BID REQUIREMENTS

INVITATION TO BID

The Owner will receive sealed bids from Contractors in, **Public Works Department, 2018 Kings Chapel Road Perry, GA 31069** . Bids must be physically on the table in the Bid Room by **2:00 PM** o'clock, at the time legally prevailing in Atlanta, Georgia on **Thursday, July 18, 2019** , for the construction of **Houston County Detention Center Chilled Water Plant Upgrades** located in **Perry** , Georgia. At the time and place noted above, the bids will be publicly opened and announced.

Bidding Documents may be obtained FTP Site of the office of the Design Professional, **NBP Engineers, Inc.,** If problems occur with downloading, call **478-745-1691**. The FTP Site link is:

- **Internet browser** - Go to the **ftp://19048:detention@ftp.nbpengineers.com/**
- **FTP Client** – Server **ftp.nbpengineers.com** Username**19048** and the password **detention**

Bidders are cautioned that acquisition of Bidding Documents through any source other than the office of the Design Professional is not advisable. Acquisition of Bidding Documents from unauthorized sources places the bidder at risk of receiving incomplete or inaccurate information upon which to base a bid.

There will be a *pre-bid* conference held on **Thursday, June 27, 2019** , at **10:00 AM** at **Public Works Department, 2018 Kings Chapel Road Perry, GA 31069 .** Attendance at this conference is **MANDATORY** for any Contractor intending to bid on this project. Others may attend if they so desire.

Interested firms are required to meet state licensure requirements and document minimum experience requirements with construction as indicated in the documents. These requirements are specified in Section 01 4000 – Quality Requirements. A copy of this section is available upon request.

Bidders' attention is called to Section 01 4000 – QUALITY REQUIREMENTS, which establishes minimum qualifications for Contractors bidding this project. The Statement of Qualifications specified shall be submitted in writing to the Owner as required in the Supplementary General Conditions. Bids will not be accepted from Contractors failing to meet the qualifications established or from Contractors failing to submit the required documentation of qualifications. A listing of qualified bidders will be published and distributed to plan holders of record. All protests of decisions regarding qualifications must be submitted in writing to the Owner by not later than three working days thereafter.

Contract, if awarded, will be on a lump sum basis. No bid may be withdrawn for a period of thirty-five days after time has been called on the date of opening except in accordance with the provisions of Georgia law. Bids must be accompanied by a Bid Bond made payable to the Owner in an amount equal to not less than five percent of the Bid. Both a performance bond and a payment bond will be required, each in an amount equal to 100 percent of the Contract Sum prior to execution of contract.

The Owner reserves the right in its sole and complete discretion to waive technicalities and informalities. The Owner further reserves the rights in its sole and complete discretion to reject all bids and any bid that is not responsive or that is over the budget. The Owner anticipates that the contract will be awarded to the responsive and responsible bidder who provides the lowest bid within the budget. In judging whether the bidder is responsible, the Owner will consider, but is not limited to, the following:

- Whether the bidder or its principals are currently ineligible, debarred, suspended, or otherwise excluded from bidding or contracting by any state or federal agency, department, or authority;
- Whether the bidder or its principals have been terminated for cause or are currently in default on a public works contract;
- Whether the bidder can demonstrate sufficient cash flow to undertake the project as evidenced by a Current Ratio of 1.0 or higher;
- Whether the bidder can demonstrate a commitment to safety with regard to Workers' Compensation by having an Experience Modification Rate (EMR) over the past three years not having exceeded an average of 1.2; and
- Whether the bidder's past work provides evidence of an ability to successfully complete public works projects within the established time, quality, or cost, or to comply with the bidder's contract obligations.

In the event all responsive and responsible bids are in excess of the budget, the Owner, in its sole and absolute discretion and in addition to rejecting all bids, reserves the right either to supplement the budget or to negotiate with the lowest responsive and responsible bidder (after all deductive alternates are taken) but only for the purpose of making changes to the project that will result in a cost to the Owner that is within the budget, as it may be supplemented.

BID REQUIREMENTS

INSTRUCTIONS TO BIDDERS

1. **Basis of Contract.** Contract, if awarded, will be on a lump sum basis and will be substantially in accordance with the Contract shown on pages Contract – 1 to Contract – 4.

2. **Examination of Site.** In undertaking the work under this Contract, the Contractor acknowledges that he has visited the Project Site and has taken into consideration all observed conditions that might affect his work.

3. **Surety and Insurance Companies.** The Contract provides that the surety and insurance companies must be acceptable to the Owner. Only those sureties listed in the Department of Treasury's Listing of Approved Sureties (Department Circular 570) are acceptable to the Owner. At the time of issuance, all insurance and bonds must be issued by a company licensed by the Georgia Insurance Commissioner to transact the business of insurance in the State of Georgia for the applicable line of insurance. Such company shall be an insurer (or, for qualified self insurers or group self insureds, a specific excess insurer providing statutory limits) with an A.M. Best Financial Strength Rating of "A-" or better and with an A.M. Best Financial Size Category of Class V or larger.

4. **Bidding Documents.** The Bidding Documents comprise the Construction Documents, the Invitation to Bid, the Instructions to Bidders, the Bid Form, and all Addenda, upon which the bidder submits a bid.

5. **Addenda.** All Addenda issued prior to bid date adjust, modify, or change the drawings and specifications as set forth in the Addenda. No Addenda will be issued within five days of the date set for opening bids without an extension of the bid date. All such Addenda are part of the contract.

6. **Interpretations.** No oral interpretation will be made to bidders as to the meaning of the drawings and specifications. Requests for interpretation of drawings and specifications must be made in writing to the Design Professional not later than six days prior to the date set for receipt of the bids. Failure on the part of the successful bidder to request clarification shall not relieve him as Contractor of the obligation to execute such work in accordance with a later interpretation by the Design Professional. All interpretations made to bidders will be issued in the form of Addenda to the plans and specifications and will be sent to all plan holders of record. Acknowledgement of receipt of such Addenda shall be listed in the Bid Form by the Contractor.

7. **Alternates.** Unless otherwise stipulated, all alternate bids are deductive. It is in the best interest of the public, and the intent of the Owner is, that the entire Project be constructed within the funds allocated in the Project budget. The acceptance of any deductive alternate will be utilized as a last resort to accomplish the Project without requiring a redesign and rebidding of the Project. Any alternate, or alternates, if taken, will be taken in numerical sequence to the extent necessary.

8. **Sales Tax.** Unless otherwise provided for in the Contract Documents, the Contractor shall include in his bid all sales taxes, consumer taxes, use taxes, and all other applicable taxes that are legally in effect at the time bids are received.

9. **Trade Names, Specifications.**

(a) *No Restriction of Competition.* When reference is made in the Contract Documents to trade names, brand names, or to the names of manufacturers, such references are made solely to indicate that products of that description may be furnished and are not intended to restrict competitive bidding. If it is desired to use products of trade or brand names or of manufacturers' names that are different from those mentioned in the Bidding Documents, application for the approval of the use of such products must reach the hands of the Design Professional at least ten days prior to the date set for the opening of bids (*see* 9(b) below). This provision applies only to the party making a submittal prior to bid. If approved by Design Professional, the Design Professional will issue an addendum to all bidders. This provision does not prevent the Owner from initiating the addition of trade names, brand names, or names of manufacturers by addendum prior to bid.

(b) *Request for Approval of Substitute Product*. All requests for approval of substitution of a product that is not listed in the Bidding Documents must be made to the Design Professional in writing. For the Design Professional to prepare an addendum properly, an application for approval of a substitute product must be accompanied by a copy of the published recommendations of the manufacturer for the installation of the product together with a complete schedule of changes in the drawings and specifications, if any, that must be made in other work in order to permit the use and installation of the proposed product in accordance with the recommendations of the manufacturer of the product. The application to the Design Professional for approval of a proposed substitute product must be accompanied by a schedule setting forth in which respects the materials or equipment submitted for consideration differ from the materials or equipment designated in the Bidding Documents.

(c) *Burden of Proof.* The burden of proving acceptability of a proposed product rests on the party making the submission. Therefore, the application for approval must be accompanied by technical data that the party requesting approval desires to submit in support of its application. The Design Professional will consider reports from reputable independent testing laboratories, verified experience records showing the reputation of the proposed product with previous users, evidence of reputation of the manufacturer for prompt delivery, evidence of reputation of the manufacturer for efficiency in servicing its products, or any other written information that is helpful in the circumstances. The degree of proof required for approval of a proposed product as acceptable for use in place of a named product or named products is that amount of proof necessary to convince a reasonable person beyond all doubt. To be approved, a proposed product must also meet or exceed all express requirements of the Contract Documents.

(d) *Issuance of Addenda.* If the Design Professional approves the submittal, an addendum will be issued to all prospective bidders indicating the approval of the additional product(s). Issuance of an addendum is a representation to all bidders that the Design Professional in the exercise of his professional discretion established that the product submitted for approval is acceptable and meets or exceeds all express requirements. If a submittal is initially rejected by the Design Professional, but determined to be acceptable to Design Professional after a conference with the Owner, an addendum covering the said submittal will be issued prior to the opening of bids. The successful bidder may furnish no products of any trade names, brand names, or manufacturers' names except those designated in the Contract Documents unless approvals have been published by addendum in accordance with the above procedure. Oral approvals of products are not valid.

(e) *Conference with the Owner*. Any party who alleges that rejection of a submittal is the result of bias, prejudice, caprice, or error on the part of the Design Professional may request a conference with a representative of the Owner, provided: that the request for said conference, submitted in writing, shall have reached the Owner at least six days prior to the date set for the opening of bids, time being of the essence.

10. **Employment of Georgia Citizens and Use of Georgia Products.** The work provided for in this Contract is to be performed in Georgia. It is the desire of the Owner that materials and equipment manufactured or produced in Georgia shall be used in the work and that Georgia citizens shall be employed in the work at wages consistent with those being paid in the general area in which the work is to be performed. This desire on the part of the Owner is not intended to restrict or limit competitive bidding or to increase the cost of the work; nor shall the fulfillment of this desire be asserted by the Contractor as an excuse for any noncompliance or omission to fulfill any obligation under the contract.

11. **Trading with the State Statutes, Ethics.** By submitting a bid, the bidder certifies that the provisions of law contained in O.C.G.A. Sections 45-10-20 to 45-10-71, which prohibit officials and employees of the state from engaging in certain transactions with the state and state agencies, and the Governor's Executive Orders governing ethics, have not and will not be violated in any respect in regard to this contract and further certifies that registration and all disclosures required thereby have been complied with.

12. **Georgia Security and Immigration Compliance Act Requirements.** No bid will be considered unless the Contractor certifies its compliance with the Immigration reform and Control Act of 1986 (IRCA), D.L. 99-603 and the Georgia Security Immigration Compliance Act OCGA 13-10-91 *et seq.* The Contractor shall execute the Georgia Security and Immigration Compliance Act Affidavit, as found in Section 7 of the Construction Contract. Contractor also agrees that it will execute any affidavits required by the rules and regulations issued by the Georgia Department of Audits and Accounts. If the Contractor is the successful bidder, contractor warrants that it will include a similar provision in all written agreements with any subcontractors engaged to perform services under the Contract.

13. **Owner's Policy Statement.** The policy of the Owner is that minority business enterprises shall have the maximum opportunity to participate in the Owner's purchasing process. The Owner encourages all minority business enterprises to compete for, win, and receive contracts for goods, services, and construction. In addition, Georgia law provides a state income tax credit available to any business that subcontracts with a minority-owned business. [*See* O.C.G.A. §48-7-38 and O.C.G.A. §50-5-130. *See also* Executive Order of the Governor No. A-11-0002-1992.]

14. **Bids.**

(a) *Bid Opening.* Bids will be opened and announced as stated in the Invitation to Bid.

(b) *Bid Submission.* All bids must be submitted on the Bid Form as attached hereto and must be signed, notarized by a notary public, and **sealed with corporate E-Verify Number on outside of envelope.** All blanks for information entry in bid forms submitted to Owner should be filled. Blanks left unfilled constitute irregularities in the bid and place the bidder at risk of having the bid rejected *unless* the Owner rules the irregularity to be an informality or technicality that the director can waive, as is made clear in Paragraph 16 of these "Instructions to Bidders" and on the Bid Form. Numbers shall be written in English words and in Arabic numerals. **The inclusion of any condition, alternate, qualification, limitation, or provision not called for shall render the bid nonresponsive and shall be sufficient cause for rejection of a bid.**

(c) *Bid Security.* Bids must be accompanied by a Bid Bond made payable to the Owner in an amount not less than five percent of the Bid. Bid Bonds should be furnished on forms accepted as standard by the insurance industry, but shall be substantially in accordance with the Bid Security Form attached hereto.

(d) *Delivery of Bids.* Bids are to be addressed to the Owner, at the address and room number shown in the Invitation to Bid. Bids must be enclosed in an opaque, sealed envelope; marked with the Bid Date, Bid Time, Bid Number, Name of Project; and identified with the words "Bid for Construction." Bids must be placed in the hands of the Owner at the specified location by not later than the hour and date named in the Invitation to Bid. After that time, no bids may be received. It is the sole responsibility of the bidder to ensure the delivery of the bids to the required address.

(e) Alternates. A bid must be submitted for all alternates. Failure to so may render the bid nonresponsive and be sufficient cause for rejection of a bid.

(f) *Withdrawal of Bids.* Bids may be withdrawn by bidders prior to the time set for official opening. After time has been called, no bid may be withdrawn for a period of thirty-five days after the time and date of opening except as provided in O.C.G.A Section 13-10-22 (appreciable error in calculation of bid). Negligence or error on the part of any bidder in preparing his bid confers no right of withdrawal or modification of his bid after time has been called except as provided by Georgia law.

15. **Contract Award.** Award shall be made on a lump sum basis to the lowest responsive and responsible bidder. The lowest bid will be the bid whose price, after incorporating all accepted alternates, is the lowest responsive bid that was received from a responsible bidder. No bid may be withdrawn for a period of thirty-five days after time has been called on the date of opening except in accordance with the provisions of law.

16. **Owner's Rights Concerning Award.** The Owner reserves the right in its sole and complete discretion to waive technicalities and informalities. The Owner further reserves the right in its sole and complete discretion to reject all bids and any bid that is not responsive or that is over the budget, as amended. In judging whether the bidder is responsible, the Owner will consider, but is not limited to consideration of, the following:

(a) Whether the bidder or its principals are currently ineligible, debarred, suspended, or otherwise excluded from bidding or contracting by any state or federal agency, department, or authority;

(b) Whether the bidder or its principals have been terminated for cause or are currently in default on a public works contract;

(c) Whether the bidder can demonstrate sufficient cash flow to undertake the project as evidenced by a Current Ratio of 1.0 or higher;

(d) Whether the bidder can demonstrate a commitment to safety with regard to Workers' Compensation by having an Experience Modification Rate (EMR) over the past three years not having exceeded an average of 1.2; and

(e) Whether the bidder's past work provides evidence of an ability to successfully complete public works projects within the established time, quality, or cost, or to comply with the bidder's contract obligations.

17. **Owner's Right to Negotiate with the Lowest Bidder.** In the event *all* responsive and responsible bids are in excess of the budget, the Owner, in its sole and absolute discretion and in addition to the rights set forth above, reserves the right either to (i) supplement the budget with additional funds to permit award to the lowest responsive and responsible bid, or (ii) to negotiate with the lowest responsive and responsible bidder (after taking all deductive alternates) only for the purpose of making changes to the Project that will result in a cost to the Owner that is within the budget, as it may be amended.

18. **Contract Forms.** The contract forms, including the payment and performance bonds, shall be as set forth in the General Conditions, Section 7 – Forms.

[Remainder of Page Intentionally Left Blank]

BID REQUIREMENTS

BID FORM

To: OWNER _____

Re: Project Name and No. _____

Bid Date: _____

THE BID:

Bid. Having carefully examined the Specifications entitled _____ and the Bidding Documents and Addendum (a) No.(s) _____, as well as the Site and conditions affecting the Work, bidder hereby proposes to furnish all services, labor, materials, and equipment called for by them for the entire Work, in accordance with the aforesaid documents, for the sum of:

_____ Dollars ($ _____)

which sum is hereinafter called the Bid. The Bid shall be the amount of the Contract Sum executed between the Owner and the Contractor unless Alternates are accepted.

Alternates. We further propose that, should any of the following alternates be accepted and be incorporated in the Contract, the Bid will be altered in each case as follows:

Deductive Alternate No. 1 – Omit replacement of make-up water stations serving heating water and chilled water systems.

Deduct the sum of _____ Dollars ($ _____)

Errors or Revisions. Prior to the bid opening date and hour, errors may be stricken or revisions may be made and corrections entered on this proposal form or on the bid envelope with sufficient clarity to be easily understood. All such annotations shall be binding on the bidder.

No Withdrawal. For and in consideration of the sum of $10.00, the receipt of which is hereby acknowledged, bidder and Owner agree that this bid may not be revoked or withdrawn after the time set for the opening of bids, except as provided in Georgia law, but is an irrevocable offer that shall remain open for acceptance for a period of thirty-five days following the time set for the opening of bids.

Execution of the Contract. If bidder is notified in writing by statutory mail of the acceptance of this bid within thirty-five days after time set for the opening of bids, bidder agrees to execute within ten days the Contract for the Work for the above stated Bid, as adjusted by the accepted Alternates, and at the same time to furnish and deliver to the Owner a Performance Bond and a Payment Bond on forms shown in Section 7 of the General Conditions of the Contract, both in an amount of equal to 100 percent of the Contract Sum.

Commencement and Completion of Work. Upon the Effective Date of the Contract, bidder agrees to commence all Preconstruction Activities. Upon issuance of a Proceed Order, bidder agrees to commence physical activities on the Site with adequate forces and equipment and to complete to Material Completion all work in **90** consecutive calendar days beginning the day after the date of the Proceed Order.

Bid Bond. Enclosed herewith is a Bid Bond *(NO OTHER FORM ACCEPTABLE)* in the amount of _____ Dollars ($ _____) (being not less than five percent of the Bid). Bidder agrees that the above stated amount is the proper measure of liquidated damages that the Owner will sustain by bidder's failure to execute the Contract or to furnish the Performance and Payment Bonds should bidder's bid be accepted.

Obligation of Bid Bond. If this bid is accepted within thirty-five days after the date set for the opening of bids and bidder fails to execute the Contract within ten days after Notice of Successful Bid, or if bidder fails to furnish both Performance and Payment Bonds, the obligation of the Bid Bond will remain in full force and effect and the money payable thereon shall be paid into the funds of the Owner as liquidated damages for such failure; otherwise, the obligations of the Bid Bond will be null and void.

Bidder Certification

Certification under Oath. Under oath I certify that I am a principal or other representative of the bidder, and that I am authorized by it to execute the foregoing bid on its behalf; and further, that I am a principal person of the bidder with management responsibility for the construction for the bidder, and as such I am personally knowledgeable of all its pertinent matters. I further certify that this bid is made without prior understanding, agreement, or connection with any corporation, firm, or person submitting a bid for the same services, materials, labor, supplies, or equipment and is in all respects fair and without collusion or fraud. Bidder and its principals understand that collusive bidding is a violation of state and federal law and can result in fines, prison sentences, and civil damage awards. Bidder agrees to abide by all conditions of this bid.

BY: _____
Authorized *Signature* *(BLUE INK)*

_____
Printed Name Title

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

_____
Notary Public

My commission expires: _____

(SEAL)

NOTE: THE NOTARY SEAL MUST BE APPLIED UNDER GEORGIA LAW, WHETHER OR NOT THE LAW OF THE STATE WHERE EXECUTED PERMITS OTHERWISE.

STATEMENT OF BIDDER'S QUALIFICATIONS:
(To be subscribed and sworn to before a notary public.)

The bidder submits the following statement of bidder's qualifications for consideration by the Owner.

Bidder's Name: _____
LEGAL NAME OF BUSINESS

Bidder's Address: _____
LEGAL BUSINESS ADDRESS (NO P.O. BOX, ***MUST*** BE PHYSICAL ADDRESS)

_____
CITY STATE ZIP

_____
MAILING ADDRESS IF DIFFERENT FROM ABOVE

Telephone Number: _____ _____
AREA CODE NUMBER

The full names of persons and firms interested in the foregoing bid as principals are as follows:

(1)_____
Circle One: President Partner Owner Other

(2)_____
Circle One: Vice President Secretary Partner Other

(3)_____
Circle One: Vice President Secretary Partner Other

Note: *If incorporated: The names of both the President and Corporate Secretary must be indicated. If a partnership, all partners must be indicated.*

Social Security Number or **FEIN:** _____

Contractor's Georgia License Type and Number: _____

Contractor's Federal Employment Verification Certification: ***(Must include completed Contractor Affidavit as found in Section 7 of the Contract)***

The Contractor is registered with, authorized to use, is using and will continue to use, the federal work authorization program throughout the term of the contract, and holds the following authorization:

User Identification Number: _____

Date of Authorization: _____

State Where Organized or Incorporated: _____

Plan of Organization: (Circle One) Proprietorship Corporation Partnership Joint Venture Other (Describe)

Years Engaged in Construction Contracting in Present Firm Organization: _____ years.

Bidder Hereby Certifies that bidder:
a. Has never refused to sign a contract at the original bid on a public works contract except as allowed under Georgia law.

b. Has never been terminated for cause on a public works contract.

c. Has had no (criminal or felony) convictions, suspensions, or debarments of the bidder, its officers, or its principals for building code violations, bid rigging, or bribery in the last ten years.

d. Is not and its organization or its principals are not debarred, suspended, declared ineligible, or otherwise excluded by any Federal or State department or agency from doing business with the Federal Government or a State.

e. Has insurance required by the Contract Documents in place or has arranged to obtain it from an insurer authorized to do business in the State of Georgia.

f. Has sufficient bonding capacity to obtain a payment and performance bond from a surety meeting the requirements of the Contract Documents and authorized to do business in the State of Georgia.

g. Has sufficient cash flow to perform this Project.

Remarks or explanations of the above paragraphs a through g:

_____

_____

_____

_____

Bidder Certification

Certification under Oath. Under oath I certify that I am a principal or other representative of the bidder, and that I am authorized by it to execute the foregoing Statement of Bidder's Qualifications is true and correct, including any explanation above and submitted under oath.

BY: _____
Authorized *Signature* *(BLUE INK PLEASE)*

_____
Printed Name Title

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

_____
Notary Public

My commission expires: _____

(SEAL)

NOTE: THE NOTARY SEAL MUST BE APPLIED UNDER GEORGIA LAW, WHETHER OR NOT THE LAW OF THE STATE WHERE EXECUTED PERMITS OTHERWISE.

Statistical Information. This request is made for statistical purposes only.

PLEASE INDICATE BELOW WHICH OF THE FOLLOWING DESCRIPTIONS APPLY TO YOUR COMPANY:

____ MINORITY BUSINESS ENTERPRISE (MBE) – One of the following statements describes this business: **a)** Owned by a member of a minority race; or **b)** a partnership of which a majority of interest is owned by one or more members of a minority

race; or **c)** a public corporation of which a majority of the common stock is owned by one or more members of a minority race. A member of a minority race is defined as a person who is a member of a race that comprises less than fifty percent of the total population of the State of Georgia. For recordkeeping purposes, this includes, but is not limited to, persons who are Black, Hispanic, Asian-Pacific American, Native American, or Asian-Indian American.

____ GEORGIA MINORITY BUSINESS ENTERPRISE (GMBE) – Business meets the definition of a minority-owned business and, in addition, meets the following criteria: **a)** was organized in the State of Georgia; or **b)** reports income from the business for Georgia Income Tax purposes; or **c)** minority stockholders report earnings for Georgia Minority Business Enterprise.

____ NEITHER DESCRIPTION APPLIES TO YOUR COMPANY.

BID REQUIREMENTS
BID SECURITY FORM

NOTE TO CONTRACTOR: Use of Surety's standard Bid Bond form is acceptable as long as it substantially complies with the following:

KNOW ALL BY THESE PRESENTS, That we, {Insert Contractor's Legal Name and Address} as Principal, hereinafter called the Principal, and {Insert Legal Name and Address of Surety}, a corporation duly organized under the laws of the State of {Insert State of Corporate Organization}, as Surety, hereinafter called the Surety, are held and firmly bound unto:

OWNER: _____

Attention: _____

Phone Number: _____

Facsimile Number: _____

as Obligee, hereinafter called the Obligee in the sum of _____ (Not less than five percent of the Bid) Dollars ($ _____), for the payment of which sum well and truly to be made, the said Principal and the said Surety, bind ourselves, our heirs, executors, administrators, successors and assigns, jointly and severally, firmly by these presents.

WHEREAS, the Principal has submitted a Bid for _____;
{Insert Owner's Project Number and Project Description}

NOW, THEREFORE, if the Obligee shall accept the Bid of the Principal and (1) the Principal shall enter into a Contract with the Obligee in accordance with the terms of such Bid, and the Principal shall execute the Contract and give such bond or bonds as may be specified in the Bidding or Contract Documents with good and sufficient surety for the faithful performance of such Contract and for the prompt payment of labor and material furnished in the prosecution thereof; or (2) in the event of the failure of the Principal to enter such Contract and give such bond or bonds, and the Principal shall pay to the Obligee the difference not to exceed the difference hereof between the amount specified in said Bid and such larger amount for which the Obligee may in good faith contract with another party to perform the Work covered by said Bid; then this obligation shall be null and void, otherwise to remain in full force and effect.

Signed and sealed this _____ Day of _____, 20___

Name of Contractor: _____
Principal

_____
Witness

By: _____ (Seal)

_____
Title

Name of Surety: _____
Surety

_____
Witness

By: _____ (Seal) (*)

(*) Attach Power of Attorney

Houston County Public Works

Construction Documents
for
Bid #19-45
Houston County Detention Center
Chilled Water Plant Upgrades

June 14, 2019

NBP#19048
Prepared By:

NBP ENGINEERS
316 Corporate Parkway ▪ Macon, GA 31210
(478) 745-1691 ▪ (478) 750-9873 fax
www.nbpengineers.com

BID REQUIREMENTS

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- Whether the bidder can demonstrate a commitment to safety with regard to Workers' Compensation by having an Experience Modification Rate (EMR) over the past three years not having exceeded an average of 1.2; and
- Whether the bidder's past work provides evidence of an ability to successfully complete public works projects within the established time, quality, or cost, or to comply with the bidder's contract obligations.

In the event all responsive and responsible bids are in excess of the budget, the Owner, in its sole and absolute discretion and in addition to rejecting all bids, reserves the right either to supplement the budget or to negotiate with the lowest responsive and responsible bidder (after all deductive alternates are taken) but only for the purpose of making changes to the project that will result in a cost to the Owner that is within the budget, as it may be supplemented.

BID REQUIREMENTS

INSTRUCTIONS TO BIDDERS

1. **Basis of Contract.** Contract, if awarded, will be on a lump sum basis and will be substantially in accordance with the Contract shown on pages Contract – 1 to Contract – 4.

2. **Examination of Site.** In undertaking the work under this Contract, the Contractor acknowledges that he has visited the Project Site and has taken into consideration all observed conditions that might affect his work.

3. **Surety and Insurance Companies.** The Contract provides that the surety and insurance companies must be acceptable to the Owner. Only those sureties listed in the Department of Treasury's Listing of Approved Sureties (Department Circular 570) are acceptable to the Owner. At the time of issuance, all insurance and bonds must be issued by a company licensed by the Georgia Insurance Commissioner to transact the business of insurance in the State of Georgia for the applicable line of insurance. Such company shall be an insurer (or, for qualified self insurers or group self insureds, a specific excess insurer providing statutory limits) with an A.M. Best Financial Strength Rating of "A-" or better and with an A.M. Best Financial Size Category of Class V or larger.

4. **Bidding Documents.** The Bidding Documents comprise the Construction Documents, the Invitation to Bid, the Instructions to Bidders, the Bid Form, and all Addenda, upon which the bidder submits a bid.

5. **Addenda.** All Addenda issued prior to bid date adjust, modify, or change the drawings and specifications as set forth in the Addenda. No Addenda will be issued within five days of the date set for opening bids without an extension of the bid date. All such Addenda are part of the contract.

6. **Interpretations.** No oral interpretation will be made to bidders as to the meaning of the drawings and specifications. Requests for interpretation of drawings and specifications must be made in writing to the Design Professional not later than six days prior to the date set for receipt of the bids. Failure on the part of the successful bidder to request clarification shall not relieve him as Contractor of the obligation to execute such work in accordance with a later interpretation by the Design Professional. All interpretations made to bidders will be issued in the form of Addenda to the plans and specifications and will be sent to all plan holders of record. Acknowledgement of receipt of such Addenda shall be listed in the Bid Form by the Contractor.

7. **Alternates.** Unless otherwise stipulated, all alternate bids are deductive. It is in the best interest of the public, and the intent of the Owner is, that the entire Project be constructed within the funds allocated in the Project budget. The acceptance of any deductive alternate will be utilized as a last resort to accomplish the Project without requiring a redesign and rebidding of the Project. Any alternate, or alternates, if taken, will be taken in numerical sequence to the extent necessary.

8. **Sales Tax.** Unless otherwise provided for in the Contract Documents, the Contractor shall include in his bid all sales taxes, consumer taxes, use taxes, and all other applicable taxes that are legally in effect at the time bids are received.

9. **Trade Names, Specifications.**

(a) *No Restriction of Competition.* When reference is made in the Contract Documents to trade names, brand names, or to the names of manufacturers, such references are made solely to indicate that products of that description may be furnished and are not intended to restrict competitive bidding. If it is desired to use products of trade or brand names or of manufacturers' names that are different from those mentioned in the Bidding Documents, application for the approval of the use of such products must reach the hands of the Design Professional at least ten days prior to the date set for the opening of bids (*see* 9(b) below). This provision applies only to the party making a submittal prior to bid. If approved by Design Professional, the Design Professional will issue an addendum to all bidders. This provision does not prevent the Owner from initiating the addition of trade names, brand names, or names of manufacturers by addendum prior to bid.

