfaces.

3.2 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.

3.3 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.

3.4 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 parallel runs of horizontal raceways together on trapeze- or bracket-type hangers.

D. Size supports for multiple raceway installations so capacity can be increased by a 25 percent minimum in the future.

E. Support individual horizontal raceways with separate pipe hangers or clamps.

F. Install 1/4-inch- diameter or larger threaded hanger rods, unless otherwise indicated.

G. 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.

H. 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.

I. Install sleeves for cable and raceway penetrations of concrete slabs and walls unless core-drilled holes are used. Install sleeves for cable and raceway penetrations of masonry and fire-rated gypsum walls and of all other fire-rated floor and wall assemblies.

J. 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.

3.5 FIRESTOPPING

A. Apply firestopping to cable and raceway penetrations of fire-rated floor and wall assemblies to achieve fire-resistance rating of the assembly.

3.6 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.

3.7 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.

3.8 FIELD QUALITY CONTROL

A. Inspect installed components for damage and faulty work.

3.9 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.

3.10 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 solid conductor for No. 10 AWG and smaller, stranded for No. 8 AWG and larger.
2. Power and lighting circuitry: Minimum conductor size shall be #12, and maximum conductor size shall be #500 kcmil.

D. Conductor Insulation Types: Type THHN/THWN-2 complying with NEMA WC70 / ICEA S-95-658.

E. Metal-Clad Cable, Type MC:

1. Description: A factory assembly of current-carrying insulated copper conductors in an overall metallic sheath.
2. Comply with NEMA WC 70 / ICEA S-95-658 for metal-clad cable, Type MC with ground wire.

2.3 CONTROL CONDUCTORS AND CABLE

A. Discrete control conductors: Copper, stranded, type THHN/THWN-2.

1. Manufacturers:

a. Cerro Wire LLC.
b. Colonial Wire and Cable.
c. Encore Wire Corporation.
d. General Cable Corporation.
e. Okonite.
f. Prysmian Group.
g. Republic Wire, Inc.
h. Southwire.
i. Or approved equal.

2.4 CONNECTORS AND SPLICES

A. Manufacturers:

1. AFC Cable Systems.
2. AMP Incorporated/Tyco International.
3. FCI.
4. Greaves Polaris.
5. Hubbell/Anderson.
6. ILSCO.
7. NSI.
8. O-Z/Gedney; EGS Electrical Group LLC.
9. Penn Union.
10. 3M Company; Electrical Products Division.
11. 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 conductors #8 & smaller, use wirenut type twist connectors.
2. For conductors #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. Feeders: Type THHN/THWN-2, single conductors in raceway.

B. Branch Circuits:

1. Concealed in Ceilings: Type THHN/THWN-2, single conductors in raceway or metal-clad cable, Type MC.
2. Concealed in Walls and Partitions: Type THHN/THWN-2, single conductors in raceway or metal-clad cable, Type MC.
3. Exposed: Type THHN/THWN-2, single conductors in raceway.

C. Discrete Control Circuits: Type THHN/THWN-2, 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."

D. Shared neutral conductors shall not be used unless specifically indicated so on homerun circuitry designations on the drawings.

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.

4. Control / Signal Transmission Media Tests:

a. Test cable segments for faulty connectors, splices, terminations, and the integrity of the cable and its component parts.
b. Correct malfunctioning conductors and cables at Project site, where possible, and retest to demonstrate compliance; otherwise, remove and replace with new units and retest.

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

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.

PART 3 - EXECUTION

3.1 APPLICATION

A. In raceways, use insulated equipment grounding conductors.

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. FMC: Flexible metal conduit.

C. LFMC: Liquidtight flexible metal conduit.

1.4 SUBMITTALS

A. Product Data: For raceways, fittings, wireways, hinged-cover enclosures, and cabinets.

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. Comply with NFPA 70.

1.6 COORDINATION

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

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. FMC: Listed to UL 1.