(b) *Request for Approval of Substitute Product*. All requests for approval of substitution of a product that is not listed in the Bidding Documents must be made to the Design Professional in writing. For the Design Professional to prepare an addendum properly, an application for approval of a substitute product must be accompanied by a copy of the published recommendations of the manufacturer for the installation of the product together with a complete schedule of changes in the drawings and specifications, if any, that must be made in other work in order to permit the use and installation of the proposed product in accordance with the recommendations of the manufacturer of the product. The application to the Design Professional for approval of a proposed substitute product must be accompanied by a schedule setting forth in which respects the materials or equipment submitted for consideration differ from the materials or equipment designated in the Bidding Documents.

(c) *Burden of Proof.* The burden of proving acceptability of a proposed product rests on the party making the submission. Therefore, the application for approval must be accompanied by technical data that the party requesting approval desires to submit in support of its application. The Design Professional will consider reports from reputable independent testing laboratories, verified experience records showing the reputation of the proposed product with previous users, evidence of reputation of the manufacturer for prompt delivery, evidence of reputation of the manufacturer for efficiency in servicing its products, or any other written information that is helpful in the circumstances. The degree of proof required for approval of a proposed product as acceptable for use in place of a named product or named products is that amount of proof necessary to convince a reasonable person beyond all doubt. To be approved, a proposed product must also meet or exceed all express requirements of the Contract Documents.

(d) *Issuance of Addenda.* If the Design Professional approves the submittal, an addendum will be issued to all prospective bidders indicating the approval of the additional product(s). Issuance of an addendum is a representation to all bidders that the Design Professional in the exercise of his professional discretion established that the product submitted for approval is acceptable and meets or exceeds all express requirements. If a submittal is initially rejected by the Design Professional, but determined to be acceptable to Design Professional after a conference with the Owner, an addendum covering the said submittal will be issued prior to the opening of bids. The successful bidder may furnish no products of any trade names, brand names, or manufacturers' names except those designated in the Contract Documents unless approvals have been published by addendum in accordance with the above procedure. Oral approvals of products are not valid.

(e) *Conference with the Owner*. Any party who alleges that rejection of a submittal is the result of bias, prejudice, caprice, or error on the part of the Design Professional may request a conference with a representative of the Owner, provided: that the request for said conference, submitted in writing, shall have reached the Owner at least six days prior to the date set for the opening of bids, time being of the essence.

10. **Employment of Georgia Citizens and Use of Georgia Products.** The work provided for in this Contract is to be performed in Georgia. It is the desire of the Owner that materials and equipment manufactured or produced in Georgia shall be used in the work and that Georgia citizens shall be employed in the work at wages consistent with those being paid in the general area in which the work is to be performed. This desire on the part of the Owner is not intended to restrict or limit competitive bidding or to increase the cost of the work; nor shall the fulfillment of this desire be asserted by the Contractor as an excuse for any noncompliance or omission to fulfill any obligation under the contract.

11. **Trading with the State Statutes, Ethics.** By submitting a bid, the bidder certifies that the provisions of law contained in O.C.G.A. Sections 45-10-20 to 45-10-71, which prohibit officials and employees of the state from engaging in certain transactions with the state and state agencies, and the Governor's Executive Orders governing ethics, have not and will not be violated in any respect in regard to this contract and further certifies that registration and all disclosures required thereby have been complied with.

12. **Georgia Security and Immigration Compliance Act Requirements.** No bid will be considered unless the Contractor certifies its compliance with the Immigration reform and Control Act of 1986 (IRCA), D.L. 99-603 and the Georgia Security Immigration Compliance Act OCGA 13-10-91 *et seq.* The Contractor shall execute the Georgia Security and Immigration Compliance Act Affidavit, as found in Section 7 of the Construction Contract. Contractor also agrees that it will execute any affidavits required by the rules and regulations issued by the Georgia Department of Audits and Accounts. If the Contractor is the successful bidder, contractor warrants that it will include a similar provision in all written agreements with any subcontractors engaged to perform services under the Contract.

13. **Owner's Policy Statement.** The policy of the Owner is that minority business enterprises shall have the maximum opportunity to participate in the Owner's purchasing process. The Owner encourages all minority business enterprises to compete for, win, and receive contracts for goods, services, and construction. In addition, Georgia law provides a state income tax credit available to any business that subcontracts with a minority-owned business. [*See* O.C.G.A. §48-7-38 and O.C.G.A. §50-5-130. *See also* Executive Order of the Governor No. A-11-0002-1992.]

14. **Bids.**

(a) *Bid Opening.* Bids will be opened and announced as stated in the Invitation to Bid.

(b) *Bid Submission.* All bids must be submitted on the Bid Form as attached hereto and must be signed, notarized by a notary public, and **sealed with corporate E-Verify Number on outside of envelope.** All blanks for information entry in bid forms submitted to Owner should be filled. Blanks left unfilled constitute irregularities in the bid and place the bidder at risk of having the bid rejected *unless* the Owner rules the irregularity to be an informality or technicality that the director can waive, as is made clear in Paragraph 16 of these "Instructions to Bidders" and on the Bid Form. Numbers shall be written in English words and in Arabic numerals. **The inclusion of any condition, alternate, qualification, limitation, or provision not called for shall render the bid nonresponsive and shall be sufficient cause for rejection of a bid.**

(c) *Bid Security.* Bids must be accompanied by a Bid Bond made payable to the Owner in an amount not less than five percent of the Bid. Bid Bonds should be furnished on forms accepted as standard by the insurance industry, but shall be substantially in accordance with the Bid Security Form attached hereto.

(d) *Delivery of Bids.* Bids are to be addressed to the Owner, at the address and room number shown in the Invitation to Bid. Bids must be enclosed in an opaque, sealed envelope; marked with the Bid Date, Bid Time, Bid Number, Name of Project; and identified with the words "Bid for Construction." Bids must be placed in the hands of the Owner at the specified location by not later than the hour and date named in the Invitation to Bid. After that time, no bids may be received. It is the sole responsibility of the bidder to ensure the delivery of the bids to the required address.

(e) Alternates. A bid must be submitted for all alternates. Failure to so may render the bid nonresponsive and be sufficient cause for rejection of a bid.

(f) *Withdrawal of Bids.* Bids may be withdrawn by bidders prior to the time set for official opening. After time has been called, no bid may be withdrawn for a period of thirty-five days after the time and date of opening except as provided in O.C.G.A Section 13-10-22 (appreciable error in calculation of bid). Negligence or error on the part of any bidder in preparing his bid confers no right of withdrawal or modification of his bid after time has been called except as provided by Georgia law.

15. **Contract Award.** Award shall be made on a lump sum basis to the lowest responsive and responsible bidder. The lowest bid will be the bid whose price, after incorporating all accepted alternates, is the lowest responsive bid that was received from a responsible bidder. No bid may be withdrawn for a period of thirty-five days after time has been called on the date of opening except in accordance with the provisions of law.

16. **Owner's Rights Concerning Award.** The Owner reserves the right in its sole and complete discretion to waive technicalities and informalities. The Owner further reserves the right in its sole and complete discretion to reject all bids and any bid that is not responsive or that is over the budget, as amended. In judging whether the bidder is responsible, the Owner will consider, but is not limited to consideration of, the following:

(a) Whether the bidder or its principals are currently ineligible, debarred, suspended, or otherwise excluded from bidding or contracting by any state or federal agency, department, or authority;

(b) Whether the bidder or its principals have been terminated for cause or are currently in default on a public works contract;

(c) Whether the bidder can demonstrate sufficient cash flow to undertake the project as evidenced by a Current Ratio of 1.0 or higher;

(d) Whether the bidder can demonstrate a commitment to safety with regard to Workers' Compensation by having an Experience Modification Rate (EMR) over the past three years not having exceeded an average of 1.2; and

(e) Whether the bidder's past work provides evidence of an ability to successfully complete public works projects within the established time, quality, or cost, or to comply with the bidder's contract obligations.

17. **Owner's Right to Negotiate with the Lowest Bidder.** In the event *all* responsive and responsible bids are in excess of the budget, the Owner, in its sole and absolute discretion and in addition to the rights set forth above, reserves the right either to (i) supplement the budget with additional funds to permit award to the lowest responsive and responsible bid, or (ii) to negotiate with the lowest responsive and responsible bidder (after taking all deductive alternates) only for the purpose of making changes to the Project that will result in a cost to the Owner that is within the budget, as it may be amended.

18. **Contract Forms.** The contract forms, including the payment and performance bonds, shall be as set forth in the General Conditions, Section 7 – Forms.

[Remainder of Page Intentionally Left Blank]

BID REQUIREMENTS

BID FORM

To: OWNER _____

Re: Project Name and No. _____

Bid Date: _____

THE BID:

Bid. Having carefully examined the Specifications entitled _____ and the Bidding Documents and Addendum (a) No.(s) _____, as well as the Site and conditions affecting the Work, bidder hereby proposes to furnish all services, labor, materials, and equipment called for by them for the entire Work, in accordance with the aforesaid documents, for the sum of:

_____ Dollars ($ _____)

which sum is hereinafter called the Bid. The Bid shall be the amount of the Contract Sum executed between the Owner and the Contractor unless Alternates are accepted.

Alternates. We further propose that, should any of the following alternates be accepted and be incorporated in the Contract, the Bid will be altered in each case as follows:

Deductive Alternate No. 1 – Omit replacement of make-up water stations serving heating water and chilled water systems.

Deduct the sum of _____ Dollars ($ _____)

Errors or Revisions. Prior to the bid opening date and hour, errors may be stricken or revisions may be made and corrections entered on this proposal form or on the bid envelope with sufficient clarity to be easily understood. All such annotations shall be binding on the bidder.

No Withdrawal. For and in consideration of the sum of $10.00, the receipt of which is hereby acknowledged, bidder and Owner agree that this bid may not be revoked or withdrawn after the time set for the opening of bids, except as provided in Georgia law, but is an irrevocable offer that shall remain open for acceptance for a period of thirty-five days following the time set for the opening of bids.

Execution of the Contract. If bidder is notified in writing by statutory mail of the acceptance of this bid within thirty-five days after time set for the opening of bids, bidder agrees to execute within ten days the Contract for the Work for the above stated Bid, as adjusted by the accepted Alternates, and at the same time to furnish and deliver to the Owner a Performance Bond and a Payment Bond on forms shown in Section 7 of the General Conditions of the Contract, both in an amount of equal to 100 percent of the Contract Sum.

Commencement and Completion of Work. Upon the Effective Date of the Contract, bidder agrees to commence all Preconstruction Activities. Upon issuance of a Proceed Order, bidder agrees to commence physical activities on the Site with adequate forces and equipment and to complete to Material Completion all work in **90** consecutive calendar days beginning the day after the date of the Proceed Order.

Bid Bond. Enclosed herewith is a Bid Bond *(NO OTHER FORM ACCEPTABLE)* in the amount of _____ Dollars ($ _____) (being not less than five percent of the Bid). Bidder agrees that the above stated amount is the proper measure of liquidated damages that the Owner will sustain by bidder's failure to execute the Contract or to furnish the Performance and Payment Bonds should bidder's bid be accepted.

Obligation of Bid Bond. If this bid is accepted within thirty-five days after the date set for the opening of bids and bidder fails to execute the Contract within ten days after Notice of Successful Bid, or if bidder fails to furnish both Performance and Payment Bonds, the obligation of the Bid Bond will remain in full force and effect and the money payable thereon shall be paid into the funds of the Owner as liquidated damages for such failure; otherwise, the obligations of the Bid Bond will be null and void.

Bidder Certification

Certification under Oath. Under oath I certify that I am a principal or other representative of the bidder, and that I am authorized by it to execute the foregoing bid on its behalf; and further, that I am a principal person of the bidder with management responsibility for the construction for the bidder, and as such I am personally knowledgeable of all its pertinent matters. I further certify that this bid is made without prior understanding, agreement, or connection with any corporation, firm, or person submitting a bid for the same services, materials, labor, supplies, or equipment and is in all respects fair and without collusion or fraud. Bidder and its principals understand that collusive bidding is a violation of state and federal law and can result in fines, prison sentences, and civil damage awards. Bidder agrees to abide by all conditions of this bid.

BY: _____
Authorized *Signature* *(BLUE INK)*

_____
Printed Name Title

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

_____
Notary Public

My commission expires: _____

(SEAL)

NOTE: THE NOTARY SEAL MUST BE APPLIED UNDER GEORGIA LAW, WHETHER OR NOT THE LAW OF THE STATE WHERE EXECUTED PERMITS OTHERWISE.

STATEMENT OF BIDDER'S QUALIFICATIONS:
(To be subscribed and sworn to before a notary public.)

The bidder submits the following statement of bidder's qualifications for consideration by the Owner.

Bidder's Name: _____
LEGAL NAME OF BUSINESS

Bidder's Address: _____
LEGAL BUSINESS ADDRESS (NO P.O. BOX, ***MUST*** BE PHYSICAL ADDRESS)

_____
CITY STATE ZIP

_____
MAILING ADDRESS IF DIFFERENT FROM ABOVE

Telephone Number: _____ _____
AREA CODE NUMBER

The full names of persons and firms interested in the foregoing bid as principals are as follows:

(1)_____
Circle One: President Partner Owner Other

(2)_____
Circle One: Vice President Secretary Partner Other

(3)_____
Circle One: Vice President Secretary Partner Other

Note: *If incorporated: The names of both the President and Corporate Secretary must be indicated. If a partnership, all partners must be indicated.*

Social Security Number or **FEIN:** _____

Contractor's Georgia License Type and Number: _____

Contractor's Federal Employment Verification Certification: ***(Must include completed Contractor Affidavit as found in Section 7 of the Contract)***

The Contractor is registered with, authorized to use, is using and will continue to use, the federal work authorization program throughout the term of the contract, and holds the following authorization:

User Identification Number: _____

Date of Authorization: _____

State Where Organized or Incorporated: _____

Plan of Organization: (Circle One) Proprietorship Corporation Partnership Joint Venture Other (Describe)

Years Engaged in Construction Contracting in Present Firm Organization: _____ years.

Bidder Hereby Certifies that bidder:
a. Has never refused to sign a contract at the original bid on a public works contract except as allowed under Georgia law.

b. Has never been terminated for cause on a public works contract.

c. Has had no (criminal or felony) convictions, suspensions, or debarments of the bidder, its officers, or its principals for building code violations, bid rigging, or bribery in the last ten years.

d. Is not and its organization or its principals are not debarred, suspended, declared ineligible, or otherwise excluded by any Federal or State department or agency from doing business with the Federal Government or a State.

e. Has insurance required by the Contract Documents in place or has arranged to obtain it from an insurer authorized to do business in the State of Georgia.

f. Has sufficient bonding capacity to obtain a payment and performance bond from a surety meeting the requirements of the Contract Documents and authorized to do business in the State of Georgia.

g. Has sufficient cash flow to perform this Project.

Remarks or explanations of the above paragraphs a through g:

_____

_____

_____

_____

Bidder Certification

Certification under Oath. Under oath I certify that I am a principal or other representative of the bidder, and that I am authorized by it to execute the foregoing Statement of Bidder's Qualifications is true and correct, including any explanation above and submitted under oath.

BY: _____
Authorized *Signature* *(BLUE INK PLEASE)*

_____
Printed Name Title

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

_____
Notary Public

My commission expires: _____

(SEAL)

NOTE: THE NOTARY SEAL MUST BE APPLIED UNDER GEORGIA LAW, WHETHER OR NOT THE LAW OF THE STATE WHERE EXECUTED PERMITS OTHERWISE.

Statistical Information. This request is made for statistical purposes only.

PLEASE INDICATE BELOW WHICH OF THE FOLLOWING DESCRIPTIONS APPLY TO YOUR COMPANY:

____ MINORITY BUSINESS ENTERPRISE (MBE) – One of the following statements describes this business: **a)** Owned by a member of a minority race; or **b)** a partnership of which a majority of interest is owned by one or more members of a minority

race; or **c)** a public corporation of which a majority of the common stock is owned by one or more members of a minority race. A member of a minority race is defined as a person who is a member of a race that comprises less than fifty percent of the total population of the State of Georgia. For recordkeeping purposes, this includes, but is not limited to, persons who are Black, Hispanic, Asian-Pacific American, Native American, or Asian-Indian American.

____ GEORGIA MINORITY BUSINESS ENTERPRISE (GMBE) – Business meets the definition of a minority-owned business and, in addition, meets the following criteria: **a)** was organized in the State of Georgia; or **b)** reports income from the business for Georgia Income Tax purposes; or **c)** minority stockholders report earnings for Georgia Minority Business Enterprise.

____ NEITHER DESCRIPTION APPLIES TO YOUR COMPANY.

BID REQUIREMENTS
BID SECURITY FORM

NOTE TO CONTRACTOR: Use of Surety's standard Bid Bond form is acceptable as long as it substantially complies with the following:

KNOW ALL BY THESE PRESENTS, That we, {Insert Contractor's Legal Name and Address} as Principal, hereinafter called the Principal, and {Insert Legal Name and Address of Surety}, a corporation duly organized under the laws of the State of {Insert State of Corporate Organization}, as Surety, hereinafter called the Surety, are held and firmly bound unto:

OWNER: _____

Attention: _____

Phone Number: _____

Facsimile Number: _____

as Obligee, hereinafter called the Obligee in the sum of _____ (Not less than five percent of the Bid) Dollars ($ _____), for the payment of which sum well and truly to be made, the said Principal and the said Surety, bind ourselves, our heirs, executors, administrators, successors and assigns, jointly and severally, firmly by these presents.

WHEREAS, the Principal has submitted a Bid for _____;
{Insert Owner's Project Number and Project Description}

NOW, THEREFORE, if the Obligee shall accept the Bid of the Principal and (1) the Principal shall enter into a Contract with the Obligee in accordance with the terms of such Bid, and the Principal shall execute the Contract and give such bond or bonds as may be specified in the Bidding or Contract Documents with good and sufficient surety for the faithful performance of such Contract and for the prompt payment of labor and material furnished in the prosecution thereof; or (2) in the event of the failure of the Principal to enter such Contract and give such bond or bonds, and the Principal shall pay to the Obligee the difference not to exceed the difference hereof between the amount specified in said Bid and such larger amount for which the Obligee may in good faith contract with another party to perform the Work covered by said Bid; then this obligation shall be null and void, otherwise to remain in full force and effect.

Signed and sealed this _____ Day of _____, 20___

Name of Contractor: _____
Principal

_____
Witness

By: _____ (Seal)

_____
Title

Name of Surety: _____
Surety

_____
Witness

By: _____ (Seal) (*)

(*) Attach Power of Attorney

TABLE OF CONTENTS

SECTION 01 1000

SUMMARY

PART 1 GENERAL

1.01 DESCRIPTION OF ALTERATIONS WORK

A. Replace existing chilled water pumps with new pumps with variable speed drives.

B. Replace existing digital control systems serving chilled water and heating water plants.

C. Clean chilled water piping system and chemically treat.

D. Test and Balance the completed chilled water system.

E. Scope of demolition and removal work is shown on drawings.

1.02 OWNER OCCUPANCY

A. Owner intends to continue to occupy portions of the existing building during the entire construction period.

B. Cooperate with Owner to minimize conflict and to facilitate Owner's operations.

C. Schedule the Work to accommodate Owner occupancy.

1.03 CONTRACTOR USE OF SITE AND PREMISES

A. Construction Operations: Limited to areas noted on Drawings.

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

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

D. Existing building spaces may not be used for storage.

E. Do not permit traffic over unprotected floor surfaces.

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

1. Do not disrupt or shut down life safety systems, including but not limited to fire sprinklers and fire alarm system, without 7 days' notice to Owner and authorities having jurisdiction.
2. HVAC:
    a. The building's HVAC system shall remain in service during occupied hours throughout the entire construction period; unless otherwise noted.

END OF SECTION

SECTION 01 2300
ALTERNATES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Description of Alternates.

1.02 ACCEPTANCE OF ALTERNATES

A. All alternates are deductive and must be bid on.

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

C. Coordinate related work and modify surrounding work to integrate the Work of each Alternate.

1.03 SCHEDULE OF ALTERNATES

A. Alternate No. 1 - Omit replacement of make-up water stations serving heating water and chilled water systems.:

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

SECTION 01 3000

ADMINISTRATIVE REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Preconstruction meeting.

B. Progress meetings.

C. Construction progress schedule.

D. Progress photographs.

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

F. Number of copies of submittals.

G. Submittal procedures.

1.02 RELATED REQUIREMENTS

A. Section 01 7000 - Execution and Closeout Requirements: Additional coordination requirements.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 PRECONSTRUCTION MEETING

A. Owner will schedule a meeting after Notice of Award.

B. Attendance Required:
   1. Owner.
   2. Architect.
   3. Contractor.
   4. The Building User.

C. Agenda:
   1. Distribution of Contract Documents.
   2. Submission of list of Subcontractors, and schedule of values.
   3. Designation of personnel representing the parties to Contract, and Architect.
   4. Submission of the project safety plan.
   5. Designation of personnel representing the parties in Contract and Architect.
   6. Procedures and processing of field decisions, submittals, substitutions, applications for payments, proposal request, Change Orders, and Contract closeout procedures.
   7. Submit preliminary progress schedule indicating Scheduling of Work.
   8. Joint examination of existing facilities and preparation of schedule documenting any existing damage to remain.

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

3.02 PROGRESS MEETINGS

A. Attendance Required:
   1. Contractor.
   2. Owner.
   3. Architect.
   4. Contractor's Superintendent.
   5. Major Subcontractors.

B. Agenda:
   1. Review minutes of previous meetings.
   2. Review of Work progress.

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

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

3.03 CONSTRUCTION PROGRESS SCHEDULE

A. Within 10 days after date established in Notice to Proceed, submit preliminary schedule defining planned operations for the first 60 days of Work, with a general outline for remainder of Work.

B. Present preliminary schedule at the Preconstruction meeting.

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

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

E. Include written certification that major contractors have reviewed and accepted proposed schedule.

F. Within 10 days after joint review, submit complete schedule.

G. Submit updated schedule with each Application for Payment.

3.04 PROGRESS PHOTOGRAPHS

A. Submit photographs with each application for payment, taken not more than 3 days prior to submission of application for payment.

B. Photography Type: Digital; electronic files.

C. Provide photographs of construction throughout progress of Work produced by an experienced photographer, acceptable to Architect.

D. Views:
1. Select views to illustrate progress of the work and document assemblies that may become covered by other work.

E. Digital Photographs: 24 bit color, minimum resolution of 1024 by 768, in JPG format; provide files unaltered by photo editing software.
1. Delivery Medium: Via email.
2. File Naming: Include project identification, date and time of view, and view identification.
3. PDF File: Assemble all photos into printable pages in PDF format, with 2 to 3 photos per page, each photo labeled with file name; one PDF file per submittal.

3.05 SUBMITTALS FOR REVIEW

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

B. Submit to Architect for review for the limited purpose of checking for conformance with information given and the design concept expressed in the contract documents.

C. After review, provide copies and distribute in accordance with SUBMITTAL PROCEDURES article below .

3.06 SUBMITTALS FOR INFORMATION

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

B. Submit for Architect's knowledge as contract administrator or for Owner. No action will be taken.

3.07 SUBMITTALS FOR PROJECT CLOSEOUT

A. Submit Correction Punch List for Substantial Completion.

B. Submit Final Correction Punch List for Substantial Completion.

C. When the following are specified in individual sections, submit them at project closeout:
   1. Closing submittals as required in the General Conditions.
   2. Project record documents.
   3. Operation and maintenance data.
   4. Warranties.
   5. Bonds.
   6. Other types as indicated.

3.08 NUMBER OF COPIES OF SUBMITTALS

A. Documents for Review:
   1. Small Size Sheets, Not Larger Than 8-1/2 x 11 inches: Submit the number of copies that Contractor requires, plus two copies that will be retained by Architect.

B. Documents for Information: Submit two copies.

C. Documents for Project Closeout: Make reproduction of submittal originally reviewed. Submit extra of submittals for inclusion with maintenance manuals.

3.09 SUBMITTAL PROCEDURES

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

B. Transmit each submittal with a copy of approved submittal form.

C. Sequentially number the transmittal form. Revise submittals with original number and a sequential alphabetic suffix.

D. Identify Project, Contractor, Subcontractor or supplier; pertinent drawing and detail number, and specification section number, as appropriate on each copy.

E. Apply Contractor's stamp, signed or initialed certifying that review, approval, verification of Products required, field dimensions, adjacent construction Work, and coordination of information is in accordance with the requirements of the Work and Contract Documents.

F. Assemble the submittal data for major Contractors in compete sets in hard back three-ring binders, separated by trade, (HVAC, Plumbing, and Electrical), and bound with numbered index sheets and tabs. Submittal data shall be submitted at one time unless unavailable data such as control submittal would delay project progress. Data shall include capacities, complete installation instructions, dimensional data and electrical data, BHP, motor HP, operating weights and load distribution at mounting points.

G. Deliver submittals to Architect at business address.

H. Schedule submittals to expedite the Project, and coordinate submission of related items.

I. For each submittal for review, allow 15 days excluding delivery time to and from Contractor.

J. Identify variations from Contract Documents and Product or system limitations that may be detrimental to successful performance of the completed Work.

K. Provide space for Contractor and Architect review stamps.

L. When revised for resubmission, identify all changes made since previous submission.

M. Distribute copies of reviewed submittals as appropriate. Instruct parties to promptly report any inability to comply with requirements.

N. Submittals not requested will not be recognized or processed.

END OF SECTION

SECTION 01 4000
QUALITY REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Contractor Minimum Qualifications.

B. Control of installation.

C. Tolerances.

D. Testing and inspection agencies and services.

E. Control of installation.

F. Tolerances.

1.02 SUBMITTALS

A. Contractor Minimum Qualifications: Provide bound, written evidence of the qualifications of the contracting firm at the Pre-Bid conference meeting the minimum specified herein.

1.03 CONTRACTOR'S MINIMUM QUALIFICATIONS - HVAC

A. Provide evidence of the qualifications of any proposed interested firm in a binder at the Pre-Bid conference.

B. Submit firm name, address, and telephone number, and names of full time Project Manager and foreman.

C. Submit name, address, email address, and telephone number of firm representative to contact about questions or the results of the review of the required qualification submittals.

D. Submit evidence that the interested firm shall have been in business under the present company name for a minimum of 4-years and shall not have been declared in default on any construction contract within that time.

E. The interested firm shall provide evidence of successful performance as a interested firm on at least three projects involving mechanical construction involving hydronic systems and underground piping of at least $200,000 in total construction cost. Provide a contact reference for each project.

F. Submit evidence that the interested firm has a current State of Georgia License for the mechanical work described within these documents.

G. The interested firm shall warrant that it is familiar with the Quality Assurance requirements of each technical section and his firm and his proposed interested firms have trained personnel meeting those requirements with instruments, tools, and equipment to perform the installation and start-up of specified.

H. The interested firm's foreman shall have at least four years' experience as a Superintendent on projects of similar scope and complexity as this project. List the proposed Superintendent and each project with a description. Provide a contact reference for each project.

I. The interested firm's Project Manager shall have at least two years' experience as a Project Manager on projects of similar scope and complexity as this project. List the proposed Project Manager and each project with a description. Provide a contact reference for each project.

J. Each submittal will be reviewed at the Pre-Bid conference and each interested firm will be verbally advised of any deficiencies. The firm will be required to provide or correct the information and deliver to NBP, Inc.'s offices within two working business days of the Pre-Bid conference.

K. No bids will be opened from firm's that have not provided complete information evidencing their qualifications as described above.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 CONTROL OF INSTALLATION

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

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

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

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

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

F. Verify all dimensions, elevations, grades and pitch by taking measurements at the building before ordering material or doing work which is dependent upon coordination with building conditions.

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

H. No consideration will be given to any claim based on differences between the actual dimensions and those indicated on the drawings.

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

3.02 CONTROL OF WORKER'S ATTIRE, VEHICLES, AND LANGUAGE:

A. Contractor's regularly scheduled project meetings shall include reinforcement of the prohibition of improper attire and language.

B. Worker's clothing shall be appropriate for the tasks being performed and shall not include wording or other adornments other than the Company's name and logo, if any. Shirts and trousers shall be worn at all times on the Owner's property.

C. Vehicles on the Owner's property shall not possess or exhibit signs, stickers, posters, etc. portraying or including inappropriate pictures or language.

D. Complaints regarding violations of these requirements shall be immediately conveyed to the Project Superintendent, and Architect simultaneously, with confirmation with specifics provided in writing within one workday.

3.03 TOLERANCES

A. Before ordering material or doing work which is dependent upon coordination with building conditions, Contractor shall verify all dimensions, elevations, grades and pitch by taking measurements at the building and shall be responsible for the correctness of same.

B. Monitor fabrication and installation tolerance control of products to produce acceptable Work. Do not permit tolerances to accumulate.

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

D. Adjust products to appropriate dimensions; position before securing products in place.

END OF SECTION

SECTION 01 5000
TEMPORARY FACILITIES AND CONTROLS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Temporary sanitary facilities.

B. Security requirements.

C. Vehicular access and parking.

D. Waste removal facilities and services.

1.02 TEMPORARY SANITARY FACILITIES

A. Provide and maintain required facilities and enclosures. Provide at time of project mobilization.

B. Maintain daily in clean and sanitary condition.

1.03 STORAGE AREAS:

A. Space for materials storage at the site is limited.

B. All materials not used at the end of the day shall be returned to the designated storage areas.

C. At completion of the project, material and debris shall be removed.

1.04 BARRIERS

A. Provide barriers to prevent unauthorized entry to construction areas, to prevent access to areas that could be hazardous to workers or the public, to allow for owner's use of site and to protect existing facilities and adjacent properties from damage from construction operations and demolition.

B. Provide barricades and covered walkways required by governing authorities for public rights-of-way and for public access to existing building.

C. Provide protection for plants designated to remain. Replace damaged plants.

D. Protect non-owned vehicular traffic, stored materials, site, and structures from damage.

1.05 SECURITY

A. Owner will furnish access to the building for use by Contractor.

B. The Contractor shall be responsible for keeping the mechanical rooms locked and secured, and for keeping the building locked and secured when not occupied by the Owner.

1.06 VEHICULAR ACCESS AND PARKING

A. Coordinate access and haul routes with governing authorities and Owner DPO.

B. Ingress and egress shall be limited to the most direct access to the work areas, mechanical rooms, and equipment

C. No parking outside the work site will be available on Owner premises for private vehicle operated by employees of the Contractor.

D. No vehicles or material shall be located , even temporarily, so as to hinder normal school functions.

E. Provide and maintain access to fire hydrants, free of obstructions.

F. Provide means of removing mud from vehicle wheels before entering streets.

G. Any debris dropped or tracked outside of areas in which work is being done shall be immediately cleaned up.

H. Provide temporary parking areas to accommodate construction personnel. When site space is not adequate, provide additional off-site parking.

I. Do not allow vehicle parking on existing pavement.

1.07 WASTE REMOVAL

A. Provide waste removal facilities and services as required to maintain the site in clean and orderly condition.

B. Provide containers with lids. Remove trash from site daily.

C. If materials to be recycled or re-used on the project must be stored on-site, provide suitable non-combustible containers; locate containers holding flammable material outside the structure unless otherwise approved by the authorities having jurisdiction.

D. Open free-fall chutes are not permitted. Terminate closed chutes into appropriate containers with lids.

E. All construction material and trash shall be disposed off the campus.

F. Burning of material on the site will not be permitted.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

SECTION 01 6000
PRODUCT REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Transportation, handling, storage and protection.

B. Product option requirements.

C. Substitution limitations and procedures.

1.02 RELATED REQUIREMENTS

A. Section 01 6116 - Volatile Organic Compound (VOC) Content Restrictions: Requirements for VOC-restricted product categories.

B. Section 23 0513 - MOTORS FOR HVAC EQUIPMENT: Motors for HVAC equipment.

1.03 REFERENCE STANDARDS

A. NEMA MG 1 - Motors and Generators; 2014.

PART 2 PRODUCTS

2.01 NEW PRODUCTS

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

B. DO NOT USE products having any of the following characteristics:

C. Where all other criteria are met, Contractor shall give preference to products that:
   1. If used on interior, have lower emissions, as defined in Section 01 6116.
   2. If wet-applied, have lower VOC content, as defined in Section 01 6116.
   3. Have a published GreenScreen Chemical Hazard Analysis.

D. Motors: Refer to Section 22 0513, NEMA MG 1 Type. Specific motor type is specified in individual specification sections.

E. Motors: Refer to Section 23 0513 - MOTORS FOR HVAC EQUIPMENT, NEMA MG 1 Type. Specific motor type is specified in individual specification sections.

2.02 PRODUCT OPTIONS

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

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

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

2.03 MATERIAL SAFETY DATA SHEETS (MSDS):

A. MSDS data sheets for all products to be utilized on the project shall be submitted to Owner prior to performing the work.

B. These sheets could include, but not be limited to, cleaning chemicals, caulks, lubricants, concrete, paint, etc.

C. MSD sheets shall be submitted and approved by Owner prior to the corresponding material being brought on to the Project Site.

PART 3 EXECUTION

3.01 SUBSTITUTION PROCEDURES

A. Substitutions may be considered when a product becomes unavailable through no fault of Contractor.

B. Document each request with complete data substantiating compliance of proposed substitution with Contract Documents.

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

3.02 TRANSPORTATION AND HANDLING

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

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

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

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

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

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

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

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

3.03 STORAGE AND PROTECTION

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

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

C. Store with seals and labels intact and legible.

D. Store sensitive products in weather tight, climate controlled, enclosures in an environment favorable to product.

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

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

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

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

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

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

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

END OF SECTION

SECTION 01 7000
EXECUTION AND CLOSEOUT REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Examination, preparation, and general installation procedures.

B. Cutting and patching.

C. Cleaning and protection.

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

1.02 RELATED REQUIREMENTS

A. Section 07 8400 - Firestopping.

1.03 COORDINATION

A. Coordinate scheduling, submittals, and work of the various sections of the Project Manual to ensure efficient and orderly sequence of installation of interdependent construction elements, with provisions for accommodating items installed later.

B. Notify affected utility companies and comply with their requirements.

C. Verify that utility requirements and characteristics of new operating equipment are compatible with building utilities. Coordinate work of various sections having interdependent responsibilities for installing, connecting to, and placing in service, such equipment.

D. Coordinate space requirements, supports, and installation of mechanical and electrical work that are indicated diagrammatically on Drawings. Follow routing shown for pipes, ducts, and conduit, as closely as practicable; place runs parallel with lines of building. Utilize spaces efficiently to maximize accessibility for other installations, for maintenance, and for repairs.

E. In finished areas except as otherwise indicated, conceal pipes, ducts, and wiring within the construction. Coordinate locations of fixtures and outlets with finish elements.

F. Coordinate completion and clean-up of work of separate sections.

G. After Owner occupancy of premises, coordinate access to site for correction of defective work and work not in accordance with Contract Documents, to minimize disruption of Owner's activities.

PART 2 PRODUCTS

2.01 PATCHING MATERIALS

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

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

C. Product Substitution: For any proposed change in materials, submit request for substitution described in Section 01 6000 - Product Requirements.

PART 3 EXECUTION

3.01 EXAMINATION

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

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

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

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

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

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

3.02 PREPARATION

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

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

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

3.03 GENERAL INSTALLATION REQUIREMENTS

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

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

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

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

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

3.04 CUTTING AND PATCHING

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

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

C. Execute cutting and patching including excavation and fill to complete the work, to uncover work in order to install improperly sequenced work, to remove and replace defective or non-conforming work, to remove samples of installed work for testing when requested, to provide openings in the work for penetration of mechanical and electrical work, to execute patching to complement adjacent work, and to fit products together to integrate with other work.

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

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

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

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

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

I. At penetrations of fire rated walls, partitions, ceiling, or floor construction, completely seal voids with fire rated material in accordance with Section 07 8400, to full thickness of the penetrated element.

J. Patching:
   1. Finish patched surfaces to match finish that existed prior to patching. On continuous surfaces, refinish to nearest intersection or natural break. For an assembly, refinish entire unit.
   2. Match color, texture, and appearance.
   3. Repair patched surfaces that are damaged, lifted, discolored, or showing other imperfections due to patching work. If defects are due to condition of substrate, repair substrate prior to repairing finish.

K. Refinish surfaces to match adjacent finish. For continuous surfaces, refinish to nearest intersection or natural break. For an assembly, refinish entire unit.

L. Make neat transitions. Patch work to match adjacent work in texture and appearance. Where new work abuts or aligns with existing, perform a smooth and even transition.

3.05 PROGRESS CLEANING

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

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

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

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

3.06 PROTECTION OF INSTALLED WORK

A. Protect installed work from damage by construction operations.

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

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

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

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

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

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

3.07 SAFETY

A. Contractor shall obtain welding/cutting permit prior to performing any welding or cutting with a torch on the project.

B. Two (2) 15 lb. CO_2 fire extinguishers shall be located at each permitted area.

3.08 ADJUSTING

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

3.09 FINAL CLEANING

A. Use cleaning materials that are nonhazardous.

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

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

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

E. All materials, equipment and mechanical rooms shall be cleaned prior to Final Observation.

F. Wash down and scrub clean all mechanical room floors, walls, equipment bases and equipment.

G. Paint equipment where finish has been damaged requiring retouching of finish to match factory finish.

H. All air handling equipment shall be cleaned internally prior to Substantial Completion. Clean unit casing externally and internally. Seal/replace all damaged duct liner.

I. Chipped or scraped paint shall be retouched to match original finish.

J. All dents and sags in ductwork and equipment casings shall be straightened.

K. All ductwork, insulation, equipment, pipe, pipe fittings and appurtenances shall be free of dust, rust and stains prior to Substantial Completion.

L. Clean filters of operating equipment.

M. Clean debris from roofs, gutters, downspouts, scuppers, overflow drains, area drains, drainage systems, and _____.

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

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

3.10 CLOSEOUT PROCEDURES

A. Make submittals that are required by governing or other authorities.

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

C. Notify Architect when work is considered ready for Final Observation.

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

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

F. Correct items of work listed in the Final Observation Report and comply with requirements for access to Owner-occupied areas.

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

END OF SECTION

SECTION 03 3000
CAST-IN-PLACE CONCRETE

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Concrete formwork.

B. Concrete reinforcement.

C. Miscellaneous concrete elements - equipment pads.

D. Restoration of existing concrete after installation of new underground service entrance.

E. Concrete curing.

1.02 GENERAL

A. This section includes the furnishing of all materials, labor and equipment required for installation of all concrete work shown on the drawings and specified herein. All work shall comply with reference ACI Standard 301. The work includes, but is not limited to, the following work:
   1. Replacing, repairing and patching of concrete work removed or damaged during work.
   2. New concrete bases under equipment and duct supports where specified.

1.03 FINISHES

A. Equipment Bases: Uniform rubbed finish.

1.04 REFERENCE STANDARDS

A. ACI 211.1 - Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete; 1991 (Reapproved 2009).

B. ACI 301 - Specifications for Structural Concrete; 2016.

C. ACI 304R - Guide for Measuring, Mixing, Transporting, and Placing Concrete; 2000 (Reapproved 2009).

D. ACI 308R - Guide to External Curing of Concrete; 2016.

E. ACI 318 - Building Code Requirements for Structural Concrete and Commentary; 2014 (Errata 2017).

F. ACI 347R - Guide to Formwork for Concrete; 2014.

G. ASTM A185/A185M - Standard Specification for Steel Welded Wire Reinforcement, Plain, for Concrete; 2007.

H. ASTM A497/A497M - Standard Specification for Steel Welded Wire Reinforcement, Deformed, for Concrete; 2007.

I. ASTM A615/A615M - Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement; 2016.

J. ASTM C33/C33M - Standard Specification for Concrete Aggregates; 2016, with Editorial Revision (2016).

K. ASTM C39/C39M - Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens; 2018.

L. ASTM C150/C150M - Standard Specification for Portland Cement; 2018.

M. ASTM C171 - Standard Specification for Sheet Materials for Curing Concrete; 2016.

N. ASTM C494/C494M - Standard Specification for Chemical Admixtures for Concrete; 2017.

O. ASTM C618 - Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete; 2015.

P. ASTM C685/C685M - Standard Specification for Concrete Made by Volumetric Batching and Continuous Mixing; 2014.

Q. ASTM C1240 - Standard Specification for Silica Fume Used in Cementitious Mixtures; 2015.

1.05 QUALITY ASSURANCE

A. Perform work of this section in accordance with ACI 301 and ACI 318.

PART 2 PRODUCTS

2.01 FORMWORK

A. Formwork Design and Construction: Comply with guidelines of ACI 347 to provide formwork that will produce concrete complying with tolerances of ACI 117.

B. Form Materials: Contractor's choice of standard products with sufficient strength to withstand hydrostatic head without distortion in excess of permitted tolerances.
   1. Form Facing for Exposed Finish Concrete: Contractor's choice of materials that will provide smooth, stain-free final appearance.

2.02 REINFORCEMENT

A. Reinforcing Steel: ASTM A615/A615M Grade 40 (280).
   1. Type: Deformed billet-steel bars.

B. Steel Welded Wire Reinforcement: ASTM A 185/A 185M, plain type.
   1. Mesh Size and Wire Gage: As indicated on drawings.

C. Reinforcement Accessories:
   1. Tie Wire: Annealed, minimum 16 gage.
   2. Provide stainless steel, galvanized, plastic, or plastic coated steel components for placement within 1-1/2 inches of weathering surfaces.

2.03 CONCRETE MATERIALS

A. Cement: ASTM C150, Type I - Normal Portland type.

B. Fine and Coarse Aggregates: ASTM C 33.

C. Lightweight Aggregate: ASTM C 330.

D. Fly Ash: ASTM C618, Class C or F.

E. Silica Fume: ASTM C1240, proportioned in accordance with ACI 211.1.

F. Water: Clean and not detrimental to concrete.

2.04 CONCRETE MIX DESIGN

A. Proportioning Normal Weight Concrete: Comply with ACI 211.1 recommendations.

B. Concrete Strength: Establish required average strength for concrete on the basis of field experience, as specified in ACI 301.

C. Normal Weight Concrete:
   1. Compressive Strength, per ASTM C 39 at 28 days: 3,000 psi.
   2. Maximum Slump: 4 inches.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify lines, levels, and dimensions before proceeding with work of this section.

3.02 PREPARATION

A. Formwork: Comply with requirements of ACI 301. Design and fabricate forms to support all applied loads until concrete is cured, and for easy removal without damage to concrete.

3.03 INSTALLING REINFORCEMENT AND OTHER EMBEDDED ITEMS

A. Comply with requirements of ACI 301. Clean reinforcement of loose rust and mill scale, and accurately position, support, and secure in place to achieve not less than minimum concrete coverage required for protection.

B. Install welded wire reinforcement in maximum possible lengths, and offset end laps in both directions. Splice laps with tie wire.

3.04 PLACING CONCRETE

A. Place concrete in accordance with ACI 304R.

B. Ensure reinforcement and embedded parts will not be disturbed during concrete placement.

3.05 CONCRETE FINISHING

A. Repair surface defects, immediately after removing formwork.

B. Exposed Form Finish: Rub down or chip off and smooth fins or other raised areas 1/4 inch or more in height. Provide finish as follows:

1. Smooth Rubbed Finish: Wet concrete and rub with carborundum brick or other abrasive, not more than 24 hours after form removal.

3.06 CURING AND PROTECTION

A. Comply with requirements of ACI 308R. Immediately after placement, protect concrete from premature drying, excessively hot or cold temperatures, and mechanical injury.

B. Maintain concrete with minimal moisture loss at relatively constant temperature for period necessary for hydration of cement and hardening of concrete.

3.07 DEFECTIVE CONCRETE

A. Defective Concrete: Concrete not conforming to required lines, details, dimensions, tolerances or specified requirements.

B. Repair or replacement of defective concrete will be determined by the Architect. The cost of additional testing shall be borne by Contractor when defective concrete is identified.

END OF SECTION

SECTION 07 8400
FIRESTOPPING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Firestopping systems.

B. Firestopping of all joints and penetrations in fire resistance rated and smoke resistant assemblies, whether indicated on drawings or not, and other openings indicated.

1.02 REFERENCE STANDARDS

A. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials; 2016a.

B. ASTM E814 - Standard Test Method for Fire Tests of Penetration Firestop Systems; 2013a (Reapproved 2017).

C. ITS (DIR) - Directory of Listed Products; current edition.

D. FM 4991 - Approval Standard for Firestop Contractors; 2013.

E. FA (AG) - FM Approval Guide; Factory Mutual Research Corporation; current edition.

F. SCAQMD 1168 - Adhesive and Sealant Applications; 1989 (Amended 2017).

G. UL (FRD) - Fire Resistance Directory; Current Edition.

1.03 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on product characteristics.

C. Manufacturer's Installation Instructions: Indicate preparation and installation instructions.

D. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

1.04 QUALITY ASSURANCE

A. Fire Testing: Provide firestopping assemblies of designs that provide the scheduled fire ratings when tested in accordance with methods indicated.
   1. Listing in the current-year classification or certification books of UL, FM, or ITS (Warnock Hersey) will be considered as constituting an acceptable test report.
   2. Valid evaluation report published by ICC Evaluation Service, Inc. (ICC-ES) at www.icc-es.org will be considered as constituting an acceptable test report.
   3. Submission of actual test reports is required for assemblies for which none of the above substantiation exists.

B. Installer Qualifications: Company specializing in performing the work of this section and:
   1. Approved by Factory Mutual Research Corporation under FM 4991, or meeting any two of the following requirements:.

1.05 FIELD CONDITIONS

A. Comply with firestopping manufacturer's recommendations for temperature and conditions during and after installation. Maintain minimum temperature before, during, and for 3 days after installation of materials.

B. Provide ventilation in areas where solvent-cured materials are being installed.

PART 2 PRODUCTS

2.01 FIRESTOPPING - GENERAL REQUIREMENTS

A. Primers, Sleeves, Forms, Insulation, Packing, Stuffing, and Accessories: Type required for tested assembly design.

2.02 MATERIALS

A. Firestopping Sealants: Provide only products having lower volatile organic compound (VOC) content than required by South Coast Air Quality Management District Rule No.1168.

B. Elastomeric Silicone Firestopping: Single component silicone elastomeric compound and compatible silicone sealant; conforming to the following:

C. Fibered Compound Firestopping: Formulated compound mixed with incombustible non-asbestos fibers; conforming to the following:
   1. Durability and Longevity: Permanent.
   2. Color: Dark grey.
   3. Manufacturers:
      a. A/DFire Protection Systems Inc.: www.adfire.com.
      b. USG: www.usg.com.

D. Fiber Firestopping: Mineral fiber insulation used in conjunction with elastomeric surface sealer forming airtight bond to opening; conforming to the following:
   1. Durability and Longevity: Permanent.
   2. Manufacturers:
      a. A/DFire Protection Systems Inc.: www.adfire.com.
      b. Pecora Corporation: www.pecora.com.
      c. Thermafiber, Inc.: www.thermafiber.com.
   3. Durability and Longevity: Permanent; suitable for pedestrian traffic.
   4. Manufacturers:
      a. RectorSeal: www.rectorseal.com.
      b. 3M Fire Protection Products: www.3m.com/firestop.
      c. Hilti, Inc.: www.us.hilti.com.
      d. Specified Technologies, Inc.: www.stifirestop.com.

E. Intumescent Putty: Compound that expands on exposure to surface heat gain; conforming to the following:
   1. Potential Expansion: Minimum 1000 percent.
   2. Durability and Longevity: Permanent.
   3. Color: Black, dark gray, or red.
   4. Manufacturers:
      a. RectorSeal: www.rectorseal.com.
      b. 3M Fire Protection Products: www.3m.com/firestop.
      c. Hilti, Inc.: www.us.hilti.com.
      d. Specified Technologies, Inc.: www.stifirestop.com.

F. Reusable Firestopping: Removable intumescent compressible shapes, pillows, or blocks specifically tested in removable configuration; conforming to the following:
   1. Durability and Longevity: Permanent.
   2. Manufacturers:
      a. RectorSeal: www.rectorseal.com.
      b. Hilti, Inc.: www.us.hilti.com.
      c. Nelson FireStop Products: www.nelsonfirestop.com.
      d. Specified Technologies, Inc.: www.stifirestop.com.

G. Primers, Sleeves, Forms, Insulation, Packing, Stuffing, and Accessories: Type required for tested assembly design.

END OF SECTION

SECTION 07 9005
JOINT SEALERS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Sealants and joint backing.

1.02 REFERENCE STANDARDS

A. ASTM C834 - Standard Specification for Latex Sealants; 2014.

B. ASTM C920 - Standard Specification for Elastomeric Joint Sealants; 2014.

C. ASTM C1193 - Standard Guide for Use of Joint Sealants; 2013.

1.03 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data indicating sealant chemical characteristics.

1.04 FIELD CONDITIONS

A. Maintain temperature and humidity recommended by the sealant manufacturer during and after installation.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Silicone Sealants:
   1. Bostik Inc.: www.bostik-us.com.
   2. Momentive Performance Materials, Inc. (formerly GE Silicones): www.momentive.com.
   3. Pecora Corporation: www.pecora.com.
   4. BASF Construction Chemicals-Building Systems: www.buildingsystems.basf.com.
   5. Red Devil; 100% Silicone Industrial Grade RTV Sealant: www.reddevil.com.
   6. Sherwin-Williams Company; Silicone Rubber All Purpose Sealant: www.sherwin-williams.com.

B. Acrylic Emulsion Latex Sealants:
   1. Bostik Inc.; Product ChemChaulk 600Chem-Calk 600; Product ChemChaulk 600lk 600; Product ChemChaulk 600: www.bostik-us.com.
   2. DAP, Inc.
   3. Pecora Corporation; Product AC-20AC-20; Product AC-20: www.pecora.com.
   4. BASF Construction Chemicals-Building Systems: www.buildingsystems.basf.com.
   5. Sherwin-Williams Company; White Lightning 3006 Siliconized Acrylic Latex Caulk: www.sherwin-williams.com.

2.02 SEALANTS

A. General Purpose Interior Sealant: Acrylic emulsion latex; ASTM C834, Type OP, Grade NF single component, paintable.
   1. Color: Match adjacent finished surfaces.

B. Silicone Sealant: ASTM C920, Grade NS, Class 25 minimum; Uses NT, A, G, M, O; single component, neutral curing, non-sagging, non-staining, fungus resistant, non-bleeding.
   1. Color: Match adjacent finished surfaces.
   2. Movement Capability: Plus and minus 25 percent.
   3. Service Temperature Range: -65 to 180 degrees F (-54 to 82 degrees C).
   4. Shore A Hardness Range: 15 to 35.

2.03 ACCESSORIES

A. Primer: Non-staining type, recommended by sealant manufacturer to suit application.

B. Joint Backing: Round foam rod compatible with sealant; ASTM D 1667, closed cell PVC; oversized 30 to 50 percent larger than joint width.

C. Bond Breaker: Pressure sensitive tape recommended by sealant manufacturer to suit application.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that substrate surfaces are ready to receive work.

B. Verify that joint backing and release tapes are compatible with sealant.

3.02 PREPARATION

A. Remove loose materials and foreign matter that could impair adhesion of sealant.

B. Clean and prime joints in accordance with manufacturer's instructions.

C. Perform preparation in accordance with manufacturer's instructions and ASTM C1193.

D. Protect elements surrounding the work of this section from damage or disfigurement.

3.03 INSTALLATION

A. Perform work in accordance with sealant manufacturer's requirements for preparation of surfaces and material installation instructions.

B. Perform installation in accordance with ASTM C1193.

C. Install bond breaker where joint backing is not used.

D. Install sealant free of air pockets, foreign embedded matter, ridges, and sags.

E. Apply sealant within recommended application temperature ranges. Consult manufacturer when sealant cannot be applied within these temperature ranges.

F. Tool joints concave.

3.04 PROTECTION

A. Protect sealants until cured.

END OF SECTION

SECTION 09 9000

PAINTING AND COATING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Surface preparation.

B. Field application of paints and other coatings.

C. Scope: Finish all interior and exterior surfaces exposed to view, unless fully factory-finished
   1. New partitions.
   2. Existing walls where the wall was patched or the finish was damaged by construction.
   3. Both sides and edges of plywood backboards for HVAC equipment before installing equipment.
   4. Mechanical and Electrical, Refer to the General requirements in each Division.

D. Do Not Paint or Finish the Following Items:
   1. Items fully factory-finished unless specifically so indicated; materials and products having factory-applied primers are not considered factory finished.
   2. Items indicated to receive other finishes.
   3. Items indicated to remain unfinished.
   4. Fire rating labels, equipment serial number and capacity labels, and operating parts of equipment.

END OF SECTION

SECTION 23 0510

GENERAL MECHANICAL REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Definitions.
B. Quality Assurance Requirements and Installer Qualifications.
C. General Product Delivery and Storage.
D. Installer Warranty.
E. Submittal Procedures Supplementing Section 01 3000.
F. Operating and Maintenance Manuals.
G. Execution Requirements common to Division 23 systems.
H. HVAC Demolition.
I. Existing HVAC systems.
J. Existing HVAC Equipment.
K. Equipment backboards.
L. Starting equipment and Systems-General Requirements.
M. Training Requirements.
N. Cleaning Requirements.
O. Finishing Requirements.

1.02 RELATED SECTIONS

A. Section 01 3300 - Submittal Procedures, for submittal procedures.
B. Section 01 7000 - Execution Requirements, for additional submittal and warranty requirements.
C. Section 07 8413 - Penetration Firestopping.
D. Section 9200 - Joint Sealants.
E. Section 09900 - Painting and Coatings.

1.03 DEFINITIONS

A. Manufacturer's Representatives: Wherever MANUFACTURER'S REPRESENTATIVE is referred to in this division, said representative shall be regularly employed by the manufacturer to perform similar activities to those called for herein, which indicates his competence in that field of work.
B. Concealed: Where the word concealed is used in this Division, it shall mean items above ceilings, in attics, in crawl spaces, in chases, in tunnels, in cabinet work, and under counters or equipment so as to be not visible from an elevation of 5 feet at a horizontal distance of 10 feet.
C. Finished Spaces or Areas: Where finished spaces or areas are referred to in this Division, it shall mean all spaces except concealed spaces, mechanical rooms, or boiler rooms unless otherwise noted.
D. Provide: Furnish and install.
E. Control and Interlock Wiring: All wiring, both line voltage and low voltage, other than power wiring from an electrical distribution panel, through the primary control device, to the item of equipment.
F. Primary Control Device: That ONE device for any item of equipment which interrupts power flow during normal operation. Where magnetic starters are provided, they are the primary control. For items not switches by starters, the primary control device will be that ONE

thermostat, time clock, manual switch, aquastat, P.E. switch, or relay performing the primary switching.

G. Diagrammatic: A drawing that shows arrangement and relations (as of parts).i.e.: A diagrammatic drawing uses symbols rather than pictorial representation of pipes, ducts, conduit and other items shown and is not necessarily to scale. Arrangement, location, and sizes shown are firm.

H. Readily Accessible: Items requiring maintenance shall be available for close approach for maintenance or use in a space, through an access door from floor elevation, or above a lay-in ceiling though an access point by maintenance staff safely standing on a ladder no taller than the ceiling.

I. Noted, Indicated or Shown: Where the terms "Noted", "Indicated" or "Shown" are used in these specifications, the words "in the specifications or on the plans" shall be inferred.

J. Detail: Where reference is made to a Detail, the Detail shall be on the plans unless otherwise noted.

K. Specifications: Where reference is made to these specifications, it shall be inferred in this Division of specifications.

L. Notification by the Contractor, and Instructions to the Contractor: Where reference is made in these specifications to notification by or instructions given to the Contractor, it shall be inferred that Architect shall be the instructor or shall be notified, as the case exists.

M. Division or Section Reference: Where reference is made to another Division or Section within this Division, refer to specifications table of contents for Division, Section, or Page Number.

N. Flow Diagram: A single-line, two-dimension, non-scaled drawing depicting arrangement and sequence of equipment, valves, controls, thermometers, gauges, and other specialty devices in a pipe or duct system.

1.04 REGULATORY REQUIREMENTS

A. Where requirements of these specifications exceed specified codes and ordinances, conform to these specifications.

B. Materials and equipment included in Underwriters Label Service shall bear that label. Electrical equipment shall be U.L. approved as installed.

C. Permits and Codes: Refer to the General Conditions.

D. Fire Prevention Precautions in Cutting and Welding Areas: Conform to Article 2605 Fire Prevention Precautions, Georgia State Minimum Standard Fire Prevention Code (International Fire Code), 2012 Edition, with all Georgia State Amendments, for all work involving cutting and welding.

E. HVAC: Conform to the Georgia State Minimum Standard Mechanical Code, International Mechanical Code, 2012 Edition with all Georgia State Amendments.

F. Energy: Conform to the Georgia State Energy Code for Buildings, International Energy Conservation Code, 2009 Edition, with all Georgia State Amendments.

G. All Work: Conform to State of Georgia Chapter 120-3-3 "Rules of Safety Fire Commissioner, Rules and Regulations, January 30, 2014", and ADA.

H. Electrical: Refer to Division 26. Conform to the National Electrical Code, NFPA 70, 2014 Edition.

I. Building Code: Conform to the Georgia State Minimum Standard Building Code, International Building Code, 2012 Edition with all Georgia State Amendments.

1.05 SUBMITTALS

A. Supplementing Division 1 Administrative Requirements; Contractor shall:
   1. Identify all submittals by a cover sheet showing project name, specification section, drawing or detail number, room number, date, revision date, contractor and

subcontractor's organization and project manager with phone number, the model, style and size of item being submitted with manufacturers' representative, salesman (or a preparer who can answer questions), and Preparer's phone number.

2. Prepare a master list of submittal proposed to be submitted on the project. This list shall be updated for each submission and shall be the first sheet(s) of the submission in the quantity that is submitted for review. The information and general format of the master list shall contain a Specification Section, Section Title, Item Description, Item Status and any comment.
3. Review the submittal data and check to ensure compliance with specifications prior to submitting.
    a. The Contractor agrees that submittals of equipment and material and shop drawings of equipment and material layouts required under provisions of these specifications and processed by the Design Professional are not Change Orders. The purpose of submittals is to demonstrate that the Contractor understands the design concept of the project by indicating the equipment and materials he intends to furnish and install, and by detailing the installation he intends to achieve.
    b. The Contractor shall conform to the requirements of the Contract Documents unless a change order is issued. The Contractor shall identify on each submittal that the submittal contains no deviations or the Contractor shall identify any proposed deviations.
    c. Any submittal or shop drawing not conforming to the Contract Documents without this identification and notification shall be assumed to be marked "Revise and Resubmit" (the contractor acknowledges this by the submission), and the Contractor shall promptly resubmit said submittal so as to be in full compliance with the Contract Documents.
    d. Failure of the Contractor to provide this information during the shop drawing phase shall make the Contractor responsible for all changes to achieve compliance with the Contract Documents without additional compensation.
4. Provide a Letter from the HVAC Contractor stating that they have checked all submittals for compliance with specifications.
5. Product Data:
    a. Provide data specific to the product proposed indicating capacity data, all standard and optional features to be supplied and all accessories and options available for that product.
    b. Manufacturers' standard drawings shall be modified by deletions or additions to show only items applicable to this project.