E. LFMC: Listed to UL 360.

F. Fittings: NEMA FB 1; compatible with conduit and tubing materials.

2.3 METAL WIREWAYS

A. Listed to UL 870.

B. Manufacturers:

1. Austin.
2. B-Line.
3. Hammond/
4. Hoffman.
5. Milbank.
6. Square D.
7. Thomas & Betts.
8. Unity Manufacturing.
9. Or approved equal.

C. Material and Construction: Sheet metal sized and shaped as indicated.

1. Indoors: NEMA 1.
2. Outdoors: NEMA 4X stainless steel .

D. Fittings and Accessories: Include couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.

E. Select features, unless otherwise indicated, as required to complete wiring system and to comply with NFPA 70.

F. Wireway Covers:

1. Indoors: Hinged type.
2. Outdoors: Flanged-and-gasketed type.

G. Finish: Manufacturer's standard enamel finish.

2.4 BOXES, ENCLOSURES, AND CABINETS

A. Manufacturers:

1. Arlington.
2. Austin.
3. B-Line.
4. Cooper Crouse-Hinds.
5. Emerson/General Signal; Appleton Electric Company.
6. Erickson.
7. FSR.
8. Hammond.
9. Hoffman.
10. Hubbell.
11. Milbank.
12. O-Z/Gedney.
13. Peerless.
14. RACO.
15. Robroy Industries.
16. Rose + Bopla.
17. Scott Fetzer Co.; Adalet-PLM Division.
18. Spring City Electrical.
19. Strong.
20. Thomas & Betts.
21. Vynckier.
22. Walker Systems.
23. Woodhead Industries.
24. Or approved equal.

B. Sheet Metal Outlet and Device Boxes: NEMA OS 1.

C. Cast-Metal Outlet and Device Boxes: NEMA FB 1, Type FD, with gasketed cover.

D. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.

E. Cast-Metal Pull and Junction Boxes: NEMA FB 1, cast aluminum with gasketed cover.

F. Metal Hinged-Cover Enclosures:

1. Interior Locations: NEMA 250, Type 1 with continuous hinged cover, concealed hinge, and flush latch. Finished inside and out with manufacturer's standard enamel.
2. Exterior Locations: NEMA 250, Type 4X stainless steel with continuous hinged cover and 3-point latch.
3. Removable interior panel.
4. Metal barriers to separate wiring of different systems and voltages.
5. Accessory feet where required or freestanding applications.

PART 3 - EXECUTION

3.1 RACEWAY APPLICATION

A. Outdoors:

1. Exposed: Rigid aluminum conduit.
2. Concealed: Rigid aluminum conduit..
3. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC.
4. Boxes and Enclosures: NEMA 250, 4X stainless steel

B. Indoors:

1. Exposed, Higher than 10' AFF: EMT**.**
2. Exposed, Lower than 10' AFF:
   a. In Electrical Rooms: EMT.
   b. Elsewhere: Rigid aluminum conduit.
3. Concealed: EMT.
4. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC; except use LFMC in damp or wet locations.
5. Damp or Wet Locations: Rigid aluminum conduit.
6. Boxes and Enclosures: NEMA 250, Type 1, except as follows:
   a. Damp or Wet Locations: NEMA 250, Type 4.

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 bituminous type coating.

3.2 INSTALLATION

A. Keep raceways a minimum of 6 inches away from runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.

B. Complete raceway installation before starting conductor installation.

C. Support raceways as specified in Section "Basic Electrical Materials and Methods."

D. Install temporary closures to prevent foreign matter from entering raceways.

E. 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.

F. Conceal raceways within finished walls, ceilings, and floors, unless otherwise indicated.

1. Install concealed raceways with a minimum of bends in the shortest practical distance, considering type of building construction and obstructions, unless otherwise indicated.

G. Conduits installed on the inside face of exterior building walls shall be spaced off the wall surface a minimum of ¼" using strut-type channel or "clamp-backs".

H. Install exposed raceways parallel or at right angles to nearby surfaces or structural members and follow surface contours as much as possible.

1. Run parallel or banked raceways together on common supports.
2. Make parallel bends in parallel or banked runs. Use factory elbows only where elbows can be installed parallel; otherwise, provide field bends for parallel raceways.