B. Deliver submittals to Architect at the business address.

C. Digital Delivery of Submittals:
1. Submittal data may be posted to the NBP Engineers FTP site when agreed upon by Architect and Owner during the preconstruction phase. The Contractor will be provided with a project folder and a password.
2. Prepare the submittals as described above. Take steps to reduce submittal file size.
3. Do not scan in color or high resolution unless required for clarity.
4. Optimize any scans to help control file size.
5. Ensure any reproductions are legible.
6. Organize Submittal files individually by specification section with file name format as Follows; "*CSISection# - Section Title* - any further identifier required such as *control drawings*"
7. Send an email to submittal@nbpengineers.com with a copy to the HVAC Design Professional and any Architectural Design Professional identified during the preconstruction phase.
8. Identify the submittal using the official project title, specification section and submitted item. i.e. Project No. G-xxx, Addition to Administrative Building-Section 230548-Vibration

and Seismic Controls. Include drawing or detail number, room number, date, revision date(s), contractor and subcontractor's organization as applicable

9. Include the project manager's and manufacturers' representatives, salesman's (or a preparer who can answer questions) contact information, email and phone number.
10. Identify the submittal in the email subject line using the same information listed above.
11. Provide a submittal index.
12. Ensure any submittal posted to NBP's or other FTP site has the same identification.
13. NBP Design Professionals will not process or react to submittals which are not properly transmitted, indexed, and identified.

D. Tabulation of Power Wiring Requirements: Within 60 Days of the Notice to Proceed, provide a Tabulation of Power Wiring Requirements of all proposed equipment, including H.P., amps, voltage, phase and KW, tabulated on a separate sheet. A copy of the tabulation shall be transmitted independently to the Contractor, Architect and to all affected trades. (Refer to Electrical Drawings for electrical provisions for equipment.)

E. Warranty: Submit the HVAC installer's warranty letter addressed to Owner stating the correct project name and number, if applicable, the warranty period and ensure that form has the correct date of the Material Completion.

1.06 OPERATING AND MAINTENANCE MANUALS

A. Operating and Maintenance Manuals shall be prepared by Contractor for all equipment and be submitted for review a minimum of prior to the request for Material Completion.

B. Digital delivery of Operating and Maintenance Manuals:
1. Operating and Maintenance Manuals may be delivered digitally and posted to the NBP Engineers FTP site when agreed upon by the Design Professional and the Owner during the preconstruction phase. The Contractor will be provided with a project folder and password.
2. Prepare the Operating and Maintenance Manuals as described above. Take steps to reduce submittal file size.
3. Do not scan in color or high resolution unless required for clarity.
4. Ensure any reproductions are legible.
5. Send an email to submittal@nbpengineers.com with a copy to the HVAC Design Professional and the Architectural Design Professional identified during the preconstruction phase.
6. Identify the manuals in the email subject line using the official project title, specification section and submitted item. I.E. Project No. G-xxx, Addition to Administrative Building.
7. Table of Contents(Index) sheets shall be included in the order listed with identifications typed in capital letters.
8. Ensure the manuals posted to the FTP site has the same identification.
9. NBP Design Professionals will not process or react to manuals which are not properly transmitted, indexed, and identified.

C. Each Manual shall contain the following information, data and drawings:
1. Copies of submittals (with Design Professional's review comments and stamp), equipment and materials.
2. Manufacturer's installation, operating and maintenance instructions for each item of equipment with moving parts including recommended frequency of inspections and maintenance for one year of facility operation.
3. Manufacturer's list of renewal parts for each item of equipment with recommended stock items and quantities indicated.
4. Control diagrams, electrical interlock diagrams, and control valve lists.
5. Copies of as-built shop drawings showing layouts and construction details.
6. Copies of Test and Balance Reports including list of instruments and description of methods employed.

1.07 QUALITY ASSURANCE

A. HVAC Installer Qualifications:
   1. Wherever the word "company" or "firm" is used in these subparagraphs, it shall mean the contractor/subcontractor of record for the installations used for proficiency qualification.
   2. Refer to the individual sections within this division for additional installer qualification requirements.
   3. The Contractor expressly warrants that the company performing the installation of the air conditioning systems has demonstrated proficiency in the installation, start-up and adjustment of such systems by the successful performance of work of the nature specified herein on at least three commercial or institutional buildings, each containing minimum of 200 tons capacity or greater with ducted air distribution and chilled water, PTAC or wall hung units excluded.
   4. The Contractor further warrants that the aforesaid subcontractor, if any, has trained personnel, instruments, tools, and equipment to perform the installation, start-up, instruction and maintenance service specified.
   5. The Contractor also warrants that the aforesaid installer, if any, has been in business performing services of the nature specified herein for at least five years.

B. Testing and Balancing Qualifications: Refer to Section 23 0593.

1.08 WARRANTY

A. Refer to Section 01 7000 - Contract Closeout, for additional warranty requirements.

B. Submit manufacturers' warranties prior to final inspection. Refer to the General Conditions.

C. Correct any defective Work within a one year period after Date of Material Completion. Provide HVAC Installer's warranty letter dated the date of the Material Completion

D. Where warranties beyond Contractor's one (1) year warranty are specified, the additional warranty time shall start on the same date as Contractor's warranty.

PART 2 PRODUCTS-NOT USED

PART 3 EXECUTION

3.01 EXAMINATION

A. Refer to the specifications and Architectural and Structural drawings for additional requirements pertaining to work under this discipline. Notify Architect for clarification in the event of conflict.

B. All materials of systems installation exposed in hollow spaces that are used as ducts or plenums shall have a flame spread rating of 25 or less and a smoke development rating of 50 or less.

3.02 PREPARATION

A. Drawings are diagrammatic and show the general proximity of the equipment, ducts, and pipes, etc., are not to be scaled, and do not include all required changes in direction or offsets necessary in coordinating the installation of various materials either between trades or within the same trade. All dimensions shall be verified at the building site. Prefabrication and/or installation of work from drawings shall be at Contractor's risk. Refer to Architectural plans for exact building dimensions and details.

B. Space Conditions:
   1. All apparatus shall fit into the available spaces in the building and must be introduced into the building so as not to cause damage to the structure. Equipment larger than access to equipment spaces shall be disassembled into sub-assemblies for installation.
   2. Where deviations from the plans are required in order to conform to the space limitations, such changes shall be made at no additional cost to Owner and shall be subject to approval.
   3. All equipment requiring service shall be made accessible. Coordinate piping and ductwork installation to avoid conflict with other trades.

3.03 HVAC DEMOLITION

A. The HVAC demolition plans have been prepared to assist Contractor in determining the scope of demolition work and should not be construed to be all of the demolition required. Contractor shall visit job site (after carefully reviewing the contract documents) and determine exact areas and quantities of existing materials to be removed to accomplish new construction.

B. All existing material removed from the facility shall be the property of Contractor, unless otherwise noted, and shall be removed from the facility as required by the Contract provisions concerning trash removal.

C. All existing equipment removed from the facility shall be the property of Contractor, unless otherwise noted, and shall be removed from the facility as required by the Contract provisions concerning trash removal.

D. Material and equipment which has been removed shall not be used in the new work, except as noted.

E. Where the Documents indicate an equipment item to be removed. Remove all associated material including hangers, supports, wiring, controls conduit, etc. Do not leave abandoned items.

F. Dispose of any material to be discarded in accordance with all laws and regulations.

3.04 EXISTING HVAC SYSTEMS

A. The existing mechanical equipment and systems shall remain "as-is" except as otherwise indicated or specified. Perform all work necessary to properly tie in new work with existing conditions and to adapt existing conditions to conform to the changes in the building and systems.

B. Remove exposed and accessible piping, ductwork, and other materials rendered useless due to changes or modifications. Cap outlets in piping. Blank-off or patch openings in ductwork and duct insulation. Repair insulation damaged during construction.

C. Remove concealed piping which is exposed by the removal of walls, partitions, etc., and reconnect and re-route as required to maintain system continuity.

D. Sleeves left open by removal of piping shall be cut flush with the finished slab or wall, filled with non-shrinking cement grout and/or fire rated foam flush with both sides of slab or wall to maintain slab or wall fire rating and finished to match the space finishes.

E. Openings left by removal of ductwork shall be patched matching existing construction.

F. Where existing piping, duct and/or equipment is shown on the Drawings to be reused, its identity, size, flow direction and location shall be verified prior to performing any work. Notify Architect of any discrepancies.

3.05 EXISTING HVAC EQUIPMENT

A. This project makes extensive use of existing equipment.

B. The documents specify cleaning and other modifications to some of the existing equipment to be used in the modified system.

C. The documents specify the testing of this equipment recording the condition of the equipment.

D. The documents specify checking and documenting the control interlocks for the existing equipment and systems to be reused.

E. Include these activities in the overall construction schedule. Ensure that the schedule leaves time for any deficiencies to be identified and corrected before occupancy.

3.06 INSTALLATION

A. Clearance above and in front of electrical switchgear, electrical power panels or control panels shall be maintained by mechanical systems so that no mechanical ducts, pipes, vents or equipment is routed above or across the space directly above this equipment in conformance with the National Electrical Code.

B. All equipment shall be installed in accordance with manufacturers' published installation instructions shipped with the equipment. In the event there is a discrepancy between these specifications or Drawings and the manufacturers' instructions, no work shall be performed until additional instructions are received.

C. Install and connect all appliances, equipment, and appurtenances as specified, indicated or required in accordance with the manufacturer's instructions and recommendations. Furnish and install complete auxiliary piping, water seals, valves, electric connections, and similar items, recommended by the manufacturer or as required for proper operation.

D. Equipment, valves and other items installed under this division requiring service shall be installed to be readily accessible. Refer to definitions in this section.

E. Coordinate with Contractor and monitor the progress of the work so that other trades do not obstruct items requiring access for service.

F. After final balancing, equipment with belt drives shall have their belts operating in the mid-80% position of the adjustable sheave.

G. Provide equipment belt and coupling guards shielding the perimeter and face of all new belt drives, shafts and couplings. Provide openings opposite drive and driven shafts to permit use of revolution counter. Guards for fans shall be supported from the fan and mounting base, independent of the floor or housekeeping pad.

H. Route piping and ductwork to avoid skylights, translucent, and transparent ceilings.

I. Pipe Sleeves in Slabs, Masonry Walls and Partitions:
   1. Provide sleeves in all slabs and walls/partitions unless otherwise noted.
   2. Omit sleeves on cast iron pipe through slabs on grade.
   3. Elevated Slabs: Schedule 40 black steel pipe: Sleeves shall be sized to include the insulation with minimum gap around insulation. Install, without developing a break in the pipe insulation, according to the fire sealant manufacturer's installation instructions for a U.L. Listed assembly for a rated pipe penetration through a slab.
   4. Masonry Partitions: Schedule 40 black steel pipe: Sleeves shall be sized to include the insulation with minimum gap around insulation. Install, without developing a break in the pipe insulation, according to the fire sealant manufacturer's installation instructions for a U.L. Listed assembly for a rated pipe penetration through a rated masonry wall/partition.
   5. Omit sleeves in openings core drilled in masonry partitions.
   6. Rated Drywall Partitions: Twenty gage galvanized steel. Sleeves shall be sized to include the insulation with minimum gap around the insulation. Install, without developing a break in the pipe insulation, according to the fire sealant manufacturer's installation instructions for a U.L. Listed assembly for a rated pipe penetration through a rated drywall wall/partition.
   7. Non-Rated Drywall Partitions: Omit sleeves.

J. Pipe sleeves in footings and foundation walls:
   1. Schedule 40 black steel pipe.
   2. Chilled water, heating water, condenser water, refrigerant, or process piping passing under a footing or through a foundation wall shall be installed in a pipe sleeve, two pipe sizes larger than the pipe passing through.
   3. Sleeves in walls to spaces below grade shall be provided with 10 gauge leak plates.

K. Seal sleeves and openings in mechanical room walls, fire rated partitions, and floors above grade vaportight, watertight, or for smoke/fire protection as applicable. Refer to Section 07 8400

L. Seal sleeves and openings in exterior walls vaportight or watertight as applicable.

M. Concrete Work: Refer to section 23 0548 for concrete bases and other supports required for HVAC equipment and systems. Coordinate with the Contractor.

N. Equipment and pipe support upper attachments shall be 3" x 3" x 1/4" steel angles, minimum, spanning structural members unless noted otherwise. Provide inserts and bolts for supporting pipes and equipment from structural members.

O. Saw cut or core drill openings in existing work for the installation of the mechanical system. Patching shall be performed by the trade whose work is cut. Contractor shall lay out and install his work ahead of the work of other trades wherever possible.

3.07 SPACE CONDITIONING DURING CONSTRUCTION

A. Coordinate with Contractor regarding the limits of space conditions specified or requested by other trade sections.

B. Assist Contractor in the preparation of the construction schedule and determine to what extent the project's HVAC system can be operated within the restrictions listed below to help maintain those conditions.

C. Ducted air handling systems shall not be placed into operation for testing or for temporary space conditioning until all walls in areas served by the system have been prepared for painting and the building is broom clean.

D. The building's HVAC system shall be kept clean during the entire construction process. Protect equipment, motor, ducts, pipes from dirt and debris.

E. Filters during construction:
   1. Provide and maintain filters on all air handling equipment and terminal units used for space conditioning during construction.
   2. Provide and maintain filters on all return air grilles once ceilings are installed when air handling equipment or terminal units are used for space conditioning during construction.
   3. Provide filters with a minimum MERV rating of 8.

F. Heating Terminal units such as unit heaters, cabinet heaters and finned radiation may be used for temporary heat during construction. Clean to new condition.

3.08 EQUIPMENT BACKBOARDS

A. General: Provide wood backboards for installation of surface mounted control panels, enclosed motor controllers, variable frequency controllers, and where shown.

B. Type: 3/4-inch thick grade 1 fire retardant treated plywood supported by 3/4" x 3/4" x 1/8" aluminum angle frame attached to wall with 1/4-inch toggle bolts for hollow masonry, expansion shields for solid masonry.

C. Finish: Frame and board with two coats light gray enamel paint.

3.09 STARTING EQUIPMENT AND SYSTEMS

A. Adjust equipment for proper operation within manufacturers' published tolerances.

B. Demonstrate proper operation of systems and equipment to Owner 's designated representative.

3.10 DEMONSTRATION, TRAINING AND INSTRUCTIONS

A. A manufacturer's service representative shall provide the instructions for each piece of equipment on system when specified in other Sections of this Division. A manufacturer's sales representative is not acceptable. (The instructor shall not be a sales person, but shall have service experience on a continuing basis and be knowledgeable about the subject equipment.)

3.11 FINISHING EQUIPMENT AND MATERIAL

A. Use paint systems specified in Division 9 for the substrates to be finished.

B. Paint shop-primed equipment.

C. Remove unfinished louvers, grilles, covers, and access panels on mechanical and electrical components and paint separately.

D. Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing.

E. All ferrous fasteners and hanger supports not having a corrosion resistant plated finish shall be painted to prevent rust.

F. Paint all exposed un-insulated ferrous metals, flat black.

G. Paint miscellaneous ferrous metals such as nipples and fittings on chilled water piping at drains, vents and instrument tappings before insulation.

END OF SECTION

SECTION 23 0513
MOTORS FOR HVAC EQUIPMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Single phase electric motors.

B. Three phase electric motors.

1.02 RELATED REQUIREMENTS

A. Section 26 0583 - Wiring Connections: Electrical characteristics and wiring connections.

1.03 REFERENCE STANDARDS

A. ABMA STD 9 - Load Ratings and Fatigue Life for Ball Bearings; 2015.

B. IEEE 112 - IEEE Standard Test Procedure for Polyphase Induction Motors and Generators; 2004.

C. NEMA MG 1 - Motors and Generators; 2014.

D. NFPA 70 - National Electrical Code, 2014 Edition; National Fire Protection Association.

1.04 QUALITY ASSURANCE

A. Conform to NFPA 70.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Protect motors stored on site from weather and moisture by maintaining factory covers and suitable weather-proof covering. For extended outdoor storage, remove motors from equipment and store separately.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Baldor,Century,Lincoln,Marathon,Magnetec,Toshiba

2.02 GENERAL CONSTRUCTION AND REQUIREMENTS

A. Electrical Service:
   1. Motors 1/2 HP and Smaller: 115 volts, single phase, 60 Hz.
   2. Motors 1/2 HP and larger: three phase 60 Hz.
      a. 460 volt motors on 480 volt systems.
   3. Refer to Electrical drawings for voltage and phase required.

B. Overload Protection: Single phase motors shall be furnished with built-in automatic reset overload protection.

C. Efficiency: Motors 1 HP and larger shall be premium efficiency motors and have minimum full load efficiencies not less than listed in the Energy Code.

D. Brake Horsepower: All motors shall have rated horsepower at least 10 percent above the indicated brake horsepower of equipment including belt losses and inlet vane losses.

E. Construction:
   1. Open drip-proof type except where specifically noted otherwise.
   2. Design for continuous operation in 40 degrees C environment.
   3. Design for temperature rise in accordance with NEMA MG 1 limits for insulation class, service factor, and motor enclosure type.
   4. All copper windings and leads.
   5. Motors for belt driven equipment and base mounted pumps shall have cast iron yoke and bearing housings.

F. Visible Nameplate: Indicating motor horsepower, voltage, phase, cycles, RPM, full load amps, locked rotor amps, frame size, manufacturer's name and model number, service factor, power factor, efficiency.

G. Motors serviced by Variable Frequency Controllers:
   1. Motors shall be Definite Purpose Inverter-Fed Motors complying with NEMA MG1-Part 31. Stator laminations shall be vacuum-pressure impregnated with varnish for reduction of audible motor noise.
   2. Motors shall be equipped with factory installed grounding rings to electrically ground the motor shaft to prevent eddy current damage to bearings, AEGIS-SCR.

H. Wiring Terminations:
   1. Provide terminal lugs to match branch circuit conductor quantities, sizes, and materials indicated. Enclose terminal lugs in terminal box sized to NFPA 70, threaded for conduit.
   2. For fractional horsepower motors where connection is made directly, provide threaded conduit connection in end frame.

2.03 APPLICATIONS

A. Exception: Motors less than 250 watts, for intermittent service may be the equipment manufacturer's standard and need not conform to these specifications.

B. Single phase motors for shaft mounted fans or blowers: Permanent split capacitor type.

C. Single phase motors for fans and pumps: Capacitor start, capacitor run type.

2.04 SINGLE PHASE POWER - PERMANENT-SPLIT CAPACITOR MOTORS

A. Starting Torque: Exceeding one fourth of full load torque.

B. Starting Current: Up to six times full load current.

C. Multiple Speed: Through tapped windings.

D. Open Drip-proof or Enclosed Air Over Enclosure: Class A (50 degrees C temperature rise) insulation, minimum 1.0 Service Factor, prelubricated sleeve or ball bearings, automatic reset overload protector.

2.05 SINGLE PHASE POWER - CAPACITOR START MOTORS

A. Starting Torque: Three times full load torque.

B. Starting Current: Less than five times full load current.

C. Pull-up Torque: Up to 350 percent of full load torque.

D. Breakdown Torque: Approximately 250 percent of full load torque.

E. Motors: Capacitor in series with starting winding; provide capacitor-start/capacitor-run motors with two capacitors in parallel with run capacitor remaining in circuit at operating speeds.

F. Drip-proof Enclosure: Class A (50 degrees C temperature rise) insulation, NEMA Service Factor, prelubricated sleeve bearings.

G. Enclosed Motors: Class A (50 degrees C temperature rise) insulation, 1.0 Service Factor, prelubricated ball bearings.

2.06 THREE PHASE POWER - SQUIRREL CAGE MOTORS

A. Starting Torque: Between 1 and 1-1/2 times full load torque.

B. Starting Current: Six times full load current.

C. Power Output, Locked Rotor Torque, Breakdown or Pull Out Torque: NEMA Design B characteristics.

D. Design, Construction, Testing, and Performance: Conform to NEMA MG 1 for Design B motors.

E. Insulation System: NEMA Class B or better.

F. Testing Procedure: In accordance with IEEE 112. Load test motors to determine free from electrical or mechanical defects in compliance with performance data.

G. Motor Frames: NEMA Standard T-Frames of steel, aluminum, or cast iron with end brackets of cast iron or aluminum with steel inserts.

H. Bearings: Grease lubricated anti-friction ball bearings with housings equipped with plugged provision for relubrication, rated for minimum ABMA STD 9, L-10 life of 20,000 hours. Calculate bearing load with NEMA minimum V-belt pulley with belt center line at end of NEMA standard shaft extension. Stamp bearing sizes on nameplate.

I. Sound Power Levels: To NEMA MG 1.

J. Nominal Efficiency: As scheduled at full load and rated voltage when tested in accordance with IEEE 112.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install securely on firm foundation. Mount ball bearing motors with shaft in any position.

C. Check line voltage and phase and ensure agreement with nameplate.

END OF SECTION

SECTION 23 0514
VARIABLE FREQUENCY CONTROLLERS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Variable frequency controllers

1.02 RELATED SECTIONS

A. Section 23 0513 - Motors for HVAC Equipment.

B. Section 23 0553 - Identification HVAC Piping and Equipment.

C. Section 23 0994 - HVAC Sequence of Operation.

D. Section 26 2717 - Equipment Wiring: Electrical characteristics and wiring connections.

1.03 REFERENCES

A. NEMA ICS 7.1 - Safety Standards for Construction and Guide for Selection, Installation and Operation of Adjustable-Speed Drive Systems; 2006.

B. NEMA ICS 7 - Industrial Control and Systems: Adjustable Speed Drives; National Electrical Manufacturers Association, 2006.

C. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum), National Electrical Manufacturers Association, 2008.

D. IEEE 519 - IEEE Recommended Practices and Requirements for Harmonic Control in Electric Power Systems; Institute of Electrical and Electronic Engineers; 1992 (R2004).

E. NFPA 70 - National Electrical Code 2011 Edition.

1.04 SUBMITTALS

A. Refer to Section 23 0510 - General HVAC Requirements, for submittal procedures.

B. Product Data: Provide catalog sheets showing voltage, controller size, ratings and size of switching and overcurrent protective devices, short circuit ratings, dimensions, and enclosure details.

C. Provide programming manual for drive. Manual shall be tabbed for items indicated in item H above.

D. Shop Drawings: Indicate front and side views of enclosures with overall dimensions and weights shown; conduit entrance locations and requirements; and nameplate legends.

E. Rating: Submittal shall specifically indicate that drive size submitted is rated for horsepower being served with drive at 40 degrees C (104 degrees F) and minimum of 4,000 hz switching frequency. Drives rated at lower frequencies are not acceptable.

F. Test Reports: Indicate field test and inspection procedures and test results.

G. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

H. Manufacturer's Field Reports: Indicate start-up inspection findings.

I. Operation Data: NEMA ICS 7.1. Include instructions for starting and operating controllers, and describe operating limits that may result in hazardous or unsafe conditions.

J. Maintenance Data: NEMA ICS 7.1. Include routine preventive maintenance schedule.

K. Warranty: Submit manufacturer's warranty and ensure forms have been filled out in Owner's name and registered with manufacturer.

L. Certificate: Provide Manufacturer's Certificate complying with the requirements of the General Conditions.

1.05 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

B. Products: Listed and classified by Underwriters Laboratories, Inc. as suitable for the purpose specified and indicated.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.

B. Handle in accordance with manufacturer's written instructions. Lift only with lugs provided for the purpose. Handle carefully to avoid damage to components, enclosure, and finish.

1.07 WARRANTY

A. Provide a three year warranty to include materials only.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. ABB ACH550, AC Technology QC3000, Allen Bradley 1352, Eaton IS-5000+, Emerson H300, Graham VLT6000, Hitachi J300, Yaskawa E7, Omron VT5 Series, Schneider Electric/SquareD, Toshiba E3 Series, Johnson Controls, Inc., Danfoss VLT HVAC.

2.02 DESCRIPTION

A. Variable Frequency Controllers: Enclosed controllers suitable for operating the indicated loads, in conformance with requirements of NEMA ICS 7. Select unspecified features and options in accordance with NEMA ICS 3.1.
   1. Employ microprocessor-based inverter logic isolated from power circuits.
   2. Employ pulse-width-modulated inverter system providing a carrier frequency adjustable from 4,000Hz to 8,000Hz.
   3. Design for ability to operate controller with motor disconnected from output.
   4. Design to attempt five automatic restarts following fault condition before locking out and requiring manual restart.

B. Enclosures: NEMA 250, Type 1, suitable for equipment application in places restricted to persons employed on the premises.

C. Attic Enclosure: NEMA 250, Type 3R, suitable for equipment application in places restricted to persons employed on the premises. Provide insulated enclosure with vent fan and inlet for ducted connection and view panel.

D. Finish: Manufacturer's standard enamel.

2.03 OPERATING REQUIREMENTS

A. Rated Input Voltage: 208 volts, three phase, 60 Hertz.

B. Motor Nameplate Voltage: 200 volts, three phase, 60 Hertz.

C. Displacement Power Factor: Between 1.0 and 0.95, lagging, over entire range of operating speed and load.

D. Operating Ambient: 0 degrees C to 40 degrees C.

E. Minimum Efficiency at Full Load: 95 percent.

F. Volts Per Hertz Adjustment: Plus or minus 10 percent.

G. Current Limit Adjustment: 60 to 110 percent of rated.

H. Acceleration Rate Adjustment:.5 to 360 seconds.

I. Deceleration Rate Adjustment: 1 to 360 seconds.

J. Input Signal: 4 to 20 mA DC.

2.04 COMPONENTS

A. Display: Provide integral digital display to indicate output voltage, output frequency, and output current.

B. Status Indicators: Separate indicators for overcurrent, overvoltage, ground fault, overtemperature, and input power ON.

C. Furnish HAND-OFF-AUTOMATIC selector switch and manual speed control. Omit on fans with automatic isolation dampers.

D. Include undervoltage release.

E. Control Power Source: Integral control transformer.

F. Door Interlocks: Furnish mechanical means to prevent opening of equipment with power connected, or to disconnect power if door is opened; include means for defeating interlock by qualified persons.

G. Safety Interlocks: Furnish terminals for remote contact to inhibit starting under both manual and automatic mode.

H. Control Interlocks:
   1. Furnish terminals for remote contact to allow starting in automatic mode.
   2. Furnish BACNET communication device(s) to interface VFD with the BAS.
   3. Provide auxiliary outputs to comply with the sequence of operation specified in Section 23 0994. Furnish programmable analog outputs(two minimum) and programmable digital outputs(three minimum).

I. Manual Bypass: Bypass shall be integral to the variable speed drive and manufactured by same firm that manufactures drive. Furnish contactor, motor running overload protection, and short circuit protection for full voltage, non-reversing operation of the motor. By-pass shall be two contactor type (does not allow maintenance on inverter while motor is operating).

J. Emergency Stop: Use dynamic brakes for emergency stop function.

K. Jogging: On drives serving motors of supply, return, or exhaust fans ducted into one single header duct, provide capability to bring motor up to preset, adjustable, low speed, prior to fan isolation damper opening, signal fan isolation damper to open, then continue to ramp motor up to controlled speed.

L. Disconnecting Means: Include integral circuit breaker on the line side of each controller.

M. Wiring Terminations: Match conductor materials and sizes indicated.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that surface is suitable for controller installation.

B. Do not install controller until building environment can be maintained within the service conditions required by the manufacturer.

3.02 INSTALLATION

A. Install in accordance with NEMA ICS 7.1 and manufacturer's instructions.

B. Tighten accessible connections and mechanical fasteners after placing controller.

C. Select and install overload heater elements in motor controllers to match installed motor characteristics.

D. Provide engraved plastic nameplates; refer to Section 23 0553 - Mechanical Identification, for product requirements and location.

E. Neatly type label inside each motor controller door identifying motor served, nameplate horsepower, full load amperes, code letter, service factor, and voltage/phase rating. Place in clear plastic holder.

3.03 MANUFACTURER'S FIELD SERVICES

A. Provide services of factory trained representative for minimum of one day(s) to prepare and start the controllers, calibrate the controls and inspect the installation.

B. Provide services of factory trained representative for minimum of one day(s) to instruct Owner on operation and maintenance.

C. Controller manufacturer shall provide no less than 4 hours of on-site technical assistance to the controls contractor to assure a working hand-off of the BACnet points list. Coordinate with start-up services.

D. Provide start-up certificate in the format prescribed by the General Conditions.

3.04 ADJUSTING

A. Make final adjustments to installed controller to assure proper operation of load system. Obtain performance requirements from installer of driven loads.

3.05 DEMONSTRATION

A. Demonstrate operation of controllers in automatic and manual modes.

END OF SECTION

SECTION 23 0516

EXPANSION FITTINGS AND LOOPS FOR HVAC PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Flexible pipe connectors.

1.02 RELATED REQUIREMENTS

1.03 SUBMITTALS

A. Refer to Section 23 0510 - General HVAC Requirements, for submittal procedures.

B. Product Data:
   1. Flexible Pipe Connectors: Indicate maximum temperature and pressure rating, face-to-face length, live length, hose wall thickness, hose convolutions per foot and per assembly, fundamental frequency of assembly, braid structure, and total number of wires in braid.

PART 2 PRODUCTS

2.01 FLEXIBLE PIPE CONNECTORS - STEEL PIPING

A. Manufacturer: Southeast Hose Model SEC.

B. Other acceptable manufacturers offering equivalent products.
   1. BOA Model B3-1.
   2. Flexible Metal Hose Co. Model DFC.
   3. Model PCS.
   4. Reflex Model KFCS.
   5. Metraflex Model ML.
   6. Twin City Model TCHS.
   7. Whatley Model SS.

C. Inner Hose: Stainless Steel.

D. Exterior Sleeve: Single braided, stainless steel.

E. Pressure Rating: 125 psi and 450 degrees F.

F. Joint: Flanged.

G. Size: Use pipe sized units.

H. Length:
   1. Up To and Including 8 Inches: Not less than three pipe diameters.

I. Maximum offset: 3/4 inch on each side of installed center line.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.

END OF SECTION

SECTION 23 0519
METERS AND GAGES FOR HVAC PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Pressure gages and pressure gage taps.

B. Test Plugs.

1.02 RELATED REQUIREMENTS

A. Section 23 2113 - HYDRONIC PIPING.

1.03 REFERENCE STANDARDS

A. ASME B40.100 - Pressure Gauges and Gauge Attachments; 2013.

B. UL 393 - Indicating Pressure Gauges for Fire-Protection Service; Current Edition, Including All Revisions.

1.04 SUBMITTALS

A. Refer to Section 23 0510 - General HVAC Requirements, for submittal procedures.

B. Product Data: Provide list that indicates use, operating range, total range and location for manufactured components.

1.05 FIELD CONDITIONS

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

PART 2 PRODUCTS

2.01 PRESSURE GAGES

A. Manufacturers:
   1. Trerice Model 500X.
   2. Other acceptable manufacturers offering equivalent products: Duro 102, Marsh 103, Palmer 40SPDLH, Weksler BM1, Weiss *AG-1.