I. Join raceways with fittings designed and approved for that purpose and make joints tight.

J. Raceway connectors shall be insulated throat type. If uninsulated throat connectors are installed, use insulating bushings to protect conductors.

K. Expansion joints: Where raceways of any type pass a building or structure expansion joint, a standard expansion joint fitting, compatible with the type of raceway being used, shall be provided and installed. Review architectural and structural drawings for locations of expansion joints.

L. 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.

M. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lb tensile strength. Leave at least 12 inches of slack at each end of pull wire. Label each end of pull wires with location of opposite end.

N. Flexible Connections:

1. Use maximum of 72 inches of flexible conduit for recessed and semi-recessed lighting fixtures.
2. Use maximum of 24 inches of flexible conduit for equipment subject to vibration, noise transmission, or movement; and for all motors.
3. Use LFMC in damp or wet locations.

O. Install hinged-cover enclosures and cabinets plumb. Support at each corner.

3.3 PROTECTION

A. Provide final protection and maintain conditions that ensure coatings, finishes, and cabinets are without damage or deterioration at time of Final Acceptance.

1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
2. Repair damage to PVC or paint finishes with matching touchup coating recommended by manufacturer.

3.4 CLEANING

A. After completing installation of exposed, factory-finished raceways and boxes, inspect exposed finishes and repair damaged finishes.

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 CABLE LABELS

A. Colored Adhesive Tape: Self-adhesive vinyl tape not less than 3 mils thick by 1 to 2 inches.

2.2 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. Sequence of Work: If identification is applied to surfaces that require finish, install identification after completing finish work.

D. Self-Adhesive Identification Products: Clean surfaces before applying.

E. Circuit Identification Labels on Boxes: Panel and circuit number.

1. Interior Boxes:

a. Exposed: Pressure-sensitive, self-adhesive plastic label on cover.
b. Concealed:

1) Pressure-sensitive, self-adhesive plastic label on cover; or
2) Permanent marker on cover, legible by Architect, Engineer, and Owner.

2. Exterior Boxes:

a. Engraved plastic label on cover; and
b. Pressure-sensitive, self-adhesive plastic label inside cover.

F. Color-Coding of Phase, Neutral, and Ground Conductors: Use the following colors for service, feeder, and branch-circuit phase conductors:

	Configuration	Phase A	Phase B	Phase C	Neutral	Ground
1.	120/240-V, 1 Ph, 3W	Black	Red	N/A	White	Green
2.	120/208-V, 3 Ph, 4W	Black	Red	Blue	White	Green
3.	277/480-V, 3 Ph, 4W	Brown	Orange	Yellow	Gray	Green

4. For conductors #6 AWG and smaller, factory apply color the entire length of conductors.
5. 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.
6. At each panelboard, a color code legend shall be permanently posted corresponding to the conductors and voltage in that panelboard.

G. Apply identification to conductors as follows:

1. Conductors to Be Extended in the Future: Indicate source and circuit numbers.
2. Multiple Power or Lighting Circuits in the Same Enclosure: Identify each conductor with source, voltage, circuit number, and phase. Use color-coding to identify circuits' voltage and phase.

H. 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. Switchgear, switchboards, panelboards, electrical cabinets, and enclosures.
2. Disconnect switches and enclosed circuit breakers.

I. Nameplate colors shall be: White surface with black core.

END OF SECTION 260553

SECTION 262416 - PANELBOARDS

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. Lighting and appliance branch-circuit panelboards.

1.3 DEFINITIONS

A. GFCI: Ground-fault circuit interrupter.

B. RMS: Root mean square.

1.4 SUBMITTALS

A. Product Data: For each type of panelboard, overcurrent protective device, accessory, and component indicated. Include dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes.

B. Shop Drawings: For each panelboard and related equipment.

   1. Dimensioned plans, elevations, sections, and details. Show tabulations of installed devices, equipment features, and ratings. Include the following:

      a. Enclosure types and details for types other than NEMA 250, Type 1.
      b. Trim types and details.
      c. Bus configuration, current, and voltage ratings.
      d. Short-circuit current rating of panelboards and overcurrent protective devices.
      e. Features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.