B. Pressure Gages: ASME B40.100, UL 393 drawn steel case, phosphor bronze bourdon tube, rotary brass movement, brass socket, with front recalibration adjustment, black scale on white background.
   1. Case: Cast aluminum with phosphor bronze bourdon tube, Stem(flangeless) mounting.
   2. Size: 4-1/2 inch diameter.
   3. Mid-Scale Accuracy: One percent.
   4. Hydronic Water Scale: Feet-H2O in 2 ft. graduations. Scale range shall be so pump suction pressure is above lower 10% and pump discharge is below upper 10% of scale range.

2.02 PRESSURE GAGE TAPPINGS

A. Ball Valve: 1/4 inch, 400 psig WOG, Bronze two piece body, standard port, chrome plated brass ball, reinforced teflon seats and stuffing box ring, blow-out proof stem design, adjustable packing gland, zinc coated steel lever handle with vinyl hand grip, threaded ends.

B. Pulsation Damper: Pressure snubber, brass with 1/4 inch connections, as manufactured by Trerice, Model 872,Duro, Marsh, Weksler, Weiss.

2.03 TEST PLUGS

A. Manufacturers:
   1. FDI Model Super Seal.
   2. Other acceptable manufacturers offering equivalent products: MG Piping Products Co., Peterson Equipment Co. "Pete's Plug II, Sisco, Trerice, Texas Fairfax, Universal Lancaster.

B. Test Plug: 1/4 inch or 1/2 inch brass fitting and cap for receiving 1/8 inch outside diameter pressure or temperature probe with neoprene core for temperatures up to 200 degrees F. Provide extra-long shaft when mounted on insulated pipe.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Provide one pressure gage per base mounted pump, installing taps before strainer (Suction Diffuser) and on suction and discharge of pump. Pipe to gage.

C. Install pressure gages on hydronic systems with pulsation dampers. Provide ball valve to isolate each gage connection to system. Extend nipples to allow clearance from insulation.

D. Install pressure tappings on piping where specified or shown on flow diagrams and details. Provide valve to isolate each tapping connection to system. Extend nipples to clear insulation.

E. Provide instruments with scale ranges selected according to service with largest appropriate scale.

F. Install gages and thermometers in locations where they are easily read from normal operating level. Install vertical to 45 degrees off vertical.

G. Adjust gages and thermometers to final angle, clean windows and lenses, and calibrate to zero.

H. Locate test plugs adjacent to thermometers, temperature wells, pressure gages, coil connections, and where shown on flow diagrams and details. Install in 1/2 inch pipe opening(minimum), with bushing.

I. Install test plugs vertical to horizontal. Do not install pointing down.

END OF SECTION

SECTION 23 0553

IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Nameplates.

B. Pipe markers.

1.02 REFERENCE STANDARDS

A. ASME A13.1 - Scheme for the Identification of Piping Systems; 2015.

PART 2 PRODUCTS

2.01 NAMEPLATES

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

B. Size:1/2 inch high letters unless otherwise noted.

C. Size when located on ceiling grid: 3/8 inch high letters unless otherwise noted.

2.02 PIPE MARKERS

A. Manufacturers: Brimar, Kolbi Industries Style A thru E(5 inch and smaller) else Style F thru H, Marking Services Inc., Seton Identification Products - Setmark.

B. Color: Conform to ASME A13.1.

C. Pipe Markers for Indoor Use: Seton Setmark; media indicator with direction-of-flow arrows on calendared vinyl sheet; snap-around type for pipe sizes to 5-7/8 inches diameter, strap around type with nylon ties for pipe sizes 6 inches diameter and larger.

PART 3 EXECUTION

3.01 PREPARATION

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

3.02 INSTALLATION

A. Identify pumps with plastic nameplates.

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

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

D. Install Pipe Markers on all piping systems at the following Locations:
   1. Mechanical Equipment Rooms:
      a. Within 18 inches of each valve.
      b. Within 36 inches of each 90 elbow, tee, connection to equipment or vessel and point where pipe exits room.
      c. At not over 20 feet intervals along all exposed piping.
   2. Above Suspended Ceilings:
      a. Within 18 inches of each valve or valve assembly.
      b. At tees, identify both main and branch within 36 inches of tee.
      c. Within 36 inches of each 90 elbow.
      d. At not over 30 feet intervals along all concealed piping.
   3. Concealed Piping in Chases or Shafts: Identify each pipe visible through access door panel.
   4. Piping Exposed in Rooms Other Than Mechanical Equipment Areas:
      a. Omit identification on piping, 1 inch exterior diameter or smaller(insulated or uninsulated) or exposed at connections to equipment or plumbing fixtures.

b. With the above exception, identify at not less than one point each piping run visible in each room, with identification on not over 20 feet intervals.

END OF SECTION

SECTION 23 0593

TESTING, ADJUSTING AND BALANCING FOR HVAC

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Initial testing, adjustment, and balancing of hydronic systems.

B. Measurement of final operating condition of HVAC systems.

C. Testing of control sensors, controllers and safeties.

1.02 RELATED REQUIREMENTS

A. Section 01 4000 - Quality Requirements: Employment of testing agency and payment for services.

B. Section 23 0800 - Commissioning of HVAC.

C. Section 23 3300 - Air Duct Accessories.

1.03 REFERENCE STANDARDS

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

B. AABC MN-1 - AABC National Standards for Total System Balance; Associated Air Balance Council; 2002.

C. NEBB (TAB) - Procedural Standards for Testing Adjusting and Balancing of Environmental Systems; 2015, with Errata (2017).

1.04 SUBMITTALS

A. Refer to Section 23 0510 - General HVAC Requirements for submittal procedures.

B. Submit name of adjusting and balancing agency for approval within 30 days after Notice to Proceed.

C. Initial Review: Submit results of testing and balancing agency's examination of documents and systems within 30 days after Notice to Proceed.

D. Initial Report: Indicate deficiencies in systems that would prevent proper testing, adjusting, and balancing of systems and equipment to achieve specified performance.
   1. Submit under provisions of Section 01 4000.
   2. Submit prior to Contractor's Request for Material Completion.
   3. Submit copies of report for review prior to final acceptance of Project. Provide final copies for Architect and for inclusion in operating and maintenance manuals.
   4. Include actual instrument list, with manufacturer name, serial number, and date of calibration.
   5. Form of Test Reports: Where the TAB standard being followed recommends a report format use that; otherwise, follow ASHRAE Std 111.
   6. Units of Measure: Report data in both I-P (inch-pound) and SI (metric) units.
   7. Test Reports: Indicate data on AABC MN-1 forms, forms prepared following ASHRAE Std 111, or NEBB forms.
   8. Include the following on the title page of each report:
      a. Name of Testing, Adjusting, and Balancing Agency.
      b. Address of Testing, Adjusting, and Balancing Agency.
      c. Telephone number of Testing, Adjusting, and Balancing Agency.
      d. Project name.
      e. Project location.
      f. Project Architect.
      g. Project Engineer.
      h. Project Contractor.
      i. Report date.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 GENERAL REQUIREMENTS

A. Perform total system balance in accordance with one of the following:
   1. AABC (NSTSB), AABC National Standards for Total System Balance.
   2. NEBB Procedural Standards for Testing Adjusting Balancing of Environmental Systems.

B. Begin work after completion of systems to be tested, adjusted, or balanced and complete work and submit Report prior to the Final Observation of the project.

C. TAB Agency Qualifications:
   1. Company specializing in the testing, adjusting, and balancing of systems specified in this section.
   2. Certified by one of the following:
      a. AABC, Associated Air Balance Council: www.aabc.com/#sle; upon completion submit AABC National Performance Guaranty.
      b. NEBB, National Environmental Balancing Bureau: www.nebb.org/#sle.
   3. Company shall an independent firm with no relationship with any Contractor on this Project.

D. TAB Supervisor and Technician Qualifications: Certified by same organization as TAB agency.

E. Pre-Qualified TAB Agencies: Testing and Balancing shall be performed by one of the following firms:
   1. Air Analysis of Atlanta.
   2. Air Data - Macon, Inc.
   3. Alpha Air Balance.
   4. HVAC Testing Services, Inc.
   5. TAB Services.
   6. Thomas Balancing.

3.02 EXAMINATION

A. Review the contract documents and existing conditions for appurtenances and arrangement for balancing prior to the installation of any equipment or material. the Contractor shall notify Architect of any omissions noted within 30 days of the Contractor's notice to proceed.

B. Verify that systems are complete and operable before commencing work. Ensure the following conditions:
   1. Systems are started and operating in a safe and normal condition.
   2. Temperature control systems are installed complete and operable.
   3. Proper thermal overload protection is in place for electrical equipment.
   4. All filters are clean and in place. If required, install temporary media in addition to filters.
   5. Duct systems are clean of debris.
   6. Fans are rotating correctly.
   7. Fire and volume dampers are in place, accessible, operable and open. Report observation on test report.
   8. Smoke dampers are in place, damper and operator are accessible, damper is operable, and open. Report observation on test report.
   9. All dampers and operators function smoothly from shut-off to full open.
   10. Air coil fins are cleaned and combed.
   11. Access doors are installed at specified components are accessible, are closed and duct end caps are in place.
   12. Air outlets are installed and connected.
   13. Duct system leakage is minimized.
   14. Hydronic systems are flushed, filled, and vented.
   15. Pumps are rotating correctly.

16. Proper strainer baskets are clean and in place.
17. Service and balance valves are open.

3.03 PREPARATION

A. Provide instruments required for testing, adjusting, and balancing operations. Make instruments available to Architect to facilitate spot checks during testing.

B. Testing of equipment shall be simultaneous where components of a systems are connected; e.g. DX coil and condensing unit.

3.04 ADJUSTMENT TOLERANCES

A. Hydronic Systems: Adjust to within plus or minus 10 percent of design.

3.05 RECORDING AND ADJUSTING

A. Ensure recorded data represents actual measured or observed conditions.

B. Permanently mark settings of valves, dampers, and other adjustment devices allowing settings to be restored. Set and lock memory stops.

C. After adjustment, take measurements to verify balance has not been disrupted or that such disruption has been rectified.

D. Leave systems in proper working order, replacing belt guards, closing access doors, closing doors to electrical switch boxes, and restoring thermostats to specified settings.

3.06 WATER SYSTEM PROCEDURE

A. Adjust water systems to provide required or design quantities.

B. Use calibrated Venturi tubes, orifices, or other metered fittings and pressure gages to determine flow rates for system balance. Where flow metering devices are not installed, base flow balance on temperature difference across various heat transfer elements in the system.

C. Adjust systems to provide specified pressure drops and flows through heat transfer elements prior to thermal testing. Perform balancing by measurement of temperature differential in conjunction with air balancing.

D. Effect system balance with automatic control valves fully open to heat transfer elements.

E. Effect adjustment of water distribution systems by means of balancing cocks, valves, and fittings. Do not use service or shut-off valves for balancing unless indexed for balance point.

F. Where available pump capacity is less than total flow requirements or individual system parts, full flow in one part may be simulated by temporary restriction of flow to other parts.

3.07 CONTROL SYSTEM PROCEDURE

A. Sequence of Operation: Operate systems thru specified Sequence and confirm system function.

B. Thermostats, Input/Output sensors and Controls: Measure temperature or flow at device and record measurement and setting of controller.

3.08 SCOPE

A. Test, adjust, and balance the following:
   1. HVAC Pumps.
   2. Existing Air Cooled Water Chillers.

3.09 MINIMUM DATA TO BE REPORTED

A. Electric Motors:
   1. Manufacturer.
   2. Model/Frame.
   3. HP/BHP.
   4. Phase, voltage, amperage; nameplate, actual, no load.
   5. RPM.

6. Service factor.
7. Starter size, rating, heater elements.
8. Sheave Make/Size/Bore.

B. Pumps:
1. Identification/number.
2. Manufacturer.
3. Size/model.
4. Impeller.
5. Service.
6. Design flow rate, pressure drop, BHP.
7. Actual flow rate, pressure drop, BHP.
8. Discharge pressure.
9. Suction pressure.
10. Total operating head pressure.
11. Shut off, discharge and suction pressures.
12. Shut off, total head pressure.
13. Plot actual operating point on pump curve chart.

C. Existing Chillers:
1. Identification/number.
2. Manufacturer.
3. Capacity.
4. Model number.
5. Serial number.
6. Evaporator entering water temperature, design and actual.
7. Evaporator leaving water temperature, design and actual.
8. Evaporator pressure drop, design and actual.
9. Evaporator water flow rate, design and actual.

END OF SECTION

SECTION 23 0716
HVAC EQUIPMENT INSULATION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Equipment insulation.

1.02 REFERENCE STANDARDS

A. ASTM C534/C534M - Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form; 2016.

B. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2015a.

1.03 SUBMITTALS

A. See Section 23 0510 - General HVAC Requirements for submittal procedures.

B. Product Data: Provide product description, thermal characteristics, list of materials and thickness for equipment scheduled.

C. Manufacturer's Instructions: Indicate installation procedures that ensure acceptable workmanship and installation standards will be achieved.

1.04 QUALITY ASSURANCE

A. Applicator Qualifications: Company specializing in performing the type of work specified in this section with minimum three years of experience.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Accept materials on site in original factory packaging, labeled with manufacturer's identification, including product density and thickness.

B. Protect insulation from weather and construction traffic, dirt, water, chemical, and mechanical damage, by storing in original wrapping.

1.06 FIELD CONDITIONS

A. Maintain ambient temperatures and conditions required by manufacturers of adhesives, mastics, and insulation cements.

B. Maintain temperature during and after installation for minimum period of 24 hours.

PART 2 PRODUCTS

2.01 REGULATORY REQUIREMENTS

A. Surface Burning Characteristics: Flame spread/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E 84, NFPA 255, or UL 723.

2.02 FLEXIBLE ELASTOMERIC CELLULAR INSULATION

A. Manufacturer:
   1. Armacell International; Model AP: www.armacell.com.
   2. Aerocel; Sheet.
   3. K-Flex USA; Insul-Sheet.

B. Insulation: Preformed flexible closed-cell elastomeric rubber insulation complying with ASTM C 534 Grade 1, in sheet form.
   1. 'K' ('Ksi') value: 0.25 at 75 degrees F (0.04 at 24 degrees C).
   2. Maximum Moisture Absorption: < 1.0 percent by volume, when tested in accordance with ASTM C 209.
   3. Water Vapor Permeability: 0.05 perm-inches, when tested in accordance with ASTM E 96.
   4. Minimum Service Temperature: -40 degrees F.
   5. Maximum Service Temperature: 180 degrees F.

6. Connection: Waterproof vapor barrier adhesive.

C. Elastomeric Foam Adhesive: Air dried, contact adhesive, compatible with insulation.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that equipment has been tested before applying insulation materials.

B. Verify that surfaces are clean and dry, with foreign material removed.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Factory Insulated Equipment: Do not insulate.

C. Exposed Equipment: Locate insulation and cover seams in least visible locations.

D. Apply insulation close to equipment by grooving, scoring, and beveling insulation. Fasten insulation to equipment with studs, pins, clips, adhesive, wires, or bands.

E. Fill joints, cracks, seams, and depressions with bedding compound to form smooth surface. On cold equipment, use vapor barrier cement.

F. Flexible Elastomeric Cellular Insulation: Secure sheet insulation with adhesive. Seal Joints with adhesive. Paint exposed insulation with two coats of vinyl insulation paint after adhesive has dried for twelve hours, minimum. Allow two hours, minimum, between coats.

G. Finish insulation at supports, protrusions, and interruptions.

H. Nameplates and ASME Stamps: Bevel and seal insulation around; do not insulate over.

I. Equipment Requiring Access for Maintenance, Repair, or Cleaning: Install insulation so it can be easily removed and replaced without damage.

3.03 SCHEDULE

A. Cooling Systems:
1. Pump Bodies: Do not insulate. Refer to detail for drain pan under pump volute.

END OF SECTION

SECTION 23 0719
HVAC PIPING INSULATION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Piping insulation.

B. Jackets and accessories.

1.02 REFERENCE STANDARDS

A. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2014.

B. ASTM B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate (Metric); 2014.

C. ASTM C534/C534M - Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form; 2016.

D. ASTM C552 - Standard Specification for Cellular Glass Thermal Insulation; 2016a.

E. ASTM C585 - Standard Practice for Inner and Outer Diameters of Thermal Insulation for Nominal Sizes of Pipe and Tubing; 2010 (Reapproved 2016).

F. ASTM C591 - Standard Specification for Unfaced Preformed Rigid Cellular Polyisocyanurate Thermal Insulation; 2017.

G. ASTM C 1126 - Standard Specification for Faced or Unfaced Rigid Cellular Phenolic Thermal Insulation; 2009.

H. ASTM D2842 - Standard Test Method for Water Absorption of Rigid Cellular Plastics; 2012.

I. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2015a.

J. ASTM E96/E96M - Standard Test Methods for Water Vapor Transmission of Materials; 2016.

K. NFPA 255 - Standard Method of Test of Surface Burning Characteristics of Building Materials; National Fire Protection Association 2007.

L. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Current Edition, Including All Revisions.

1.03 SUBMITTALS

A. See Section 23 0510 - General HVAC Requirements for submittal procedures.

B. Product Data: Provide product description, thermal characteristics, list of materials and thickness for each service, and locations.

C. Manufacturer's Instructions: Indicate installation procedures that ensure acceptable workmanship and installation standards will be achieved.

1.04 QUALITY ASSURANCE

A. All insulation, mastics, coatings, sealants, and adhesives shall be certified by the manufacturer to be Asbestos-free.

B. Applicator Qualifications: Company specializing in performing the type of work specified in this section with minimum Three years of experience.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Accept materials on site, labeled with manufacturer's identification, product density, and thickness.

PART 2 PRODUCTS

2.01 REGULATORY REQUIREMENTS

A. Surface Burning Characteristics: Flame spread/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E 84, NFPA 255, or UL 723.

2.02 CELLULAR GLASS

A. Manufacturers:
   1. Pittsburgh Corning Corporation: www.foamglasinsulation.com.

B. Insulation: ASTM C552, Type II.
   1. 'K' value: 0.37 at 100 degrees F.
   2. Service Temperature: Up to 900 degrees F.
   3. Water Vapor Permeability: 0.005 perm inch.
   4. Water Absorption: 0.2 percent by volume, maximum.

2.03 PHENOLIC

A. Manufacturers:
   1. ITW; Model Trymer-Green
   2. Dyplast DyTherm
   3. Insulphen

B. Insulation Material: ASTM C 1126, closed cell rigid molded phenolic foam, 5# density, minimum.
   1. Dimension: Comply with requirements of ASTM C585.
   2. 'K' value: 0.21 at 75 degrees F, when tested in accordance with ASTM C 518.
   3. Minimum Service Temperature: Minus 70 degrees F.
   4. Maximum Service Temperature: 248 degrees F.
   5. Water Absorption: 0.5 percent by volume, maximum, when tested in accordance with ASTM D2842.
   6. Moisture Vapor Transmission: 1.0 perm inch.
   7. Connection: Waterproof vapor barrier adhesive.

2.04 FLEXIBLE ELASTOMERIC CELLULAR INSULATION

A. Manufacturer:
   1. Aeroflex USA, Inc.; Aerocel: www.aeroflexusa.com/#sle.
   2. Armacell LLC: www.armacell.us/#sle.
   3. K-Flex USA LLC; Insul-Tube: www.kflexusa.com/#sle.

B. Insulation: Preformed flexible closed-cell elastomeric rubber insulation complying with ASTM C 534 Grade 1; use molded tubular material. Split tube installation is prohibited.
   1. 'K' ('Ksi') value: 0.25 at 75 degrees F (0.04 at 24 degrees C).
   2. Maximum Moisture Absorption: < 1.0 percent (pipe) by volume, when tested in accordance with ASTM C 209.
   3. Water Vapor Permeability: 0.05 perm-inches, when tested in accordance with ASTM E 96.
   4. Minimum Service Temperature: Minus 40 degrees F.
   5. Maximum Service Temperature: 220 degrees F.
   6. Connection: Waterproof vapor barrier adhesive.

C. Elastomeric Foam Adhesive: Air dried, contact adhesive, compatible with insulation.

2.05 JACKETS

A. Saran Industrial Vapor Retardant Film:
   1. Manufacturers: ITW
   2. Material: Polyvinylidene chloride polymer film, 4-mil minimum thickness.
   3. Adhesive: Compatible with insulation and jacket.
   4. Vapor Retardant Tape: Compatible with film jacket by same manufacturer.

B. PVC Plastic.
   1. Jacket: One piece molded type fitting covers and sheet material, off-white color.
      a. Minimum Service Temperature: 0 degrees F.
      b. Maximum Service Temperature: 150 degrees F.
      c. Moisture Vapor Permeability: 0.002 perm inch, maximum, when tested in accordance with ASTM E96/E96M.
      d. Thickness: 10 mil.
      e. Connections: Brush on welding adhesive.

C. Aluminum Jacket: ASTM B209 (ASTM B209M) formed aluminum sheet.
   1. Thickness: 0.016 inch sheet.
   2. Finish: Embossed.
   3. Joining: Longitudinal slip joints and 2 inch laps.
   4. Fittings: 0.016 inch thick die shaped fitting covers with factory attached protective liner.

2.06 STAPLES, BANDS, AND WIRES

A. Staples shall be outward clinching type of type 304 or 316 stainless steel, or monel.

B. Bands shall be galvanized steel, aluminum, brass, or nickel copper alloy, of 3/4 inch nominal width. The band thickness exclusive of coating shall be not less than 30 gauge for steel and nickel copper alloy.

C. Wire shall be 18-gauge stainless steel.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that piping has been tested before applying insulation materials.

B. Verify that surfaces are clean and dry, with foreign material removed.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install in accordance with NAIMA National Insulation Standards.

C. Exposed Piping: Locate insulation and cover seams in least visible locations. Exterior of insulation shall be uniform in appearance.

D. Insulation jacket shall fit snug to insulation.

E. Valves and fittings:
   1. Insulate pipe and all valves and fittings including valve bonnets on chilled water piping. Leave only valve stems, open ends of wells and gauge cocks exposed.
   2. All Other Piping: Insulate pipe and fittings, but omit insulation on unions and valves. Taper insulation ends and cover with jacket material.

F. Insulation at Hangers: Hangers for horizontal, chilled water and trapeze supports shall be outside of insulation with saddles as specified herein.

G. Saddles:
   1. Provide galvanized steel saddles at each point where pipe insulation passes through a hanger or rests on a support.
   2. Saddles shall be 180 arc for horizontal piping, 360 arch for vertical piping.
   3. Center saddle on pipe hanger.
   4. Length and gauge of saddle shall be as follows:
      a. 2 inch pipe size and smaller: 18 Gauge saddle, 8 inch long, minimum.
      b. 2-1/2 & 3 inch pipe size: 18 Gauge saddle, 12 inch long, minimum.
      c. 4 inch pipe size: 16 Gauge saddle, 16 inch long, minimum.
      d. 6 inch pipe size and larger: 16 Gauge saddle, 24 inch long, minimum.

3.03 CLEANING

A. Clean adjacent surfaces, valves, valve handles, etc. of jacketing materials.

3.04 SCHEDULES

A. Chilled Water systems:
   1. Chilled Water Supply and Return (above grade)
      a. Pipe: 1-1/2 inch thick cellular glass jacketed with PVC Jacket or 1-inch phenolic foam with Saran 560 vapor jacket and PVC Jacket .
      b. Fittings: Install pipe insulation over fittings.
         1) Where pipe sizes permit, miter insulation to fit at elbows.
         2) Provide molded insulation to fit fittings for larger pipes.
         3) Thickness of fitting insulation shall match piping insulation thickness.
         4) Finish insulation at fittings with PVC jacket where exposed and finish with glass fabric in mastic elsewhere.
   2. Fittings and valves at test plugs, thermometer sockets, and pressure gage tappings: Foamed plastic insulating tape, 1/8 inch thick, minimum.
   3. Interconnecting piping on pump pressure gages: 3/4 inch thick preformed flexible elastomeric cellular rubber insulation and with foamed plastic insulating tape, 1/8 inch, minimum.
   4. Pipe subject to condensation: 3/4 inch thick preformed flexible elastomeric cellular rubber insulation.
   5. Air Vents: Insulate piping from chilled water manual air vents for five feet from point of connection to chilled water pipe.

END OF SECTION

SECTION 23 0913

INSTRUMENTATION AND CONTROL DEVICES FOR HVAC

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Control panels.

B. Control valves.

C. Input/Output Sensors.

D. Miscellaneous accessories.

1.02 REFERENCE STANDARDS

A. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); National Electrical Manufacturers Association; 2014.

1.03 SUBMITTALS

A. Refer to Section 23 0510- General HVAC Requirements for submittal procedures.

B. Product Data: Provide description and engineering data for each control system component. Include sizing as requested. Provide data for each system component and software module.

C. Shop Drawings: Indicate complete operating data, system drawings, wiring diagrams, and written detailed operational description of sequences. Submit schedule of valves indicating size, flow, and pressure drop for each valve. For automatic dampers indicate arrangement, velocities, and static pressure drops for each system.

D. Operation and Maintenance Data: Include inspection period, cleaning methods, recommended cleaning materials, and calibration tolerances.

1.04 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in performing the work of this section with minimum 5 years' experience employed directly by the digital equipment manufacturer.

B. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc., as suitable for the purpose specified and indicated.

PART 2 PRODUCTS

2.01 EQUIPMENT - GENERAL

A. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc., as suitable for the purpose specified and indicated.

2.02 CONTROL PANELS

A. Unitized cabinet type for each system under automatic control with relays and controls mounted in cabinet and temperature indicators, pressure gauges, pilot lights, push buttons and switches flush on cabinet panel face.

B. NEMA 250, general purpose utility enclosures with hinged, lockable face panel.

C. Finish: Baked enamel factory finish.

D. Provide common keying for all panels with two keys per control panel.

E. Nameplates:
   1. Use device identification and number from control drawings.
   2. Identify panel with permanent label mounted on panel face. Nameplate shall be bakelite with white letters, 3/8 inch minimum height.
   3. Identify all panel mounted devices with permanent label mounted adjacent to device. Nameplates shall be bakelite with white letters, 1/8 inch minimum height.

F. Door mounted devices: Refer to the Sequence of Operation for devices specified to be door mounted.

G. Wiring:
   1. Power supply of capacity required with disconnect switch, surge protection, fuse holder with fuses or circuit breaker, 120 VAC service receptacle.
   2. Conductors color coded with both ends identified with manufactured alpha-numeric self-adhesive vinyl tags, 3 mils thick, minimum, keyed to termination points.
   3. Connections and junctions to terminal strips and devices only.
   4. Route wiring parallel to cabinet side in wiring troughs or laced with nylon ties.
   5. Wiring and devices that derive power from other sources shall be located in a separate compartment and be provide with separate terminal strips.
   6. Cover all line voltage terminations in panel.

H. Indicator lights: 24 VAC light emitting diode. 100,000 hour lamp life. Provide single "Press-To-Test" button for all lights in panel.

2.03 CONTROL VALVES

A. Butterfly Pattern:
   1. Manufacturers: Bray 31, Centerline Model 200, Crane 12, Grinnell 8000, Hammond 5111, Milwaukee WA, Mueller 51, Nibco WD-2000-3, Stockham LG551.
   2. Iron body, aluminum bronze disc, resilient replaceable EDPM seat for service to 180 degrees F wafer or lug ends, stainless steel stem, extended neck.
   3. Hydronic Systems:
      a. Rate for service pressure of 125 psig at 250 degrees F.
      b. Size for 1 psig maximum pressure drop at design flow rate.
   4. Electric operator:
      a. Manufacturers: Bray 70, Grinnell, Johnson.
      b. Single phase, permanently split-capacitor, reversible motor with Class F insulation or better with self-locking worm gear drive mechanism in enclosure.
      c. Enclosure: Water-proof die-cast aluminum cover and base, NEMA-4, 4X, IP 65, polyester powder coated, coupling direct to valve. One power and one control conduit NPT entries.
      d. Provide all corrosion resistant (non-ferrous) components, fasteners and mounting devices and connections.
      e. Valve status display: Color coded visual indicator to display valve position through full range of travel.
      f. SPDT-DB travel limit switches.
      g. Manual override with aluminum handwheel.
      h. Stainless steel mechanical travel stops.
      i. Provide servo control for modulating control sequences.
      j. Provide heater with thermostat prewired to terminal block for operators located in exterior locations.

2.04 INPUT/OUTPUT SENSORS

A. Temperature Sensors:
   1. Platinum resistance temperature detectors with resistance tolerance of plus or minus 0.1 percent at 70 degrees F, interchangeability less than plus or minus 0.2 percent, time constant of 13 seconds maximum for fluids and 200 seconds maximum for air.
   2. Measuring current maximum 5 mA with maximum self-heat of 0.031 degrees F/mW in fluids and 0.014 degrees F/mW in air.
   3. Provide 3 lead wires and shield for input bridge circuit.
   4. Use insertion elements in ducts not affected by temperature stratification and smaller than 9 square feet. Use averaging elements where larger or prone to stratification. Sensor length 8 feet or 16 feet as required.
   5. Use sensor holder with mounting plate and conduit enclosure with cover plate for elements mounted on ducts. Provide extension between plate and enclosure on insulated ducts.

6. Insertion elements for liquids shall be with brass socket with minimum insertion length of 2-1/2 inches. Provide lagging extensions on insulated pipes.
7. Room digital thermostats: Sensor with setpoint adjustment marked warmer/cooler, built-in override button, terminal block wiring connection and I/O communication port for portable monitoring device. Locking cover. blank cover in all public spaces
8. Outside air sensors: Watertight inlet fitting, shielded from direct rays of sun.

B. Hydronic Differential Pressure Sensors:
1. Differential strain gauge with amplifier, self-contained, 24vDC power supply, externally adjustable span and range.
2. Span:
a. Span shall be continuously adjustable from 0-125% of expected full pressure or differential pressure.
b. The zero shall be continuously adjustable on outputs.
3. Sensor shall be capable of withstanding overpressure range limit of 300% of the normally expected value.
4. Output: 4-20mA signal, 2 wire.

C. Equipment Operation Sensors:
1. Status Inputs for Electric Motors:
a. U.L. Listed current sensing relay with split core current transformer, 1 amp @ 30 VAC adjustable setpoint output switch, adjustable mounting bracket, power and trip LED indication.
b. Constant speed fans and pumps: Output switch trip setpoint at 10% below the normal motor operating speed and current draw.
c. Variable speed fans and pumps: Output switch trip setpoint at 5% below the lowest motor operating speed and current draw as determined in the commissioning process, typically 20%.
d. Product: Veris Industries Hawkeye H-900, Kele D-150, Veris Industries.

2.05 SWITCHING DEVICES

A. Electric Relays:
1. Heavy duty, isolated, cabinet mounted, blade plug-in type with base.
2. Rating: 10 amps, minimum at 125 VAC:

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify that systems are ready to receive work.

C. Beginning of installation means installer accepts existing conditions.

D. Sequence work to ensure installation of components is complementary to installation of similar components in other systems.

E. Coordinate installation of system components with installation of mechanical systems equipment such as air handling units and air terminal units.

F. Ensure installation of components is complementary to installation of similar components.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Locate all control devices except for sensors and devices integral to equipment within control panels, unless otherwise noted.

C. Install control devices in a readily accessible location. Refer to definitions in Section 23 0510.

D. Coordinate with Contractor and monitor the work so that other trades do not obstruct control devices or other items requiring access for service.

E. Device mounting:
   1. All devices shall be permanently mounted and secured in place.
   2. Mount control panels on backboards adjacent to associated equipment on vibration free walls or free standing angle iron supports. Refer to Section 23 0510 for backboards.
   3. Panel mounted controls: Secure to panel backs with non-ferrous sheet metal screws.
   4. Gypsum Board and Plaster walls: Moly-bolt type anchor. No adhesive or plastic insert anchors.
   5. Concrete Walls: Non-ferrous screws and expansion shields.
   6. Concrete masonry units: Mount to recessed box or secure with moly-bolt type anchor.
   7. Provide accessory wall adapter plates where required to cover block or wall opening edges.
   8. Pipe and duct mounted devices: Secure to well or mounting flange. Provide well and flange extensions on insulated duct and pipe to clear insulation thickness.
   9. Mount control valves with stem at or above the horizontal.

F. Identification:
   1. Nameplates: Identify all sensors mounted in mechanical rooms using device ID and number from control drawings with permanent label mounted adjacent to device. Nameplates shall be engraved plastic laminate with uppercase black letters on a white field, 1/4 inch minimum height.
      a. Include sensor type, normal setpoints information on nameplate.
      b. Mounting: Attach nameplates with epoxy cement or non-ferrous screws after final painting.
   2. Color code conductors with both ends identified with manufactured alpha-numeric self-adhesive vinyl tags, 3 mils thick, minimum, keyed to termination points.

G. Electrical wiring:
   1. All control and interlock wiring shall be provided under this section.
   2. No splices between field devices and control panels are permitted.
   3. All Wiring materials and methods shall comply with Division 26 except:
      a. Minimum wire size shall be 14 AWG(copper) for line voltages.
      b. Minimum wire size shall be 18 AWG(copper) for signal.
   4. Fire Alarm System Interface: Signal for fan shutdown shall be obtained from fire alarm output relay located in mechanical room adjacent to the starter/motor control center, unless otherwise noted.
   5. Electric Operators:
      a. Power wiring for controls provided under Division 26 is shown on the Electrical Drawings. Provide conduit, conductors, power supplies and transformers as required for power to operate electric operators.

H. Mount in center of 8x8 inch block face with recessed mounting box and accessory wall adapter plate covering block opening where mounted in concrete masonry units.

I. Provide separable sockets for liquid elements. Mount sockets as specified in Section 23 2113 . Cut element to length for full insertion into well and provide conducting compound.

J. Install current sensing relays in starter enclosure for equipment served.

K. Install control valves in a readily accessible location.

L. Install control valves with stems upright or horizontal, not inverted.

3.03 SCHEDULES

A. Refer to Sequence of Operation for valve normal position and to Drawings for valve coefficients.

END OF SECTION

SECTION 23 0923

DIRECT-DIGITAL CONTROL SYSTEM FOR HVAC

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Digital control equipment.

B. Software.

C. Software set-up and application programming.

D. Operator Training.

1.02 RELATED REQUIREMENTS

A. Section 23 0510 -General HVAC Requirements-Demonstration, Training and Instructions.

B. Section 23 0913 - Instrumentation and Control Devices for HVAC.

C. Section 26 0583 - Wiring Connections: Electrical characteristics and wiring connections.

1.03 REFERENCE STANDARDS

A. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.04 SUMMARY

A. The Building Automation System (BAS) shall be comprised of a distributed process network control system complete with all necessary hardware and software including all programming and a complete system of direct automatic temperature controls (DDC).

B. The BAS shall be capable of total integration of the facility infrastructure system with user access to all system data both locally over a secure Intranet within the building and by remote access by a standard Web Browser over the Internet. This shall include HVAC control, electrical, gas and water metering, energy management, alarm monitoring, and all trending, reporting and maintenance management functions related to building operations as indicated on the drawings or in this specification.

1.05 SYSTEM DESCRIPTION

A. Automatic temperature control field monitoring and control system using field programmable micro-processor based units . All devices down to field level controllers shall communicate using BACnet protocol. BACnet interfaces or gateways are not acceptable.

B. Base system on distributed system of fully intelligent, stand-alone controllers, operating in a multi-tasking, multi-user environment on token passing network, with central and remote hardware, software, and interconnecting wire and conduit. Provide Building Controllers (BC), Advanced Application Controllers (AAC), and Application Specific Controllers (ASC) as required to achieve specified sequences and performance. Every device in the system which executes control logic and directly controls HVAC equipment must conform to a standard BACnet Device profile as specified in ANSI/ASHRAE 135, BACnet Annex L.

C. Include computer software and hardware, operator input/output devices, control units, local area networks (LAN), sensors, control devices, actuators.

D. Provide control systems consisting of thermostats, control valves, dampers and operators, indicating devices, interface equipment and other apparatus and accessories required to operate mechanical systems, and to perform functions specified.

E. The Contractor shall connect DDC controllers via a new field bus, to a network controller or I/P router, to communicate the building DDC data to/from the existing BAS web-servers via the campus ethernet intranet.

F. The Contractor shall provide an interface location to accept a fiber optics connection and interface fully between the control system's local area network and the campus intranet. Contractor shall be responsible for coordination with the University IT department to ensure that

the building automation system will perform in the data network environment without disruption to any of other activities taking place on that LAN. TCP/IP connections and addresses will be provided by South Georgia State College for connection of the campus workstation with field panel nodes.

G. The Contractor shall be responsible for all equipment, cables, installation, and programming to implement the required interface with the campus network.

H. Include installation and calibration, supervision, adjustments, and fine tuning necessary for complete and fully operational system.

1.06 SUBMITTALS

A. Refer to Section 23 0510 - General HVAC Requirements for submittal procedures.

B. Product Data: Provide data for each system component and software module.

C. Shop Drawings:
1. Table of Contents listing sheet titles and sheet numbers.
2. Each sheet shall have a title containing the type of information included and the HVAC system controlled.
3. Provide drawing legend and list of abbreviations.
4. System architecture: Provide a drawing of the proposed system architecture showing configuration and locations for DDC controllers, connection to SGSC network, power and control wiring for each device, and hardware and wiring for connections to networks external to the building.
5. Provide floor plans in electronic and hard copy format locating all control units, workstations, servers, LAN interface devices, gateways, etc. Include all WAN and LAN communication wiring routing, power wiring, power originating sources, and low voltage power wiring. Indicate network number, device ID, address, device instance, MAC address, drawing reference number, and controller type for each control unit. Indicate media, protocol, baud rate, and type of each LAN. All optical isolators, repeaters, end-of-line resistors, junctions, ground locations, etc. shall be located on the floor plans. Wiring routing as-built conditions shall be maintained accurately throughout the construction period and the drawings shall be updated to accurately reflect accurate, actual installed conditions coordinated with the work of other trades.
6. DDC system data: Proposed system manufacturer's data sheets on DDC controllers, sensors, meters, relays, actuators, motors, protection services, and other devices specified herein. Include data on system software packages to be installed and illustrations of proposed graphics displays.
7. Diagrams: Separate field wiring diagrams for each system, motor starting and interlock wiring, ladder diagrams, control wiring, interior electrical circuits or control instruments with terminal and control device designations, actuators and motors, colors of wires, locations of instruments and remote elements, interfaces with communications equipment provided with equipment specified in other Sections, and normal positions of relays. Each diagram shall have terminals labeled as they will be marked on the installed equipment. Electrical wiring diagrams shall include diagrams with all wire numbers and terminal block numbers identified. Provide panel termination drawings on separate drawings. Ladder diagrams shall appear on system schematic. Clearly differentiate between portions of wiring, which is existing, factory-installed and portions to be field-installed.
8. The control submittal is to include schematic control drawings showing the configuration of the equipment, the location of all sensors, monitoring inputs, and controlled devices and any equipment that the control system monitors, enables or controls, even if the equipment is primarily controlled by packaged or integral controls.
9. With each schematic, provide a point summary table listing building number and abbreviation, system type, equipment type, full point name, point description, Ethernet backbone network number, network number, device ID, object ID (object type, instance number). Provide a full points list with the following included for each point:

a. Controlled system
b. Point abbreviation/acronym
c. Point description
d. Engineering unit to be displayed with the point
e. Control point or set-point (Yes / No)
f. Monitoring point (Yes / No)
g. Intermediate point (Yes / No)
h. Calculated point (Yes / No)

10. Proposed Graphics: Submittal shall include all proposed displays as required by the project documents and specifications.
11. Sequences of operation: Complete detailed sequences of operation, including a narrative of the system operation and interactions and interlocks with other systems written by the control vendor; notations indicating whether interlock or interaction is accomplished through software or hard-wired connections; detailed delineation of control between packaged controls and the DDC system; and sequences of operation for packaged controlled equipment that interfaces with the DDC system describing what points the DDC system monitors only and what points are control points and are adjustable. Sequence shall include:
    a. Equipment start-up sequences.
    b. Warm-up mode sequences.
    c. Normal operating mode sequences.
    d. Detailed sequences for all control strategies, e.g., economizer control, optimum start/stop, capacity control, staging, optimization, etc.
    e. Temperature and pressure control: setbacks, setups, resets, etc.
    f. Shutdown sequences.
    g. Unoccupied mode sequences.
    h. Sequences for all alarms and emergency shut downs.
    i. Effects of power or equipment failure with all standby component functions.
    j. Seasonal operational differences and recommendations.
    k. Initial and recommended values for all adjustable settings, set-points and parameters that are typically set or adjusted by operating staff; and any other control settings or fixed values, delays, etc. that will be useful during testing and operating the equipment.
    l. Schedules, if known.
    m. All sequences shall be written in small statements, each with a number for reference. For a given system, numbers will not repeat for different sequence sections, unless the sections are numbered
12. BACnet Systems:
    a. BACnet object description, object ID, and device ID, for each I/O point.
    b. Documentation for any non-standard BACnet objects, properties, or enumerations used detailing their structure, data types, and any associated lists of enumerated values.
    c. Submit PICS indicating the BACnet functionality and configuration of each controller.

D. Proposed Graphics: Contractor proposed graphic displays are to be submitted for Emory review and approval. Submittal shall include all proposed displays as required by the project documents and specifications. Provide demonstration disk containing graphics. Manufacturer's Instructions: Indicate manufacturer's installation instructions for all manufactured components.

E. Manufacturer's Instructions: Indicate manufacturer's installation instructions for all manufactured components.

F. Project Record Documents: Record actual locations of control components, including control units, thermostats, and sensors.

G. Operation and Maintenance Data:

1. Include interconnection wiring diagrams complete field installed systems with identified and numbered, system components and devices.
2. Include keyboard illustrations and step-by-step procedures indexed for each operator function.
3. Include inspection period, cleaning methods, cleaning materials recommended, and calibration tolerances.
4. Provide maintenance instructions and spare parts lists for each type of control device, control unit, and accessory.
5. Provide BAS User's Guides (Operating Manuals) for each controller type and for all workstation hardware and software and workstation peripherals.
6. Provide BAS advanced Programming Manuals for each controller type and for all workstation software.
7. Include all submittals (product data, shop drawings, control logic documentation, hardware manuals, software manuals, installation guides or manuals, maintenance instructions and spare parts lists) in maintenance manual; in accordance with requirements of Divisions 1 and 23.
8. Provide as-built network architecture drawings showing all BACnet nodes including a description field with specific controller identification, description and location information.
9. Record copies shall include individual floor plans with controller locations with all interconnecting wiring routing including space sensors, LAN wiring, power wiring, low voltage power wiring. Indicate device instance, MAC address and drawing reference number.
10. Provide record system architecture riser diagram showing the location of all controllers.
11. Complete original issue diskettes for all software provided, including operating systems, programming language, backup copy of programming code for the controllers in the project, operator workstation software and graphics software.
12. Licenses, guarantees, and warranty documents for all equipment and systems.
13. Maintain project record documents throughout the construction period and submit final documents at Material Completion.

H. Observation by Architect: Provide an affidavit to Architect stating the Controls Systems are performing in accordance with the contract documents prior to Request for Substantial Completion.

I. Warranty: Submit manufacturer's warranty and ensure forms have been filled out in Owner s name and registered with manufacturer.

J. Certificate: Provide Manufacturer's Certificate complying with the requirements of the General Conditions.

1.07 QUALITY ASSURANCE

A. Perform work in accordance with NFPA 70.

B. Personnel: Mechanics and electricians performing this work shall be regularly engaged in the installation of automatic temperature controls and be in the direct employ of the installing company and shall have a copy of the approved submittal data in immediate possession when performing work.

C. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc., as suitable for the purpose specified and indicated.

1.08 WARRANTY

A. See Section 01 7800 - Closeout Submittals for additional warranty requirements.

B. All components, system software, and parts furnished and installed by the BAS Contractor shall be guaranteed against defects in materials and workmanship for one year from date of Material Completion. Project-specific software, database software, and firmware updates which resolve known software deficiencies as identified by the BAS Contractor shall be provided to the Owner at no charge during the warranty period. All corrective software modifications made during

warranty period shall be updated on all user documentation and on user and manufacturer archived software disks.

C. At Material Completion, the BAS Contractor shall upgrade all control software and firmware packages to the latest release available from the vendor.

D. Provide five year manufacturer's warranty for field programmable micro-processor based units.

1.09 PROTECTION OF SOFTWARE RIGHTS

A. The Owner shall sign a copy of the manufacturer's standard software and firmware licensing agreement as a condition of this contract. Such license shall grant use of all programs and application software to Owner as defined by the manufacturer's license agreement, but shall protect manufacturer's rights to disclosure of trade secrets contained within such software. All project developed software and documentation shall become the property of the Owner. These include, but are not limited to:
   1. Project graphic images
   2. Record drawings
   3. Project network database
   4. Project-specific application programming code
   5. All documentation

B. The Contractor shall provide additional software licensing as follows:
   1. Provide or upgrade all licensing for all software packages at all required workstations. Building automation system licensing shall allow unlimited simultaneous users for access to all aspects of the system including system access, workstations, points, programming, database management, graphics, etc. No restrictions shall be placed on the licensing. All operator interfaces, programming environment, networking, database management and any other software used by the Contractor to install the system or needed to operate the system to its full capabilities shall be licensed and provided to the Owner.
   2. All software should be available on all Operator Workstations or servers provided, and on all Portable Operator Terminals. Hardware and software keys to provide all rights shall be installed on all workstations. At least 2 sets of CDs shall be provided with backup software for all software provided, so that the Owner may reinstall any software as necessary. Include all licensing for workstation operating systems, and all required third-party software licenses.
   3. Provide licensing and original software copies for each Operator Workstation or server.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Carrier i-Vu by Commercial Controls Group.

B. Johnson Controls, Inc.; Metasys.

2.02 BACNET COMMUNICATION

A. Control products, communication media, connectors, repeaters, hubs, and routers shall comprise a BACnet internetwork. Controller and operator interface communication shall conform to the latest edition of ANSI/ASHRAE Standard 135, BACnet.

B. Each controller shall have a communication port for temporary connection to a laptop computer or other operator interface. Connection shall support memory downloads and other troubleshooting operations.

C. Controllers with real-time clocks shall use the BACnet Time Synchronization service. The system shall automatically synchronize system clocks daily from an operator-designated controller via the internetwork. If applicable, system shall automatically adjust for daylight savings and standard time.

D. Web server or workstation and controllers shall communicate using BACnet protocol. Web server or workstation and control network backbone shall communicate using ISO 8802-3

(Ethernet) Data Link/Physical layer protocol and BACnet/IP addressing as specified in ANSI/ASHRAE 135, BACnet Annex J.

E. The system shall use BACnet as the native communication protocol between distributed controllers communicating on the controller network (i.e., Field Bus) and must, as a minimum, support the following Objects and Application Services (Conference Class 3):
   1. Objects > Binary Input Services > Readproperty
   2. Binary Output Writeproperty
   3. Binary Value
   4. Analog Input
   5. Analog Output ReadMultipleProperty
   6. Analog Value ReadMultipleProperty
   7. Calendar
   8. Schedules.

2.03 OPERATOR WORKSTATION/CAMPUS SERVERS

A. The Contractor shall connect DDC controllers via a new field bus, to a network controller or I/P router, to communicate the building DDC data to/from the existing BAS web-servers.

B. The Contractor shall update the existing BAS web-server with the latest revision of operating system and control system software. Configure the software according to the DDC system manufacturer's specifications and in accordance with BACnet Operator Workstation software.

C. The Contractor shall update the existing web-server, as required, to have a single, integrated, and fully functional BAS. Updates to the web-server shall include but are not limited to:
   1. Server hardware computer components
   2. Database updates of new controllers, I/O, and BACnet objects/properties
   3. Controller programming code
   4. Data logging and reports of BAS data
   5. Alarm presentation and routing
   6. Master time scheduling algorithms
   7. Graphical representation of data
   8. Graphics adjustment of application parameters (i.e., setpoints)
   9. Trend of points
   10. Adjustments of calibration offsets on analog devices.

D. Application Development
   1. Master time schedules shall be programmed through the BAS web-server. Local time schedules will be programmed for each system in the controllers by the contractor and occupancy commands shall be bound from the web-server to the building level controllers by the contractor where the applications require time based control.
   2. Other Supervisory Applications
      a. The contractor shall be responsible for mapping all points (BACnet objects/properties) to/from the controllers to/from the web-server.
      b. With the exception of master time schedules or optimized start/stop algorithms, all applications shall be programmed within the controllers.
      c. Within an application program, there are numerous BACnet objects with BACnet properties that must be adjusted from the web-server graphics, during the commissioning of a system and/or be available for adjustment as requirements change by operators. This adjustment shall be done via the server and via web based access through a web browser from any computer (not only through an operator work station) and, as a minimum, the following properties must be available for adjustment from the web interface graphics fed from the web-server:
         1) Setpoints
         2) Timing parameters
         3) PID loop gain
         4) PID loop integral time constant

5) PID loop derivative time constant
6) Alarm limits
7) Calibration offsets for analog values
8) Analog input values
9) Manual start/stop & open/closed override commands
10) Equipment status overrides
11) Manual override of analog output values

2.04 BUILDING CONTROL UNITS

A. Modular in design and consisting of processor board with programmable RAM memory, local operator access and display panel, and integral interface equipment. The BC(s) shall provide fully distributed control independent of the operational status of operator work stations or web-servers. All necessary calculations required to achieve control shall be executed within the BC independent of any other device. All control strategies performed by the BC(s) shall be both operator definable and modifiable through the Operator Interfaces. Each BC shall provide intelligent, standalone control of HVAC functions. Each BC may be capable of standalone direct digital operation utilizing its own processor, non-volatile memory, input/output, wiring terminal strips, A/D converters, real-time clock/calendar and voltage transient and lightning protection devices.

B. All controllers other than those used for terminal equipment shall be defined as a BC unit.

C. Battery Backup: For minimum of 48 hours for complete system including RAM without interruption, with automatic battery charger.

D. All local controller operating parameters, setpoints, and schedules shall be stored in non-volatile EEPROM memory.

E. Arrange Unit and Unit I/O so that control unit functions continue if communications over network are lost.

F. Control Units Functions:
   1. Monitor or control each input/output point.
   2. Completely independent with hardware clock/calendar and software to maintain control independently.
   3. Acquire, process, and transfer information to operator station or other control units on network.
   4. Accept, process, and execute commands from other control unit's or devices or operator stations.
   5. Access both data base and control functions simultaneously.
   6. Record, evaluate, and report changes of state or value that occur among associated points. Continue to perform associated control functions regardless of status of network.
   7. Perform in stand-alone mode:
      a. Start/Stop.
      b. Automatic Temperature Control.
      c. Event initiated control.
      d. Calculated point.
      e. Scanning and alarm processing.
      f. Full direct digital control.
      g. Trend logging.
      h. Global communications.

G. Global Communications:
   1. Broadcast point data onto network, making that information available to all other system control units.
   2. Transmit any or all input/output points onto network for use by other control units and utilize data from other control units.

H. Input/Output Capability:

1. Discrete/digital input (contact status) isolated, either N.O. or N.C. as specified.
2. Discrete/digital output: Isolated relay contacts with built-in HOA switch rated for 1 amp at 24 VAC, minimum.
3. Analog input: Compatible with sensors specified in Instruments and Control Elements.
4. Analog Output: Supervised Analog output compatible with operator(0-10VDC, 4-20mA) with built-in HOA and manual positioner, 8 bit minimum.
5. Pulse input (5 pulses/second).
6. Pulse output (0-655 seconds in duration with 0.01 second resolution).

I. Provide transient protection on all I/O signals where cable or device is external to building.

J. Monitor, control, or address data points. Mix shall include analog inputs, analog outputs, pulse inputs, pulse outputs and discrete inputs/outputs, as required. Each building controller shall be provided with a minimum of one spare digital and analog output points, and two universal input points.

K. Point Scanning: Set scan or execution speed of each point to operator selected time from 1 to 250 seconds.

L. Upload/Download Capability: Download from or upload to operator station. Upload/Download time for entire control unit database maximum 10 seconds on hard wired LAN, or 60 seconds over voice grade phone lines.

M. Test Mode Operation: Place input/output points in test mode to allow testing and developing of control algorithms on line without disrupting field hardware and controlled environment. In test mode:
   1. Inhibit scanning and calculation of input points. Issue manual control to input points (set analog or digital input point to operator determined test value) from work station.
   2. Control output points but change only data base state or value; leave external field hardware unchanged.
   3. Enable control actions on output points but change only data base state or value.

2.05 LOCAL AREA NETWORK (LAN)

A. Provide communication between control units and operator station(s) over local area network (LAN).

B. LAN Capacity: Not less than 60 stations or nodes.

C. Break in Communication Path: Alarm and automatically initiate LAN reconfiguration.

D. LAN Data Speed: Minimum 2500 Kb.

E. Communication Techniques: Allow interface into network by multiple operation stations and by auto-answer/auto-dial modems. Support communication over telephone lines utilizing modems.

F. Transmission Median: Fiber optic or single pair of solid 24 gauge twisted, shielded copper cable.

G. Network Support: Time for global point to be received by any station, shall be less than 3 seconds. Provide automatic reconfiguration if any station is added or lost. If transmission cable is cut, reconfigure two sections with no disruption to system's operation, without operator intervention.

2.06 OPERATING SYSTEM SOFTWARE

A. Input/Output Capability From Operator Station:
   1. Request display of current values or status in tabular or graphic format.
   2. Command selected equipment to specified state.
   3. Initiate logs and reports.
   4. Change analog limits.
   5. Add, delete, or change points within each control unit or application routine.
   6. Change point input/output descriptors, status, alarm descriptors, and engineering unit descriptors.

7. Add new control units to system.
8. Modify and set up maintenance scheduling parameters.
9. Develop, modify, delete or display full range of color graphic displays.
10. Automatically archive select data even when running third party software.
11. Provide capability to sort and extract data from archived files and to generate custom reports.
12. Support two printer operations.
    a. Alarm printer: Print alarms, operator acknowledgments, action messages, system alarms, operator sign-on and sign-off.
    b. Data printer: Print reports, page prints, and data base prints.

B. Web Based Operator System Access: Via software password with minimum 30 access levels at work station and minimum 3 access levels at each control unit.

C. Data Base Creation and Support: Changes shall utilize standard procedures. Control unit shall automatically check work station data base files upon connection and verify data base match. Minimum capability shall include:
1. Add and delete points.
2. Modify any point parameter.
3. Change, add, or delete English language descriptors.
4. Add, modify, or delete alarm limits.
5. Add, modify, or delete points in start/stop programs, trend logs, etc.
6. Create custom relationship between points.
7. Create or modify DDC loops and parameters.
8. Create or modify override parameters.
9. Add, modify, and delete any applications program.
10. Add, delete, develop, or modify dynamic color graphic displays.

D. Dynamic Color Graphic Displays:
1. Utilizes custom symbols or system supported library of symbols.
2. Sixteen (16) colors, minimum.
3. Sixty (60) outputs of real time, live dynamic data per graphic.
4. Dynamic graphic data.
5. 1,000 separate graphic pages, minimum.
6. Modify graphic screen refresh rate between 1 and 60 seconds.

E. Alarm Processing:
1. Off normal condition: Cause alarm and appropriate message, including time, system, point descriptor, and alarm condition. Select alarm state/value and which alarms shall cause automatic dial-out.
2. Critical alarm or change-of-state: Display message, stored on disk for review and sort, or print.
3. Print on line changeable message, up to 60 characters in length, for each alarm point specified.
4. Display alarm reports on video. Display multiple alarms in order of occurrence.
5. Define time delay for equipment start-up or shutdown.
6. Allow unique routing of specific alarms.
7. Operator specifies if alarm requires acknowledgments.
8. Continue to indicate unacknowledged alarms after return to normal.
9. Alarm notification:
    a. Automatic print.
    b. Display indicating alarm condition.
    c. Selectable audible alarm indication.
    d. Paging software.

F. Event Processing: Automatically initiate commands, user defined messages, take specific control actions or change control strategy and application programs resulting from event

condition. Event condition may be value crossing operator defined limit, change-of-state, specified state, or alarm occurrence or return to normal.

G. Automatic Restart: Automatically restart field equipment on restoration of power. Provide time delay between individual equipment restart and time of day start/stop.

H. Messages:
1. Automatically display or print user-defined message subsequent to occurrence of selected events.
2. Compose, change, or delete any message.
3. Display or log any message at any time.
4. Assign any message to any event.

I. Reports:
1. Manually requested with time and date.
2. Long term data archiving to hard disk.
3. Automatic directives to download to transportable media such as floppy diskettes for storage.
4. Data selection methods to include data base search and manipulation.
5. Data extraction with mathematical manipulation.
6. Data reports shall allow development of XY curve plotting, tabular reports (both statistical and summary), and multi-point timed based plots with not less than four (4) variables displayed.
7. Generating reports either normally at operator direction, or automatically under work station direction.
8. Reports may either manually displayed or printed, or may be printed automatically on daily, weekly, monthly, yearly or scheduled basis.
9. Include capability for statistical data manipulation and extraction.
10. Provide capability to generate four types of reports: Statistical detail reports, summary reports, trend graphic plots, x-y graphic plots.

J. Parameter Save/Restore: Store most current operating system, parameter changes, and modifications on disk or diskette.

K. Data Collection:
1. The supplied system must incorporate the ability to access all data using browsers without requiring proprietary operator interface and configuration programs. An Open DataBase Connectivity (ODBC) compliant web-server database is required for all system database parameter storage to allow all historical data to be easily imported into any ODBC compliant software (i.e. Microsoft ACCESS, EXCEL, etc.) This data shall reside on a supplier-installed server for all database access. Systems requiring proprietary database and user interface programs shall not be acceptable.
2. Automatically collect and store in disk files.
3. Provide archiving of stored data for use with system supplied custom reports.

L. Graphic Display: Support graphic development on work station with software features:
1. Page linking.
2. Generate, store, and retrieve library symbols.
3. Single or double height characters.
4. Sixty (60) dynamic points of data per graphic page.
5. Pixel level resolution.
6. Animated graphics for discrete points.
7. Analog bar graphs.
8. Display real time value of each input or output line diagram fashion.

M. Maintenance Management:
1. Run time monitoring, per point.
2. Maintenance scheduling targets with automatic annunciation, scheduling and shutdown.

3. Equipment safety targets.
4. Target point reset, per point.

N. Advisories:
1. Summary which contains status of points in locked out condition.
2. Continuous operational or not operational report of interrogation of system hardware and programmable control units for failure.
3. Report of power failure detection, time and date.
4. Report of communication failure with operator device, field interface unit, point, programmable control unit.

2.07 LOAD CONTROL PROGRAMS

A. General: Support inch-pounds and SI (metric) units of measurement.

B. Automatic Time Scheduling:
1. Self-contained programs for automatic start/stop/scheduling of building loads.
2. Support up to seven (7) normal day schedules, seven (7) "special day" schedules and two (2) temporary day schedules.
3. Special days schedule shall support up to 30 unique date/duration combinations.
4. Any number of loads assigned to any time program; each load can have individual time program.
5. Each load assigned at least 16 control actions per day with 1 minute resolution.
6. Sequence starting of equipment with motors 3 KW or larger with adjustable time delay.
7. Minimum of 30 holiday periods up to 100 days in length may be specified for the year.
8. Create temporary schedules.
9. Broadcast temporary "special day" date and duration.

C. Night Setback/Setup Program: Reduce heating space temperature setpoint or raise cooling space temperature setpoint during unoccupied hours; in conjunction with scheduled start/stop and optimum start/stop programs.