C. Panelboard Schedules: For installation in panelboards.

D. Operation and Maintenance Data: For panelboards and components to include in emergency, operation, and maintenance manuals. If Section “Operation and Maintenance Data” is included in the project manual, in addition to items there, include the following:

   1. Manufacturer's written instructions for testing and adjusting overcurrent protective devices.

1.5 QUALITY ASSURANCE

A. Source Limitations: Obtain panelboards, overcurrent protective devices, components, and accessories through one source from a single manufacturer.

B. Product Options: Drawings indicate size, profiles, and dimensional requirements of panelboards and are typically based on Square D products. Products of other manufacturers are acceptable if they can be installed in the space indicated.

C. 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. Comply with NEMA PB 1.

D. Comply with NFPA 70.

1.6 PROJECT CONDITIONS

A. Interruption of Existing Electric Service: Do not interrupt electric service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electric service according to requirements indicated:

1. Notify Engineer/Owner no fewer than two weeks in advance of proposed interruption of electrical service.
2. Do not proceed with interruption of electrical service without Owner's written permission.

1.7 COORDINATION

A. Coordinate layout and installation of panelboards and components with other construction that penetrates walls or is supported by them, including electrical and other types of equipment, raceways, piping, and encumbrances to workspace clearance requirements.

1.8 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Keys: Six spares for each type of panelboard cabinet lock.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Panelboards, Overcurrent Protective Devices, and Accessories:

a. Eaton Corporation; Cutler-Hammer Products.
b. General Electric Co.; Electrical Distribution & Protection Div.
c. Siemens Energy & Automation, Inc.
d. Square D.

2.2 MANUFACTURED UNITS

A. Enclosures: Flush- and surface-mounted cabinets, as scheduled in the drawings. NEMA PB 1, Type 1.

1. Rated for environmental conditions at installed location.

a. Outdoor Locations: NEMA 250, Type 3R.

2. Front Hinged Trim: Interior Panelboards: Entire front trim hinged to box with full-length piano hinge, and with standard door within hinged trim cover.

3. Finish: Manufacturer's standard enamel finish over corrosion-resistant treatment or primer coat.
4. Directory Card: With transparent protective cover, mounted in metal frame, inside panelboard door.

B. Phase Buses:

1. Material: Hard-drawn copper, 98 percent conductivity.

C. Ground and Neutral Bars:

1. Equipment Ground Bar: Adequate for feeder and branch-circuit equipment ground conductors; bonded to box.
2. Neutral Bar: Adequate for feeder and branch-circuit neutral conductors.

D. Conductor Connectors: Suitable for use with conductor material.

1. Main and Neutral Lugs: Mechanical type.
2. Ground Lugs and Bus Configured Terminators: Mechanical or compression type.

E. Future Devices: Mounting brackets, bus connections, and necessary appurtenances required for future installation of devices. These locations will be indicated as SPACE on the panel schedules in the drawings.

2.3 PANELBOARD SHORT-CIRCUIT RATING

A. Fully rated to interrupt symmetrical short-circuit current available at terminals.

2.4 LIGHTING AND APPLIANCE BRANCH-CIRCUIT PANELBOARDS

A. Doors: Concealed hinges; secured with flush latch with tumbler lock; keyed alike.

B. Main Overcurrent Protective Devices: Circuit breaker, where scheduled.

C. Branch Overcurrent Protective Devices: Bolt-on circuit breakers, replaceable without disturbing adjacent units.

2.5 OVERCURRENT PROTECTIVE DEVICES

A. Molded-Case Circuit Breaker: UL 489, with interrupting capacity to meet available fault currents.

1. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads, and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.

B. Molded-Case Circuit-Breaker Features and Accessories: Standard frame sizes, trip ratings, and number of poles.

1. Lugs: Mechanical style, suitable for number, size, trip ratings, and conductor materials.
2. Multipole units enclosed in a single housing or factory-assembled to operate as a single unit.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install panelboards and accessories according to NEMA PB 1.1.