D. Calculated Points: Define calculations and totalization computed from monitored points (analog/digital points), constants, or other calculated points.
1. Employ arithmetic, algebraic, Boolean, and special function operations.
2. Treat calculated values like any other analog value, use for any function that a "hard wired point" might be used.

E. Event Initiated Programming: Event may be initiated by any data point, causing series of controls in a sequence.
1. Define time interval between each control action between 0 to 3600 seconds.
2. Output may be analog value.
3. Provide for "skip" logic.
4. Verify completion of one action before proceeding to next. If not verified, program shall be able to skip to next action.

F. Direct Digital Control: Each control unit shall provide Direct Digital Control software so that the operator may customize control strategies and sequences of operation by defining the appropriate control loop algorithms and choosing the optimum loop parameters.
1. Control loops: Defined using "modules" that are analogous to standard control devices.
2. Output: Paired or individual digital outputs for pulse-width modulation, and analog outputs, as required.
3. Firmware:
a. PID with analog or pulse-width modulation output.
b. Floating control with pulse-width modulated outputs.
c. Two-position control.
d. Primary and secondary reset schedule selector.
e. Hi/Lo signal selector.
f. Single pole double throw relay.

g. Single pole double throw time delay relay with delay before break, delay before make and interval time capabilities.

4. Direct Digital Control loops: Downloaded upon creation or on operator request. On sensor failure, program shall execute user defined failsafe output.
5. Display: Value or state of each of the lines which interconnect DDC modules.

G. Fine Tuning Direct Digital Control PID or floating loops:
1. Display information:
a. Control loop being tuned
b. Input (process) variable
c. Output (control) variable
d. Setpoint of loop
e. Proportional band
f. Integral (reset) Interval
g. Derivative (rate) Interval

H. Trend logging:
1. Each control unit will store samples of control unit's data points.
2. Update file continuously at discretely assignable intervals.
3. Automatically initiate upload request and then store data on hard disk.
4. Time synchronize sampling at operator specified times and intervals with sample resolution of one minute.
5. Co-ordinate sampling with on/off state of specified point.
6. Display trend samples on work station in graphic format. Automatically scale trend graph with minimum 60 samples of data in plot of time vs data.

2.08 PROGRAMMING APPLICATION FEATURES

A. Trend Point:
1. Sample up to 6 points, real or computed, with each point capable of collecting samples at intervals specified in minutes, hours, days, or month.
2. Output trend logs as line graphs or bar graphs. Output graphic on terminal, with each point for line and bar graphs designated with a unique pattern, vertical scale either actual values or percent of range, and horizontal scale time base. Print trend logs up to 12 columns of one point/column.

B. Alarm Messages:
1. Allow definition of minimum of 50 messages, each having minimum length of 180 characters for each individual message.
2. Assign alarm messages to system messages including point's alarm condition, point's off-normal condition, totalized point's warning limit, hardware elements advisories.
3. Output assigned alarm with "message requiring acknowledgments".
4. Operator commands include define, modify, or delete; output summary listing current alarms and assignments; output summary defining assigned points.

C. Weekly Scheduling:
1. Automatically initiate equipment or system commands, based on preselected time schedule for points specified.
2. Provide program times for each day of week, per point, with one minute resolution.
3. Automatically generate alarm output for points not responding to command.
4. Provide for holidays, minimum of 100 consecutive holidays.
5. Output summary: Listing of programmed function points, associated program times, and respective day of week programmed points by software groups or time of day.

D. Interlocking:
1. Permit events to occur, based on changing condition of one or more associated master points.

2. Binary contact, high/low limit of analog point or computed point shall be capable of being utilized as master. Same master may monitor or command multiple slaves.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify that conditioned power supply is available to the control units and to the operator work station.

C. Verify that field end devices, wiring, and pneumatic tubing is installed prior to installation proceeding.

3.02 PROGRAMING

A. Include operating system programming of software capability specified to provide:
   1. Set-up of system I/O capability, operator access as defined by the User, database creation and support.
   2. Graphic Display-Systems:
      a. Provide and generate dynamic color graphics providing menu-generated flow charting of each building process using background graphics, standard and user defined symbols and dynamic variables.
      b. Provide flow charting for each system indicating all available points.
      c. Indicate setpoint condition status by changing color, flashing. Provide flow charting for each system indicating all available points.
   3. Graphic Displays- Floor Plans:
      a. Provide building floor plan graphics with thermographics or temperature readouts and a change in color during alarms.
      b. Show actual locations of equipment, and thermostats on the graphics.
   4. Equipment Runtime monitoring.

B. Include Load Control and HVAC programming of software to provide:
   1. System and equipment operating to specified Sequence of Operation:
   2. Start-stop Optimization.
   3. Night set-up/set-back of temperature set-points as directed by User.

C. Include Application system programming of software capability specified to provide:
   1. Trend logging:
      a. Logging, reporting and graphing of user defined system trends on disk file and printer as directed by user.
      b. Organize data in each trend logs to facilitate documenting system operation in compliance with Sequence of Operation.
   2. Alarms: Logging, reporting and printing of user defined system alarms on disk file and printer as directed by user.
   3. Scheduling:
      a. Program user defined system scheduling of occupied times as directed by user.
      b. Implement optimized starting and stopping for building warm-up/cool-down before occupancy.
      c. Program user defined system scheduling as directed by user.

3.03 INSTALLATION

A. Install control units and other hardware in position on permanent walls where accessible for inspection, maintenance and repair and not subject to excessive vibration.

B. Install software in control units and in operator work station. Implement all features of programs to specified requirements and appropriate to sequence of operation. Refer to Section 23 0993.

C. Identification:
   1. Nameplates: Identify all sensors mounted in mechanical rooms using device ID and number from control drawings with permanent label mounted adjacent to device.

Nameplates shall be engraved plastic laminate with uppercase black letters on a white field, 1/4 inch minimum height.

a. Mounting: Attach nameplates with epoxy cement or non-ferrous screws after final painting.

2. Conduit/Cable Markers:
   a. Color coded, sunlight resistant cable ties.
   b. Location: Install on all conduit and raceways exposed or above ceilings in a visible location at:
      1) Connections to junction, pull boxes, or manholes. Label box cover with nominal system voltage, circuit number and panel identification legibly written with permanent marker.
      2) Connections to equipment.
      3) Each side of a wall, roof or floor penetration.
      4) Along straight runs at 50 feet intervals.
      5) At changes of direction.
      6) Parallel Conduits: Group markers on each conduit in-line with the adjacent marker.
   c. Color: Baby Blue.
3. Color code cable with both ends identified with manufactured alpha-numeric self-adhesive vinyl tags, 3 mils thick, minimum, keyed to termination points.

D. Communication Wiring:
1. All wiring shall be in accordance with National Electrical Codes and Division 26 of this specification. Communication wiring shall be provided in a customized color jacketing material. Material color shall be as submitted and approved. In addition all wiring jackets shall be labeled “BAS” in 3 foot or fewer intervals along the length of the jacket material.
2. Contractor shall supply all communication wiring between Controllers, Routers, and other devices.
3. Control LAN For any portions of this network required under this section of the specification, contractor shall use Category 5 or better cable as specified in TIA-568B. Media shall be Class 2 plenum rated and installed in accordance with manufacturer's recommendations. Network shall be run with no splices and separate from any wiring over thirty (30) volts.

E. Signal Wiring:
1. Contractor shall run all signal wiring in accordance with National Electric Codes and Division 26 of this Specification.
2. Signal wiring to all field devices, including, but not limited to, all sensors, transducers, transmitters, switches, etc. shall be twisted, 100% shielded pair, minimum 18-gauge wire with PVC cover, Class 2 plenum rated. Signal wiring shall be run with no splices and separate from any wiring above thirty (30) volts.
3. Signal wiring shield shall be grounded at controller end only unless otherwise recommended by the controller manufacturer.

F. Low Voltage Analog Output Wiring:
1. Contractor shall run all low voltage control wiring in accordance with National Electric Codes and Division 26 of this Specification.
2. Low voltage control wiring shall be minimum 18-gauge, twisted pair, 100% shielded, with PVC cover, Class 2 plenum-rated. Low voltage control wiring shall be run with no splices separate from any wiring above thirty (30) volts.

G. Electrical Wiring Installation:
1. All terminations of field wiring shall be to terminal strips.
2. Power wiring to control units shown on drawings is provided under Division 26. Provide conduit and conductors and power supplies and transformers to extend power to all supplemental control units.

3. Wiring System: Install complete wiring system for electric control systems. Conceal wiring except in mechanical rooms and areas where other conduit and piping are exposed. Installation of wiring shall generally follow building lines. Install in accordance with National Electrical Code and Division 26 of this Specification. Fasten flexible conductors bridging cabinets and doors, neatly along hinge side, and protect against abrasion. Tie and support conductors neatly.
4. Control Wiring Conductors: Install control wiring conductors, without splices between terminal points, color-coded. Install in neat workmanlike manner, securely fastened. Install in accordance with National Electrical Code and Division 26 of this Specification.
5. Communication wiring, signal wiring and low voltage control wiring shall be installed separate from any wiring over thirty (30) volts. Signal wiring shield shall be grounded at controller end only, unless otherwise recommended by the controller manufacturer.
6. All control network wiring shield shall be terminated as recommended by controller manufacturer. All control network wiring shall be labeled with a network number, NodeID at each termination and shall correspond with the network architecture and floor plan submittals.
7. Install all control wiring external to panels in electric metallic tubing or raceway. Installation of wiring shall generally follow building lines. Provide compression type connectors. Provide rigid conduit at all exterior locations and where subjected to moisture. All conduits penetrating partitions, walls or floors shall be sealed with an approved material to prevent migration of air through the conduit system and maintain the required firestopping performance. Communication wiring, signal wiring and low voltage control wiring may be run without conduit in concealed, accessible locations if noise immunity is ensured. Contractor will be fully responsible for noise immunity and rewire in conduit if electrical or RF noise affects performance. Accessible locations are defined as areas inside mechanical equipment enclosures, such as heating and cooling units, instrument panels etc.; in accessible pipe chases with easy access, or suspended ceilings with easy access. Installation of wiring shall generally follow building lines. Run in a neat and orderly fashion, bundled where applicable, and completely suspended (strapped to rigid elements or routed through wiring rings) away from areas of normal access. Tie and support conductors neatly with suitable nylon ties. Conductors shall not be supported by the ceiling system or ceiling support system. Conductors shall be pulled tight and be installed as high as practically possible in ceiling cavities. Wiring shall not be supported by piping, conduit, the ceiling or ductwork. Conductors shall not be installed between the top cord of a joist or beam and the bottom of roof decking. Contractor shall be fully responsible for noise immunity and rewire in conduit if electrical or RF noise affects performance.
8. Communication cabling shall be provided in an Owner approved color dedicated to the BAS.
9. Number-code or color-code conductors appropriately for future identification and servicing of control system. Code shall be as indicated on approved installation drawings.

H. Provide conduit and electrical wiring in accordance with Section 26 0583. Electrical material and installation shall be in accordance with appropriate requirements of .

3.04 MANUFACTURER'S FIELD SERVICES

A. Start and commission systems. Allow sufficient time for start-up and commissioning prior to placing control systems in permanent operation.

B. Provide start-up certificate in the format prescribed by the General Conditions.

3.05 DEMONSTRATION, TRAINING AND INSTRUCTIONS

A. Refer to Section 23 051023 0510- Demonstration, Training and Instructions for additional requirements.

B. Demonstrate a complete and operating system to Owner.

END OF SECTION

SECTION 23 0994
HVAC SEQUENCE OF OPERATION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Submittal and Execution Requirements.

B. Sequence of operation for:
   1. Central Chilled water systems.

1.02 RELATED SECTIONS

A. Section 23 0923 - Digital Control Equipment.

B. Section 23 0913 - Instruments and Control Elements.

C. Section 26 2717 - Equipment Wiring: Electrical characteristics and wiring connections.

1.03 SYSTEM DESCRIPTION

A. This Section defines the manner and method by which controls function. Requirements for each type of control system operation are specified. Equipment, devices, and system components required for control systems are specified in other Sections.

1.04 SUBMITTALS

A. Refer to Section 23 0510 - General HVAC Requirements for submittal procedures.

B. Shop Drawings: Indicate mechanical system controlled and control system components.
   1. Label with settings, adjustable range of control and limits.
   2. Include written description of control sequence.
   3. Include flow diagrams for each control system, graphically depicting control logic.

C. Review controls with and obtain approval of chiller manufacturer. Mark control diagrams "Approved" by chiller manufacturer.

D. Project Record Documents: Record actual locations of components and setpoints of controls, including changes to sequences made after submission of shop drawings.

PART 3 EXECUTION

2.01 GENERAL

A. All operators shall be in NORMAL position when each system is OFF.

B. All temperatures are Fahrenheit.

C. Chiller Safety Control: Safety thermostat in chilled water entering chiller shall stop [respective] chilled water pump at 90 F.

D. Sequences specified herein indicate the functional intent of the systems operation and may not fully detail every aspect of the programming that may be required to obtain the indicated operation. Contractor shall provide all programming necessary to obtain the sequences/system operation indicated.

E. Except as specified otherwise, throttling ranges, proportional bands, and cycle differentials shall be centered on the associated setpoint. All modulating feedback control loops shall include the capability of having proportional, integral, derivative action. Unless the loop is specified "proportional only" or "P+I", Contractor shall apply appropriate elements of integral and derivative gain to each control loop which shall result in stable operation, minimum settling time, and shall maintain the primary variable within the specified maximum allowable variance.

F. Where any sequence or occupancy schedule calls for more than one motorized unit to start simultaneously, the DDC System start commands shall be staggered by 5 second (adj.) intervals to minimize inrush current.

G. Alarm messages specified throughout the sequences shall be assigned to discrete priority levels. Priority levels dictate the handling and destination of alarm reports.

H. Wherever a value is indicated as adjustable (adj.), it shall be modifiable, with the proper password level, from the operator interface or via a function block menu. For these points, it is unacceptable to have to modify programming statements to change the setpoint.

I. Where reset action is specified in a sequence of operation, but a reset schedule is not indicated on the drawings, the contractor shall determine a fixed reset schedule that shall result in stable operation and shall maintain the primary variable within the specified maximum allowable variance one of the following methods shall be employed. Obtain approval of reset schedule from Engineer. All parameters of reset schedule shall be adjustable without programming statement modifications.

J. Where "prove operation" of a device (generally controlled by a digital output) is indicated in the sequence, it shall require that the DDC System shall, after an adjustable time delay after the device is commanded to operate (feedback delay), confirm that the device is operational via the status input. If the status point does not confirm operation after the time delay or anytime thereafter for an adjustable time delay (debounce delay) while the device is commanded to run, an alarm shall be enunciated audibly and via an alarm message at the operator interface and print at the alarm printers. A descriptive message shall be attached to the alarm message indicating the nature of the alarm and actions to be taken. Contractor shall provide messages to meet this intent. Upon failure, run command shall be removed and the device shall be locked out until the alarm is manually acknowledged unless specified otherwise.

K. The DDC shall provide for adjustable maximum rates of change for increasing and decreasing output from the following analog output points:
   1. Speed control of variable speed drives.
   2. Hydronic cooling system temperature setpoint reset.

L. Wherever a value is indicated to be dependent on another value (i.e.: setpoint plus 5 F) the DDC System shall use that equation to determine the value. Simply providing a virtual point that the operator must set is unacceptable. In this case three virtual points shall be provided. One to store the parameter (5 F), one to store the setpoint, and one to store the value which is the result of the equation.

2.02 MONITOR POINTS

A. Arrangement: Locate all control points for a system within one DDC panel within the mechanical equipment room containing the majority of the equipment for that system.

B. Each DDC controller including associated input/output modules, shall be provided with a minimum of three spare input and output points of each type installed.

C. Monitoring: In addition to the temperature, pressure, digital or flow sensor points required to implement the sequence of operation, refer to the HVAC system flow diagrams and Input/Output point schedules shown on the drawings.

D. Chiller: Refer to Section 23 6417. Provide BAS interface with chiller to monitor the status and operating performance of the chiller system.

2.03 CENTRAL CHILLED WATER SYSTEMS

A. General Description:
   1. Chilled Water Plant consists of two(2) chillers in a variable-primary pumping arrangement. Chilled water pumps (via a VFD and by-pass valve) varies flow between approximately a minimum flow of xxx GPM (depending on manufacturer) to full design flow based on chilled water valve position. Minimum flow shall be maintained by modulating VFD and bypass valve in sequence to maintain minimum flow. Provide flow measurement of chilled water.

B. Cooling Enable: Cooling from chiller operation shall be enabled when any chilled water air system is calling for cooling and ODT is above 55 F, or whenever manually enabled by the plant operator at the operator interface.

C. Air Cooled Chillers (CHR-1, CHR-2)

1. Operates on built-in chiller controls when chilled water pump is operating. Provide DDC relay at chiller to start/stop chiller through differential pressure sensor. Differential pressure sensor shall be able to resolve and switch at pressures form 1 foot W.G. to 20 feet W.G. with 90% repeatability. Provide remote reset of the chiller leaving water temperature.
2. Safety Control: Sensor in chilled water entering chiller shall stop chilled water pump at 90 F CHR temperature.

D. Chiller Lead/Lag Operation:
1. The two chillers shall operate in a lead/lag fashion. Each chiller shall be enabled after and adjustable delay to allow proof of flow and pump status.
2. The time delay shall allow for orderly chilled water system startup, shutdown, and sequencing.
3. All setpoints shall be field adjusted during test and balance to meet requirements of actual field conditions.
4. To prevent short cycling, there shall be a user definable delay (adj.) between staging up or down, unless shutdown on safeties or failure.
    a. The lead chiller shall run first.
    b. On failure of the lead chiller, a lag chiller shall run and the lead chiller shall turn off.
    c. The designated lead chiller shall rotate upon one of the following conditions (user selectable):
        1) manually through a software switch
        2) if chiller runtime (adj.) is exceeded
        3) weekly
        4) monthly

E. Chiller Sequencing:
1. Provide adaptive optimization software to manage chiller line and sequence chillers, managing lead/lag rotation to satisfy building cooling load requirements and optimize efficiency for the building load profile, equalize run-time, and react to equipment malfunctions.

F. Chiller Staging - Start Lag Chiller(s):
1. On increasing chilled water supply temperature rising 3 F (adj.) above the setpoint for and adjustable period of 20 minutes,
2. OR - if the flow rate through the lead chiller(s) exceeds the maximum value recommended by the manufacturer for an adjustable period of 20 minutes.
3. Gradually reset the demand limit of the operating lead chiller(s) down to 50% (adj.) Slowly open the isolation valve on the lag chiller to be started.
4. Lag chiller shall be enabled when pump flows are proven for orderly system startup.
5. The lag chiller shall stage on and run in unison with the lead chiller(s) to maintain chilled water temperature setpoint.
6. After chiller operating status is proven, the demand limit control for the operating chillers shall reset to 100%.

G. Chiller Staging - Stop Lag Chiller(s):
1. When the sum of the total chilled water flow through the operating chillers drops below total minimum GPM of the operating chillers, a lag chiller shall be shut down.
2. The lag chiller is commanded off and the associated chiller isolation valve shall be slowly closed.

H. Chiller isolation control valve:
1. The chiller isolation control valve shall open slowly prior to the starting of the associated chiller.

I. Chilled Water Pumps CP-1, CP-2:
1. The pumps shall operate in lead/stand by sequence. The designated lead pump shall rotate upon one of the following conditions (user selectable):

a. manually through a software switch
b. if pump runtime (adj.) is exceeded
c. weekly
d. monthly

2. Lead Pump CP-1:
   a. Start-Stop: ON when systems are on and any one of the chilled water valves are OPEN.
   b. Modulation of CP-1: Variable speed drive shall modulate to maintain 26 feet of differential pressure between chilled water supply and return at differential pressure sensor.
3. Standby Pump CP-2:
   a. Standby pump shall start automatically upon failure of the lead pump.

J. Chilled Water By-Pass Valve: N.C.
   1. When chilled water pump is on and chilled water flow drops below minimum setting, bypass valve shall be modulated open to maintain setpoint. On a rise above minimum flow, reverse sequence shall occur.

SECTION 23 2113
HYDRONIC PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Hydronic system requirements.

B. Chilled water piping, above grade.

C. Pipe and pipe fittings for:
   1. Chilled water piping system.
   2. Equipment drains and overflows.
   3. Pipe hangers and supports.
   4. Unions, flanges, mechanical couplings, and dielectric connections.

D. Valves:
   1. Ball valves.
   2. Butterfly valves.
   3. Check valves.

1.02 RELATED REQUIREMENTS

A. Section 23 0510 - General HVAC Requirements- Pipe sleeves.

B. Section 23 0553 - IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT.

C. Section 23 0719 - HVAC PIPING INSULATION.

D. Section 23 2114 - HYDRONIC SPECIALTIES.

E. Section 23 2500 - HVAC Water Treatment: Pipe cleaning.

1.03 REFERENCE STANDARDS

A. ASME B16.3 - Malleable Iron Threaded Fittings: Classes 150 and 300; 2016.

B. ASME B16.5 - Pipe Flanges and Flanged Fittings; 2013.

C. ASME B16.22 - Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings; 2013.

D. ASME B31.9 - Building Services Piping; 2014.

E. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2012.

F. ASTM A234/A234M - Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service; 2017.

G. ASTM B32 - Standard Specification for Solder Metal; 2008 (Reapproved 2014).

H. ASTM B88 - Standard Specification for Seamless Copper Water Tube; 2016.

I. ASTM B88M - Standard Specification for Seamless Copper Water Tube (Metric); 2016.

J. ASTM D1785 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120; 2015.

K. ASTM D2241 - Standard Specification for Poly (Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series); 2015.

L. ASTM D2467 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80; 2015.

M. ASTM D2680 - Standard Specification for Acrylonitrile-Butadiene-Styrene (ABS) and Poly(Vinyl Chloride) (PVC) Composite Sewer Piping; 2001 (Reapproved 2014).

N. ASTM F708 - Standard Practice for Design and Installation of Rigid Pipe Hangers; 1992 (Reapproved 2014).

O. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2015, with Errata (2016).

P. AWWA C111/A21.11 - Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings; 2017.

Q. MSS SP-58 - Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation; 2009.

1.04 SYSTEM DESCRIPTION

A. Where more than one piping system material is specified, ensure system components are compatible and joined to ensure the integrity of the system is not jeopardized. Provide necessary joining fittings. Ensure flanges, union, and couplings for servicing are consistently provided.

B. Pipe-to-Equipment Connections: Use flanges or unions to allow disconnection of components for servicing; do not use direct welded, soldered, or threaded connections.

C. Provide non-conducting dielectric connections whenever jointing dissimilar metals.

D. Fittings: Mitered Fittings and tapped pipes are not allowed. Weld elbows shall be long radius unless otherwise noted.

E. Weldolets and Threadolets in Steel Piping: Weldolets and threadolets may be used for side outlet reducing tees if more than two pipe sizes smaller than main. Bonney Forge or Allied type 1 branchlet.

F. Provide pipe hangers and supports in accordance with ASME B31.9 unless indicated otherwise.

G. Support piping independently from equipment.

H. Provide valves for shut-off and to isolate equipment, or part of systems.

I. Provide ball or butterfly valves for throttling or manual flow control service(balance valve).

J. Provide check valves on discharge of all pumps.

K. Use butterfly valves in chilled water systems for throttling, bypass and isolation service (Refer to Flow diagrams and Details).

L. Butterfly valves used to isolate equipment or to isolate lines where flanges will be removed shall be lug end.

M. Drains: Provide 3/4 inch ball valves with gasketed cap with chain for drains at main shut off valves, low points of piping, bases of vertical risers, and at equipment.

N. Provide a 3/4 inch ball valve main drain in the low point of each system for purpose of draining the system.

O. Air Vents: Provide manual or automatic air vents in accordance with Section 23 2114 at all high points in the piping and where shown.

1.05 SUBMITTALS

A. Refer to Section 23 0510 - General HVAC Requirements for submittal procedures.

B. Welders Certificate: Include welders certification of compliance with ASME (BPV IX).

C. Product Data:
   1. Include data on pipe materials, pipe fittings, valves, and accessories.
   2. Provide manufacturers catalogue information.
   3. Indicate valve data and ratings.

D. Manufacturer's Installation Instructions: Indicate hanging and support methods, joining procedures.

E. Maintenance Data: Include installation instructions, spare parts lists, exploded assembly views.

1.06 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in performing work of the type specified in this section, with minimum five years of experience.

B. Welder Qualifications: Certify in accordance with ASME (BPV IX).

1.07 REGULATORY REQUIREMENTS

A. Conform to ASME B31.9 code for installation of piping system.

B. Welding Materials and Procedures: Conform to ASME (BPV IX) and applicable state labor regulations.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Accept piping on site and inspect for cleanliness. Store in staging area in a protected location above grade.

B. Accept valves on site in shipping containers with labeling in place. Inspect for damage and store in a protected location.

C. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.

D. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.

PART 2 PRODUCTS

2.01 HYDRONIC SYSTEM REQUIREMENTS

A. Comply with ASME B31.9 and applicable federal, state, and local regulations.

B. Piping: Provide piping, fittings, hangers and supports as required, as indicated, and as follows:
   1. Where more than one piping system material is specified, provide joining fittings that are compatible with piping materials and ensure that the integrity of the system is not jeopardized.
   2. Use non-conducting dielectric connections whenever jointing dissimilar metals.
   3. Provide pipe hangers and supports in accordance with ASME B31.9 or MSS SP-58 unless indicated otherwise.

C. Pipe-to-Equipment Connections: Use unions or grooved couplings to allow disconnection of components for servicing; do not use direct welded, soldered, or threaded connections.

2.02 CHILLED WATER PIPING, ABOVE GROUND

A. Steel Pipe: ASTM A 53/A 53M, Schedule 40, black; using one of the following joint types:
   1. Welded Joints: ASTM A234/A234M, wrought steel welding type fittings; AWS D1.1/D1.1M welded.
   2. Threaded Joints: ASTM B 16.3, malleable iron fittings.
   3. Joints:
      a. Pipe sizes 2 inch and smaller: Threaded.
      b. Pipe sizes 2-1/2 inch & larger and all concealed above non-accessible ceilings: AWS D1.1,welded.

2.03 EQUIPMENT DRAINS AND OVERFLOWS

A. Copper Tube: ASTM B88 (ASTM B88M), Type K (A), drawn; using one of the following joint types:
   1. Solder Joints: ASME B16.18 cast brass/bronze or ASME B16.22 solder wrought copper fittings; ASTM B32 lead-free solder, HB alloy 96 Sn/4 Ag (tin - silver.)

2.04 PIPE HANGERS AND SUPPORTS

A. Provide hangers and supports that comply with MSS SP-58.
   1. If type of hanger or support for a particular situation is not indicated, select appropriate type using MSS SP-58 recommendations.

B. Manufacturers: B-Line, Grinnell, Globe or Michigan. Figure numbers are for Michigan.

C. Conform to ASME B31.9.

D. Hangers Sizes 1/2 to 3/4 Inch: Carbon steel, adjustable swivel, loop. Figure 100.

E. Hangers Sized for Cold Pipe 1 Inch and Over: Carbon steel, adjustable, clevis. Figure 400.

F. Multiple or Trapeze Hangers(Over 2 inch pipe size): Steel channels with welded spacers and hanger rods.

G. Wall Support for Single Pipe Sizes to 3 Inches: Carbon steel extension split ring pipe clamp, Figure 455.

H. Wall Support for Vertical Multiple Pipes(1-1/2 inch and under: Green epoxy coated, cold formed, lipped steel channel horizontal member, 1-5/8" x 1-5/8" x 12 gauge base. Secure pipes to base with pipe/tubing clamps and elastomer cushion.

I. Wall Support for Pipe Sizes 4 Inches and Over: Heavy duty, Welded carbon steel bracket and wrought steel clamp, Figure 353.

J. Floor Support for Cold Pipe(Pipe Stanchion): Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.

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

L. Inserts: Malleable iron case of galvanized steel shell and expander plug for threaded connection with lateral adjustment, top slot for reinforcing rods, lugs for attaching to forms; size inserts to suit threaded hanger rods.

2.05 UNIONS, FLANGES, MECHANICAL COUPLINGS, AND DIELECTRIC CONNECTIONS

A. Unions for Pipe 2 Inches and Less:
   1. Ferrous Piping: 150 psig malleable iron, threaded.
   2. Copper Pipe: 400 psig WOG @ 275 degrees F, Brass O-Ring type with EPDM O-Ring , brass nut and tailpiece. Threaded or soldered with reduced size end connection as required by component connection. Apollo UA, FDI UP
   3. Test Plug tappings may be included on union tailpieces to provide the test plugs specified at piping components.

B. Flanges for Pipe 2 Inches and Greater:
   1. Ferrous Piping: 150 psig forged steel, slip-on, unless noted otherwise.
   2. Gaskets: 1/16 inch thick composition sheet type gasket with aramid fiber and NBR binder. Gasket material shall be asbestos-free conforming to ASTM B16.5-2013, selected for the pressure, temperature, and service of the specific joint. Garlock BLUE-GARD 3000, TEADIT NA1001, or similar.

C. Dielectric Connections: Dielectric nipple with galvanized or plated steel threaded ends. FDI-DN, Perfection, Pro Hydronic Specialties.

2.06 BALL VALVES

A. Up To and Including 2 Inches:
   1. Two Piece Manufacturers: Apollo Model 70-100, Crane 9301, Flow Design HB/HC, Hammond 8201, Milwaukee BA200, Nibco T580, Stockham T255, Watts B6000.
   2. 400 psig WOG, Bronze two piece body, full port, chrome plated brass ball, reinforced teflon seats and stuffing box ring, blow-out proof stem design, adjustable packing gland, zinc coated steel lever handle with vinyl hand grip with memory stops on balance valves, threaded ends .

2.07 BUTTERFLY VALVES (OVER 2 INCHES)

A. Manufacturers: Centerline Model 200, Crane 12, Grinnell 8000, Hammond 5111, Milwaukee WA, Mueller 66M, Nibco WD-2000-3, Stockham LG551, Victaulic 761/W761.

B. Location: Use where specifically shown on Drawings, Detail or Flow Diagram. Refer to Legend for butterfly valve symbol.

C. Body: Cast or ductile iron with resilient replaceable EPDM seat, wafer or lug ends, extended neck.

D. Disc: Aluminum bronze.

E. Operator: 10 position lever handle.

2.08 SPRING LOADED CHECK VALVES(OVER 2 INCH)

A. Manufacturers: Centerline Model CLC, Duo-Check G12HMP, Hammond IR9253, Marlin HZNSF, Metraflex 700, Milwaukee 1400, Muessco 91AP/92AP, Stockham WG970, Victaulic 716/779.

B. Iron body, bronze trim, split plate, hinged with stainless steel spring, resilient seal bonded to body, wafer or threaded lug ends.

PART 3 EXECUTION

3.01 PREPARATION

A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.

B. Remove scale and dirt on inside and outside before assembly.

C. Prepare piping connections to equipment using jointing system specified.

D. Keep open ends of pipe free from scale and dirt. Protect open ends with temporary plugs or caps.

E. After completion, fill, clean, and treat systems. Refer to Section 23 2500 for additional requirements.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Route piping in orderly manner, parallel to building structure, and maintain plumb and level, unless noted otherwise.

C. Maintain 4 inch clearance between pipe and fittings after insulation.

D. Install piping to conserve building space and to avoid interfere with use of space.

E. Group piping at common elevations.

F. Sleeve pipe passing through new masonry partitions, walls and floors. Provide sleeves at rated partitions as required by firestopping assembly.

G. Maintain top of piping level with eccentric reducers. Arrange to drain at low points.

H. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.

I. Pipe Hangers and Supports:
   1. Install in accordance with ASME B31.9, ASTM F708, or MSS SP-58.
   2. Support horizontal piping as scheduled.
   3. Install hangers to provide minimum 1/2 inch space between finished covering and adjacent work.
   4. Place hangers within 24 inches of each horizontal elbow.
   5. Use hangers with 1-1/2 inch minimum vertical adjustment. Design hangers for pipe movement without disengagement of supported pipe.
   6. Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.
   7. Use double nuts and lock washers on threaded rod supports.
   8. Prime coat concealed steel hangers and supports not provided with a corrosion resistant finish. Refer to Section 09 9000.
   9. Support piping from floor only where shown on drawings or where piping is routed along floor.

J. Prepare exposed unfinished pipe, fittings, supports, and accessories, ready for finish painting.

K. Install valves and pipe appurtenances in a readily accessible location.

L. Install valves with stems upright or horizontal, not inverted.

M. Unions: Provide unions at locations specified and at all locations to permit removal of equipment and ATC control valves for service. Install in correct direction with brass nut

upstream. Do not install unions to expedite pipe assembly. Use flanges or grooved coupling for unions for pipes sizes over 2 inch.

N. Dissimilar Metals (Dielectric): Provide dielectric nipples to provide separation between ferrous and nonferrous piping/fittings. Install on ferrous side of connection. Do not install dielectric unions. Dielectric connection shall be comprised of dielectric nipple or thread-to sweat brass adapter or brass valve. Install unions specified with dielectric nipple where separation is required at a union.

O. Steel Pipe Nipples: All thread (close) nipples are prohibited. Nipples 1-1/2 inch and smaller and attached to larger pipes shall be schedule 80 and attached by the use of threadolets.

P. Hydronic Differential Pressure sensors: Orient pipe tapping on side of pipe. Do not connect to top or bottom of pipe.

3.03 SCHEDULES

A. Hanger spacing indicated is maximum span based on pipe material and size. Conform to structural spacing and load capacity of structural support points and provide closer spacing as required.

B. Hanger Spacing for Steel Piping.
1. 1/2 inch, 3/4 inch, and 1 inch: Maximum span, 7 feet; minimum rod size, 1/4 inch.
2. 1-1/4 inches: Maximum span, 8 feet; minimum rod size, 3/8 inch.
3. 1-1/2 inches: Maximum span, 9 feet; minimum rod size, 3/8 inch.
4. 2 inches: Maximum span, 10 feet; minimum rod size, 3/8 inch.
5. 2-1/2 inches: Maximum span, 11 feet; minimum rod size, 3/8 inch.
6. 3 inches: Maximum span, 12 feet; minimum rod size, 3/8 inch.
7. 4 inches: Maximum span, 14 feet; minimum rod size, 1/2 inch.
8. 6 inches: Maximum span, 17 feet; minimum rod size, 1/2 inch.

END OF SECTION

SECTION 23 2114
HYDRONIC SPECIALTIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Make-up water station.

B. Air vents.

C. Pump suction diffuser fittings.

D. Relief valves.

1.02 RELATED REQUIREMENTS

A. Section 23 2113 - HYDRONIC PIPING.

1.03 REFERENCE STANDARDS

1.04 ADMINISTRATIVE REQUIREMENTS

A. ASSE 1013 - Reduced Pressure Principle Backflow Preventers; American Society of Sanitary Engineering; 1993.

1.05 SUBMITTALS

A. Refer to Section 23 0510 - General HVAC Requirements for submittal procedures.

B. Product Data: Provide product data for manufactured products and assemblies required for this project. Include component sizes, rough-in requirements, service sizes, and finishes. Include product description, model and dimensions.

C. Manufacturer's Installation Instructions: Indicate hanging and support methods, joining procedures.

D. Maintenance Data: Include installation instructions, assembly views, lubrication instructions, and replacement parts list.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Accept specialties on site in shipping containers with labeling in place. Inspect for damage.

B. Provide temporary end caps and closures on specialties. Maintain in place until installation.

C. Protect from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.

PART 2 PRODUCTS

2.01 MAKE-UP WATER STATION

A. Pressure reducing valve, backflow preventer, test cocks, strainer, Gauge, and valved by-pass, Refer to Detail on Drawings.

B. Pressure Reducing Valve: 300 PSIG maximum working pressure at 160 degrees F maximum operating temperature. Bronze pressure reducing valve for dead-end service with NPT union inlet and NPT female outlet for standard (25-75 PSIG) or low (10-35 PSIG) reduced pressure range as shown on drawings.Watts U5B.

C. Backflow Preventer: ASSE Std 1013, 175 PSIG maximum working pressure Bronze Reduced Pressure type with built-in air gap, air gap fitting, test cocks and isolation ball valves. Manufacturers: Watts 009, Conbraco Series 40-200, Febco Series 825Y, Hersey Series FRP-11, or Wilkins Series 975XLS

2.02 AIR VENTS

A. Manual Type:

1. Pipe Sizes up to 2 inches: Short vertical sections of pipe to form air chamber, same size as pipe, with 1/2 inch brass ball or gate valve at top of chamber.

2. Pipe Sizes 2-1/2 inches and over. Short vertical sections of 2-1/2 inch diameter pipe to form air chamber, with 1/2 inch brass ball or gate valve at top of chamber.
3. Equipment Rooms: Terminate discharge along wall with valve and hose end connection in an accessible location. Refer to detail on drawings.

B. Automatic Float Type:
1. Manufacturers: Amtrol 706, Armstrong 75, Hoffman 79, Wheatley 79, Watts 4VA.
2. Brass or semi-steel body, copper, polypropylene, or solid non-metallic float, stainless steel valve and valve seat; suitable for system operating temperature and pressure; with isolating valve.

2.03 PUMP SUCTION DIFFUSER FITTINGS

A. Manufacturers:
1. Armstrong SG.
2. ITT Bell & Gossett.
3. Mueller 1011.
4. Patterson SD.
5. Weatley SO.
6. Taco SD

B. Fitting: Angle pattern, cast-iron body, threaded for 2 inch and smaller, flanged for 2-1/2 inch and larger, rated for 175 psi working pressure and sized for pump and system connections, with stainless steel inlet vanes, stainless steel cylinder strainer arranged for horizontal removal, disposable fine mesh start-up strainer to fit over cylinder strainer, and permanent magnet located in flow stream and removable for cleaning.

C. Cylinder strainer with 3/16 inch diameter openings for closed piping systems.

D. Cylinder strainer with 1/8 inch diameter openings for open piping systems.

E. Accessories: Adjustable foot support, blowdown tapping in bottom, gage tapping in side.

2.04 RELIEF VALVES

A. Manufacturers:
1. Watts Model 3L; 174A.
2. Other acceptable manufacturers offering equivalent products: Armstrong, Bell & Gossett, Hoffman, Kunkle, Spence.

B. Bronze body, teflon seat, stainless steel stem and springs and test lever, automatic, direct pressure actuated, capacities ASME certified and labelled.

PART 3 EXECUTION

3.01 INSTALLATION

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

B. Install specialties in a readily accessible location.

C. Adjust pressure reducing valve for initial fill pressure indicated on Drawings.

D. Provide manual air vents at system high points and as indicated.

E. Provide valved drain and hose connection on strainer blow down connection.

F. Remove temporary strainers after cleaning systems and approximately 60 hours operating time. Tie to pump fitting without cleaning for removal after observation.

G. Pipe relief valve outlet to floor. End of pipe or fitting shall not be threaded.

END OF SECTION

SECTION 23 2123
HYDRONIC PUMPS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Base mounted, end suction pumps.

1.02 RELATED REQUIREMENTS

A. Section 03 3000 - Cast-in-Place Concrete.

B. Section 23 0513 - MOTORS FOR HVAC EQUIPMENT.

C. Section 23 0514 - VARIABLE FREQUENCY CONTROLLERS.

D. Section 26 0583 - Wiring Connections: Electrical characteristics and wiring connections.

1.03 REFERENCE STANDARDS

A. NFPA 70 - National Electrical Code, 2011 Edition; National Fire Protection Association

B. UL 778 - Standard for Motor-Operated Water Pumps; Current Edition, Including All Revisions.

1.04 PERFORMANCE REQUIREMENTS

A. All pumps shall operate at 1750 RPM unless noted otherwise.

B. Pump motors shall not overload at any point on the pump curve.

C. Impeller diameter shall not exceed 85% of casing accommodation as measured from pump cut water through centerline of shaft.

D. Pump characteristic curve shall rise continuously from maximum capacity to shut-off with shut-off head a minimum 10% greater than design head.

1.05 SUBMITTALS

A. Refer to Section 23 0510 - General HVAC Requirements for submittal procedures.

B. Submit all items in the fluid stream with or prior to pump submittals.

C. Product Data: Provide certified pump curves showing performance characteristics with pump and system operating point plotted. Include NPSH curve when applicable. Include electrical characteristics and connection requirements.

D. Manufacturer's Installation Instructions: Indicate hanging and support requirements and recommendations.

E. Operation and Maintenance Data: Include installation instructions, assembly views, lubrication instructions, and replacement parts list.

F. Certificate: Provide Manufacturer's Certificate complying with the requirements of the General Conditions.

1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacture, assembly, and field performance of pumps, with minimum three years of documented experience.

1.07 REGULATORY REQUIREMENTS

A. Products Requiring Electrical Connection: Listed and classified by UL 778 as suitable for the purpose specified and indicated.

PART 2 PRODUCTS

2.01 HVAC PUMPS - GENERAL

A. Provide pumps that operate at specified system fluid temperatures without vapor binding and cavitation, are non-overloading in parallel or individual operation, and operate within 25 percent of midpoint of published maximum efficiency curve.

B. Products Requiring Electrical Connection: Listed and classified by UL or testing agency acceptable to authority having jurisdiction as suitable for the purpose specified and indicated.

2.02 BASE MOUNTED END SUCTION PUMPS (ES)

A. Manufacturers:
1. Aurora; Model 344A: www.aurorapump.com
2. Armstrong; Model 4030: www.armstrongpumps.com
3. Bell and Gossett; Model 1510: www.bellgossett.com
4. Flo-Fab; Model 2000: www.flofab.com
5. Patterson; Model HVES: www.pattersonpumps.com
6. Peerless; Model F: www.peerlesspump.com
7. Paco; Model LF: www.paco-pumps.com
8. Taco; Model FI: www.taco-hvac.com

B. Type: Horizontal shaft, single stage, direct connected, radially split casing, for 125 psi maximum working pressure.

C. Casing: Casing shall be minimum Class 35 cast iron and provided with suction and discharge gage ports, renewable bronze casing wearing rings, seal flush connection, drain plug(s) at the low point(s), vent(s) at the high point(s), flanged suction and discharge.

D. Impeller: Impeller shall be centrifugal, fully enclosed, non-overloading, bronze and keyed to shaft with a guide ring and mechanical seal.

E. Bearings: Bearings shall be Grease lubricated steel roller or ball bearings. Bearing assembly shall be replaceable without disturbing the system piping and shall have foot support at the coupling end. Pump bearings shall be regreaseable without removal of the bearings from the bearing assembly.

F. Shaft: Shaft shall be SAE 1144 steel with a #304 stainless steel shaft sleeve.

G. Seal: Mechanical seal(s) shall be carbon rotating against a stationary ceramic seat, 225 degrees F maximum continuous operating temperature.

H. Coupling: Pump and motor shall be direct connected through Woods Standard Sureflex flexible coupling with coupling guard mounted on a common metal base.

I. Base plate shall be of structural steel or fabricated steel channel configuration fully enclosed at sides and ends, with securely welded cross members and fully open grouting area (for field grouting). The minimum base plate stiffness shall conform to ANSI/HI-2009 for grouted Horizontal Baseplate Design standards.

J. Bases for pumps handling chilled water shall be provided with a stainless steel drain pan extending under the suction diffuser and 1/2-inch tapped drainage opening.

K. Each pump shall be hydrostatically tested and painted with one coat of high quality factory approved paint and name-plated before shipment from the factory.

L. Motor: 1750 rpm unless specified otherwise; refer to Section 23 0513.

M. Variable Frequency Drive: Factory Mounted VFD; refer to Section 23 0514 for VFD requirements.

PART 3 EXECUTION

3.01 PREPARATION

A. Verify that electric power is available and of the correct characteristics.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Provide access space around pumps for service. Provide no less than minimum space recommended by manufacturer.

C. Provide line sized shut-off valve and strainer on pump suction, and line sized soft seat check valve and balancing valve on pump discharge.

D. Provide drains for bases and seals, piped to and discharging into floor drains.

E. Install base mounted pumps on concrete housekeeping base, with anchor bolts, set and level, and grout pump base in place after alignment. Refer to Section 03 3000.

F. Check, align, and certify alignment of base mounted pumps after pump leveling, after piping connections are made, and again after operation of the system for a three (3) week continuous period of time.

G. Install pressure gauge on each base mounted pump as detailed. Gauge piping shall be copper tubing extended from pump tappings.

H. Install base mounted pumps on concrete housekeeping base, with anchor bolts, set and level, and grout pump base in place after alignment. Refer to Section 03 3000.

I. Lubricate pumps before start-up.

3.03 STARTING EQUIPMENT

A. Provide manufacturer's field representative to prepare and start equipment.

B. Adjust for proper operation within manufacturer's published tolerances.

C. Demonstrate proper operation of equipment to Owner 's designated representative.

D. Provide start-up certificate in the format prescribed by the General Conditions.

3.04 SCHEDULES

A. Refer to Pump Schedule on Drawings.

END OF SECTION

SECTION 23 2500
HVAC WATER TREATMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Materials.
   1. System cleaner.
   2. Closed system treatment (water).

B. By-pass (pot) feeder.

C. Cleaning of piping systems.

D. Chemical treatment.

1.02 RELATED REQUIREMENTS

A. Section 23 2113 - HYDRONIC PIPING.

B. Section 23 2114 - HYDRONIC SPECIALTIES.

1.03 SUBMITTALS

A. Refer to Section 23 0510 - General HVAC Requirements for submittal procedures.

B. Product Data: Provide chemical treatment materials, chemicals, and equipment including electrical characteristics and connection requirements.

C. Manufacturer's Field Reports: Indicate start-up of treatment systems when completed and operating properly. Indicate analysis of system water after cleaning and after treatment.

D. Certificate: Provide Manufacturer's Certificate complying with the requirements of the General Conditions.

1.04 REGULATORY REQUIREMENTS

A. Conform to applicable code for addition of non-potable chemicals to building mechanical systems and to public sewage systems.

B. Test equipment: Furnish basic water testing equipment to include case and spare reagents for maintaining control of the program standards in the closed loop systems. The test kit shall include reagents and apparatus for determination of corrosion inhibitor level in the loop. All test equipment shall be delivered to the HVAC Shop at start-up.

PART 2 PRODUCTS

2.01 MATERIALS

A. System Cleaner:
   1. Liquid alkaline compound with emulsifying agents and detergents to remove grease and petroleum products; sodiumtripoly phosphate and sodium molybdate.
   2. The cleaner shall contain an inorganic phosphate, an organic corrosion inhibitor, dispersant, and an oil emulsifier.

B. Closed System Treatment (Water):
   1. Sequestering agent to reduce deposits and adjust pH; polyphosphate.
   2. Corrosion inhibitors; boron-nitrite, sodium nitrite and borax, sodium totyltriazole, low molecular weight polymers, phosphonates, sodium molybdate, or sulphites.
   3. Conductivity enhancers; phosphates or phosphonates.

2.02 BY-PASS (POT) CHEMICAL FEEDER

A. Manufacturers:
   1. Dearborn; Model AV.
   2. Mogul; Model 7.
   3. Neptune, a brand of the Dover Company; _____: www.neptune1.com/#sle.

B. 1.8 gal tank for working pressure of 175 psi with quick opening cap and pipe tappings.

PART 3 EXECUTION

3.01 PREPARATION

A. Systems shall be prepared, filled, started, and vented prior to cleaning.

B. Contractor shall flush all systems with clean water including mud from drip legs. Remove, clean, and replace all strainers.

C. Flush steel portions of the piping system separate from pipes of other materials. Loop together all steel pipe runs with piping not less than 1/3 the size of run, and remain in place until flushing is complete.

D. Complete circulation shall be achieved during the cleaning procedure with a minimum flow rate velocity of 2 ft./sec. All manual and automatic control valves must be in the open position.

E. All dead end pipe runs must be looped together with piping not less than 1/3 the size of run, and remain in place until cleaning is complete.

F. Place terminal control valves in open position during cleaning.

G. Provide a 1-1/2" ball valve in the low point of each system for purpose of draining the system.

3.02 PREPARATION

A. Systems shall be operational, filled, started, and vented prior to cleaning.

B. Place terminal control valves in open position during cleaning.

C. Contractor shall flush all systems with clean water including mud from drip legs. Remove, clean, and replace all strainers.

D. Contractor shall remove, clean, and replace all strainers.

E. Complete circulation shall be achieved during the cleaning procedure with a minimum flow rate velocity of 2 ft./sec. All manual and automatic control valves must be in the open position.

F. All dead end pipe runs must be looped together with piping not less than 1/3 the size of run, and remain in place until cleaning is complete.

G. Verify that electric power is available and of the correct characteristics.

3.03 CLEANING SEQUENCE

A. Concentration:
   1. As recommended by manufacturer.

B. Chilled Water Systems:
   1. Circulate for 48 hours, then drain systems as quickly as possible.
   2. Refill with clean water, circulate for 24 hours, then drain.
   3. Refill with clean water and repeat until system cleaner is removed.

C. Remove, clean, and replace strainer screens.

D. Remove strainer start-up screens and leave at strainer until the completion of Project observations.

E. Inspect, remove sludge, and flush low points with clean water after cleaning process is completed. Include disassembly of components as required.

F. Inspect make-up water stations, remove sludge, and flush low points with clean water after cleaning process is completed. Include disassembly of components as required.

3.04 INSTALLATION

A. Install in accordance with manufacturer's instructions.

3.05 CLOSED SYSTEM TREATMENT

A. Provide one bypass chemical feeder on each system. Install isolating and drain valves and necessary piping. Install around balancing valve downstream of circulating pumps unless indicated otherwise.

B. Install bypass feeder at a height of approximately 3 ft. to the tank fill opening from the finished floor.

C. Introduce closed system treatment through bypass chemical feeder when required or indicated by test.

3.06 MANUFACTURERS FIELD SERVICES

A. Provide services of factory trained representative to inspect the piping installation and test the cleanliness of the project's piping systems and make-up water system before chemical treatment, Representative shall drain low points and check system strainers for cleanliness and ensure piping systems are clean and ready for chemical treatment.

B. Factory trained representative shall start-up and calibrate chemical feed controls provided under this Section.

C. Factory trained representative shall test each systems chemical treatment prior to the Observation for Substantial Completion.

D. Demonstrate system operation to Owner and instruct Owner in required maintenance.

E. Provide start-up certificate certifying that the piping systems have been cleaned and treated as specified in the format prescribed by the General Conditions.

END OF SECTION

SECTION 26 0002
ELECTRICAL SPECIFICATIONS

PART 1 GENERAL

1.01 26 0501 EXISTING CONDITIONS

A. Hazardous Materials:
   1. A/E's Responsibility: Plans and specifications have been prepared by the A/E for the Owner without the A/E having conducted investigation as to the presence of asbestos or hazardous waste on the project. Not being a part of this contract, the A/E has not charged any fees and has not and will not advise the Owner with regard to the detection and/or removal of asbestos or hazardous waste. The Owner is aware that asbestos or hazardous waste could be present and will make all decisions with regard to its removal. The removal of all hazardous materials and encapsulation of remaining surfaces is the sole responsibility of the Owner.
   2. If the Contractor observes the existence of a friable material which must be disturbed during the course of his work, the Contractor shall promptly notify the Owner and the Architect. The Owner shall make all arrangements regarding testing and removal or encapsulation of asbestos material if present. The Contractor shall not perform any work pertinent to the friable material prior to receipt of special instructions from the Owner through the Architect.
   3. "Friable Material" is any material which can be crumbled, pulverized or reduced to a powder by hand pressure when dry.

1.02 26 0510 GENERAL ELECTRICAL REQUIREMENTS

A. General Items:
   1. Drawings are diagrammatic and show the general location of the equipment, raceway, and equipment, but are not to be scaled. All dimensions shall be verified at the building site. Prefabrication and/or installation of work from drawings shall be at the Contractor's risk. Refer to Architectural plans and sections for exact building dimensions and details.
   2. Provide housekeeping and equipment pads where penetrations occur through any slab in the electrical rooms. Any conduit that penetrates the slab and is exposed in the space shall be wrapped in a housekeeping pad. All electrical items that sit on the slab shall have housekeeping pads below. Rough up slab under bases before pouring concrete.
   3. Where penetrations are made in fire rated partitions, walls, floors or ceilings during the course of electrical installation, these penetrations shall be restored to their intended fire ratings by the use of fittings or materials as approved by Underwriter's Laboratories for this purpose.
   4. Instruct operating personnel designated by the Owner in operation and maintenance of the fire alarm system prior to the request for final inspection. A manufacturer's service representative shall provide the instructions (Instructor shall not be a sales person, but shall be one with service experience on a continuing basis, knowledgeable about the subject equipment.) The Owner will record (audio or video/audio) operating instructions given by the Contractor to the operating personnel.
   5. Regulatory Requirements
      a. Where requirements of these specifications exceed specified codes and ordinances, conform to these specifications.
      b. Materials and equipment included in Underwriters Label Service shall bear that label. Electrical equipment shall be U.L. approved as installed.
      c. Jurisdiction: Where codes or guides refer jurisdiction to local governing code officials, such official in this procedure shall be the State Fire Marshal.
      d. Permits: Obtain all permits, paying all fees in connection therewith. At completion, have work inspected by proper authorities and furnish the Design Professional an inspection certificate showing approval of installation.

e. The Code currently adopted and presently in effect is the 2009 International Energy Conservation Code with all Georgia State Amendments.
f. Fire Prevention: Conform to 2012 International Fire Code with all Georgia State Amendments.
g. Building Code: Conform to the 2012 International Building Code with all Georgia State Amendments.
h. Electrical: Conform to the 2017 National Electrical Code (NEC), NFPA, and the National Electrical Safety Code.
i. Accessibility: Americans with Disability Act.

B. Submittals: Submit electrical items prior to purchase, for confirmation of acceptance. The purpose of submittals is to demonstrate that the Contractor understands the design concept of the project by indicating the equipment and materials he intends to furnish and install, and by detailing the installation he intends to achieve. The review by the Design Professional shall NOT be construed to be for the purpose of "approving" equipment or drawings. Items to submit (not all inclusive - see individual sections for additional requirements):
1. Submit a power wiring letter indicating coordination between the mechanical equipment to be purchased and the electrical breaker shown powering it. Failure to submit this letter will require the Contractor to assume responsibility for any required changes to the electrical design attributed to mechanical equipment. Include a copy of the Tabulated List of Power Wiring Requirements with the letter. The electrical requirements for the mechanical equipment is based on the best information available at the time of design.
2. Operating and Maintenance manuals: at the end of the project provide a binder that contains shop drawings, wiring diagrams, as builts, warranty information and sign in sheets for all owner training sessions.

1.03 26 0519 LOW VOLTAGE POWER CONDUCTORS

A. Design Intent:
1. Provide copper conductors, THHN/THWN insulation.
2. All conductors shall be made in the USA.
3. Provide solid conductors for circuits #10 AWG and smaller, stranded for larger.
4. Provide a dedicated neutral conductor for all branch circuits. THERE SHALL BE NO SHARED NEUTRAL CONDUCTORS.

B. Color Code:
1. 480Y/277 V, 3 Phase, 4 Wire System:
a. Phase A: Brown.
b. Phase B: Orange.
c. Phase C: Yellow.
d. Neutral/Grounded: Gray.
2. 208Y/120 V, 3 Phase, 4 Wire System:
a. Phase A: Black.
b. Phase B: Red.
c. Phase C: Blue.
d. Neutral/Grounded: White.
3. Equipment Ground, All Systems: Green.

C. Submittal Requirements: NONE

1.04 26 0534 CONDUIT

A. Design Intent:
1. All ceilings are exposed in this portion of the building. It is critical that hard pipe conduit be installed in a neat manner, tight to structure, following building lines parallel and perpendicular. Any work that is deemed unacceptable or unsightly by the Design Professional shall be reworked by the Contractor without charge.
2. All conduit shall be made in the USA.
3. All new conduit must be painted to match the surrounding wall or ceiling color.

4. Use Rigid Metal Conduit (RMC) or Intermediate Metal Conduit for any new circuits exposed below 8 feet in mechanical rooms. New conduits located above 8 feet in mechanical and electrical rooms may be EMT.
5. Actual connections to new pumps shall be thru liquid tite flex.

B. Installation:
1. Unless dimensioned, conduit routing indicated is diagrammatic.
2. When conduit destination is indicated and routing is not shown, determine exact routing required.
3. Arrange conduit to provide no more than the equivalent of four 90 degree bends between pull points.
4. Join EMT conduit together with set screw connectors. Provide threaded couplings for RMC and IMC.
5. Provide insulating bushings or insulated throats at all conduit terminations to protect conductors.
6. Provide #16 galvanized pullwire or minimum 200 lb. polyolefin pull cord in each empty conduit except sleeves and nipples.
7. Install firestopping to preserve fire resistance rating of partitions and other elements.

C. Submittal Requirements: NONE

1.05 26 0553 IDENTIFICATION OF ELECTRICAL SYSTEMS

A. Design Intent: Labeling circuits and panels is critical when renovating a space. There cannot be too much labeling.

B. Devices to be labelled include:
1. Motor Control Centers, VFDs, Fused Disconnects: Engraved type, white on black, indicating "Name" and "Fed by Panel-Circuit".
2. New panel directories will be required on any panel that any new work is performed. Where existing work is demolished, the breakers shall be labeled as "spare". If at any time an existing circuit has to be traced to find its origin and the device(s) that it serves; once this information is gathered, the circuit shall be clearly and permanently labeled in the existing panel and on the device in the method described by the detail on the sheet. New work indicated on the panel schedule shall be identified with the load and the room number.

C. Submittal Requirements: NONE

1.06 26 2818 ENCLOSED SAFETY SWITCHES

A. Design Intent: Provide Heavy Duty type with Externally operable handle interlocked to prevent opening front cover with switch in ON position. Provide fuses to match manufacturer's instructions. Label as described in the drawings. Provide NEMA 1 rating indoor, NEMA 3R outdoor.

B. Submittal Requirements: NONE

1.07 26 XXXX STRUCTURED CABLING FOR VOICE, DATA AND COAX - INSIDE PLANT

A. Design Intent - Voice/Data: Route BLUE CAT 6 plenum rated cable from the outlet shown back to the patch panel. Terminate both ends with RJ 45 connectors. Active equipment (handsets, hubs, switches, media converters, etc.) is not included in this contract unless otherwise noted.

B. Design Intent - Pathways: Utilize EMT conduit from the device backbox out of the wall up to above the accessible ceiling. Once above the ceiling, transition to:
1. J hooks in the style of a double 2.5" Arlington loop #TL25 RC14D.

C. Installer Qualifications:
1. The telecommunications installation contractor shall be licensed in the State of Georgia as a Low Voltage Licensed Telecommunications Contractor (LVLTC).
2. The selected LVLTC shall be fully capable and experienced in the telecommunications distribution system to be installed.

3. The LVLTC shall have a minimum of five (3) years of experience installing Structured Cabling Systems and be a certified installer of the approved cable/component system solution.

D. Labeling Horizontal Cables:
   1. Permanently secure the label within 6 inches from both ends of the cable and at all pull boxes.
   2. Label shall indicate patch panel and port to which the horizontal cable is terminated.

E. Testing - Copper Cabling and Associated Equipment:
   1. Test backbone cables after termination but before cross-connection.
   2. Category 6 Links: Perform tests for wire map, length, DC continuity, attenuation, NEXT, PSNEXT, ELFEXT, PSELFEXT, return loss, and propagation delay.
   3. Utilize a Level IIe tester for Category 6 link compliance. If any part of the installed system results in a "FAIL" indicator on the tester, the problem shall be analyzed and corrected.
   4. Testers shall be correctly set to test the type and manufacturer of the horizontal cable used in the link being tested, including the correct NVP.

F. Submittal Requirements: Submit the cable test results.

END OF SECTION