B. Mount top of trim 74 inches above finished floor, unless otherwise indicated.

C. Mount plumb and rigid without distortion of box. Mount recessed panelboards with fronts uniformly flush with wall finish.

D. Install overcurrent protective devices and controllers. Set field-adjustable circuit-breaker trip ranges.

E. Panel breaker configurations shall be installed as indicated on the panel schedules or as noted. Breaker position revisions will not be accepted unless approved in writing by the Engineer.

F. Arrange conductors in gutters into groups and bundle and wrap with wire ties.

G. Install filler plates in unused spaces.

H. Install overcurrent protective devices and instrumentation.

3.2 IDENTIFICATION

A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs as specified in Section "Electrical Identification".

B. Create a directory to indicate installed circuit loads. Use a computer or typewriter to create directory; handwritten directories are not acceptable.

C. Panelboard Nameplates: Label each panelboard with laminated-plastic nameplate mounted as specified in Section "Electrical Identification".

3.3 CONNECTIONS

A. Ground equipment according to Section "Grounding and Bonding."

B. Connect wiring according to Section "Conductors and Cables."

3.4 FIELD QUALITY CONTROL

A. Prepare for acceptance tests as follows:

1. Test insulation resistance for each panelboard bus, component, connecting supply, feeder, and control circuit.
2. Test continuity of each circuit. .
3. Neutral–ground bond testing: After all fixtures, devices and equipment are installed and all connections completed to each panel, the CONTRACTOR shall disconnect the neutral feeder conductor from the neutral bar and take a megger reading between the neutral bar and grounded enclosure. If this reading is less than 25 mega-ohms, the CONTRACTOR shall disconnect the branch circuit neutral wires from the neutral bar. The CONTRACTOR shall then test each one separately to the panel until the low reading ones are found. The CONTRACTOR shall correct troubles, re-connect, and re-test until at least 25 mega-ohms from the neutral bar to the grounded panel can be achieved with only the neutral feeder disconnected.

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 molded-case circuit breakers. 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, inspect interior and exterior of panelboards. Remove paint splatters and other spots. Vacuum dirt and debris; do not use compressed air to assist in cleaning. Repair exposed surfaces to match original finish.

END OF SECTION 262416

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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 DEFINITIONS

A. HD: Heavy duty.

1.4 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.
4. Features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.

B. Operation and Maintenance Data: For enclosed switches and circuit breakers to include in emergency, operation, and maintenance manuals. If Section “Operation and Maintenance Data” is included in the project manual, in addition to items there, include the following:

1. Manufacturer's written instructions for testing and adjusting enclosed switches.

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.

1.6 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 AND NONFUSIBLE 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 4X stainless steel.

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.

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 and molded-case circuit breakers. 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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SECTION 265119 – LED INTERIOR LIGHTING

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. Section includes LED luminaires, materials, finishes, supports.

1.3 DEFINITIONS

A. CCT: Correlated color temperature.

B. CRI: Color Rendering Index.

C. Fixture: See "Luminaire."

D. LED: Light-emitting diode.

E. Lumen: Measured output of lamp and luminaire, or both.

F. Luminaire: Complete lighting unit, including lamp, reflector, and housing.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Arrange in order of luminaire designation.
2. Include data on features, accessories, and finishes.
3. Include physical description and dimensions of luminaires.
4. Include emergency lighting units, including batteries, chargers, photometric performance data.
5. Include life, output (lumens, CCT, and CRI), and energy efficiency data.

1.5 INFORMATIONAL SUBMITTALS

A. Sample warranty.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For luminaires and lighting systems to include in operation and maintenance manuals.

1.7 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Drivers: Ten for every 100 of each type and rating installed. Furnish at least one of each type.

2. Diffusers and Lenses: One for every 100 of each type and rating installed. Furnish at least one of each type.
3. Globes and Guards: One for every 20 of each type and rating installed. Furnish at least one of each type.

1.8 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. Provide luminaires from a single manufacturer for each luminaire type.

C. Each luminaire type shall be binned within a three-step MacAdam Ellipse to ensure color consistency among luminaires.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Protect finishes of exposed surfaces by applying a strippable, temporary protective covering before shipping.

1.10 WARRANTY

A. Warranty: Manufacturer and Installer agree to repair or replace components of luminaires that fail in materials or workmanship within specified warranty period.

B. Warranty Period: Five years from date of Final Completion.

PART 2 - PRODUCTS

2.1 LUMINAIRE REQUIREMENTS

A. Standards:

1. Design Lights Consortium (DLC) qualified products list or ENERGY STAR certified.
2. UL 1598, Standard for Luminaires.
3. Recessed luminaires shall comply with NEMA LE 4.
4. UL Listing: Listed for damp or wet location as applicable.

B. CRI minimum of 80 CCT at 3500 K.

C. Rated lamp life of 50,000 hours minimum to L70.

D. Lamps dimmable from 100 percent to 0 percent of maximum light output.

E. Internal driver.

2.2 MATERIALS

A. Metal Parts:

1. Free of burrs and sharp corners and edges.
2. Sheet metal components shall be steel unless otherwise indicated.

3. Form and support to prevent warping and sagging.

B. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit re-lamping without use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during re-lamping and when secured in operating position.

C. Factory-Applied Labels: Comply with UL 1598. Include recommended lamps. Locate labels where they will be readily visible to service personnel, but not seen from normal viewing angles when lamps are in place. Label shall include the following lamp characteristics:

1. "USE ONLY" and include specific lamp type.
2. Lamp diameter, shape, size, wattage, and coating.
3. CCT and CRI for all luminaires.

2.3 METAL FINISHES

A. Variations in finishes are unacceptable in the same piece. Variations in finishes of adjoining components are acceptable if they are within the range of approved Samples and if they can be and are assembled or installed to minimize contrast.

2.4 LUMINAIRE SUPPORT

A. Wires: ASTM A 641/A 641 M, Class 3, soft temper, zinc-coated steel, 12 gauge**.**

B. Wires for Humid Spaces: ASTM A 580/A 580M, Composition 302 or 304, annealed stainless steel, 12 gauge.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine roughing-in for luminaire to verify actual locations of luminaire and electrical connections before luminaire installation. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Comply with NECA 1.

B. Install luminaires level, plumb, and square with ceilings and walls unless otherwise indicated.

C. Install lamps in each luminaire.

D. Supports:

1. Sized and rated for luminaire weight.
2. Able to maintain luminaire position after cleaning and re-lamping.
3. Provide support for luminaire without causing deflection of ceiling or wall.

4. Luminaire mounting devices shall be capable of supporting a horizontal force of 100 percent of luminaire weight and vertical force of 400 percent of luminaire weight.

E. Ceiling-Grid-Mounted Luminaires:

1. Fixture is to be supported at two (2) opposite ends to the steel frame of the building using the same type of wire as used to support the lay-in ceiling track.
2. Support Clips:
    a. Fasten fixtures to ceiling grid main runner members with manufacturer clips.
3. Fixtures of Sizes Less Than Ceiling Grid Pattern:
    a. Install as indicated on reflected ceiling plans or center in acoustical panel.
    b. Support fixtures independently with at least two 3/4-inch (metal channels spanning and secured to ceiling tees.
    c. Fixture is to be supported at two (2) opposite ends to the steel frame of the building using the same type of wire as used to support the lay-in ceiling track.

3.3 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. Operational Test: After installing luminaires, switches, and accessories; and after electrical circuitry has been energized, test units to confirm proper operation.
2. Test for Emergency Lighting: Interrupt power supply to demonstrate proper operation. Verify normal transfer to battery power source and retransfer to normal. Perform a test on each unit after it is permanently installed and charged for a minimum of 24 hours. Battery shall be tested for 90 minutes. The battery test shall demonstrate compliance with the requirements of NEC 700.12(F). Repair and/or replace any units that fail the test, then retest.

B. Luminaire will be considered defective if it does not pass operation tests and inspections.

C. Corroded Fixtures: During warranty period, replace fixtures that show any signs of corrosion.

END OF SECTION 265119