SP Design Group
ARCHITECTS AND ENGINEERS, INC.
TRUTH ▪ TRUST ▪ VALUE

Date: 6-18-2026

RE: Project Number FH100
FVSU Field House Modifications
At Fort Valley State University

Addendum #1

INFORMATION:

1. There is no Equipment model number or sizing information for the DOAS or AHU-1 system? **ANSWER** – Equipment capacities are provided in the equipment schedules. Refer to specification section 23 7423 for approved manufacturers for AHU-1 and section 23 7425 for approved manufacturers for DOAS units.
2. Is this a Davis Bacon project? **ANSWER**-No

PROJECT MANUAL

Construction Contract – Delete and replace with attached Construction Contract

Bid Form – Delete and replace with attached Bid Form

Add Section 01 2300 –Alternates

Section 01 1100 –Summary of Work

1. Paragraph 1.3, A: Delete in its entirety and replace with the following "Coordinate construction schedule and operations with the Owner. Note that the project will take place during/after the football season. The contractor will have full use of the building and the immediate site around the building. No work will be allowed during a home game. The home games are as follows:"
2. Paragraph 1.4, A: Delete the last sentence.

Section 08 1113 –Hollow Metal Doors & Frames

1. Paragraph 2.4, C, 2: Delete "6 panel"

Section 10 2116 –Plastic Toilet Compartments

1. Paragraph 2.1, A – Add the following as 4 "Products meeting specifications by Scranton Products (Hiny Hidders) are acceptable."

Section 10 2813 –Toilet Accessories

1. Paragraph 2.8, G – Add the following as 3 "Products meeting specifications by Speedflow Plus are acceptable."

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Section 23 0923 –Direct-Digital Control System for HVAC

1. Paragraph 2.1: Add the following as A “Delta Controls by Control Concepts”
2. Paragraph 2.1: Add the following as B “KMC controls by ESS”
3. See attached revised specification section 23 0923 with the manufacturers included.

End of Addendum #1

478.477.7465
SPDESIGNGRP.COM
5191 COLUMBUS ROAD
MACON, GA 31206
P.O. BOX 6254
MACON, GA 31208

CONSTRUCTION CONTRACT

BETWEEN CONTRACTOR AND OWNER

THIS CONSTRUCTION CONTRACT (hereinafter the "Contract") made this day of _____ (hereinafter the "Effective Date"), by and between the **BOARD OF REGENTS OF THE UNIVERSITY SYSTEM OF GEORGIA** (hereinafter the "Owner"), for the use and benefit of **Fort Valley State University** (hereinafter the "Using Agency" or "Institution") **LEGAL Firm Name**, (hereinafter the "CM/GC"), whose address is MUST be a physical address. NO P.O. Boxes.

(a) Contractor's FEIN or Tax Identification Number: _____

(b) Contractor's Georgia License Type and Number: _____

(c) Contractor's Federal Employment Verification Certification:
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: _____

WITNESSETH, that the Contractor and the Owner, for the consideration set forth herein, the adequacy and sufficiency of which is hereby acknowledged by each party, agree as follows:

Project No. FH100

Project Name and Description: FVSU FIELD HOUSE MODIFICATIONS (hereinafter the "Project.")

1. Existing Documents. The Contractor has reviewed and taken into consideration the Bidding Documents in preparing his bid.

2. The Contract Sum: The Owner shall pay the Contractor for the performance of the contract, subject to additions and deductions provided by approved change orders, in current funds, the Contract Sum as follows:

INSERT CONTRACT SUM Dollars ($_____)

3. The Material Completion and Occupancy Date shall be achieved within **Two Hundred Ten (210)** consecutive calendar days beginning the date specified in the Proceed Order.

4. **The agreed daily amount for Liquidated Damages is:** **$** 0 per day.

5. **The agreed daily amount for Time Dependent Overhead Costs is:** $_____ per day.

6. Notice. All notices in accordance with Section 1.1.5 shall be given to the following addresses:

CONTRACTOR:

Contractor Name
Physical Address, NO P.O. Boxes
City, State Zip
Attention: Contractor POC for Project
Phone Number: Contractor Phone
Facsimile Number: Contractor Fax
Email: Contractor Email address

OWNER:
Board of Regents of the University System of Georgia
270 Washington Street, SW, 6th Floor
Atlanta, Georgia 30334
Attention: Vice Chancellor for Facilities
Phone Number: 404-656-2243
Facsimile Number: 404-657-7433

OWNER'S REPRESENTATIVE:
Board of Regents of the University System of Georgia
270 Washington Street, SW, 6th Floor
Atlanta, Georgia 30334
Attention: Choose One
Phone Number: BOR - PM Phone
Facsimile Number: 404-657-1479
Email: Choose Appropriate Email

USING AGENCY (Institution):
Fort Valley State University
1005 State University Drive
Fort Valley, Georgia 31034314
Attention: Dr. Paul Jones
Phone Number:
Facsimile Number:
Email:

DESIGN PROFESSIONAL:
SP Design Group, Architects and Engineers Inc.
5191 Columbus Road
Macon, Georgia 31206
Attention: Robert A. Day
Phone Number: 478 745 1167
Facsimile Number:
Email: bday@spdesigngrp.com

7. Scope Of The Work: The Contractor shall furnish all the materials, perform all of the Work, and do all things required by the Contract Documents.

8. Schedule and Completion: The Pre-commencement Phase Services to be performed under this Contract shall commence upon the Effective Date of the Contract and be completed within 70 days thereafter. Activities on the Site shall commence on the date specified in the Proceed Order and shall be materially complete in accordance with established Milestones, and not later than the Material Completion and Occupancy Date.

9. Periodic Progress Payments: The Owner shall make progress payments, less retainage, as set forth in Section 4 of the General Conditions.

10. Payment for Material Completion: The Contractor may request payment of the remaining contract balance, including retainage, less amounts credited the Owner or incurred as liquidated damages, and less amounts withheld for the Punchlist by reason of Minor Items or Permitted Incomplete Work (See Paragraph 6.5.3.2). Payment for Material Completion shall be made by a check payable jointly to the Contractor and Surety and shall be mailed to the Surety.

11. Final Payment: Final Payment shall be made within ten days of receipt of the final payment application as set forth in Section 6, Part 2 of the General Conditions, provided that all other requirements of the Contract shall have been met in full.

12. The Contract Documents: **This Contract, together with the Bidding Documents and the Bid, shall constitute the Contract Documents for the Project.**

13. Bonds: The Contractor shall furnish both a performance bond and a payment bond and shall pay the premiums thereon as a Cost of the Work. The Performance Bond shall guarantee the full performance of the Contract.

14. Full Performance: The Owner and the Contractor hereby agree to the full performance of the Contract Documents.

15. Applicable Law: This Contract and all rights, privileges and responsibilities shall be interpreted and construed according to the laws of the State of Georgia.

16. No Conflict Of Interest: The Contractor covenants that it presently has no interest and shall not acquire any interest, direct or indirect, that would conflict in any manner or degree with the performance required under this Contract. The Contractor

further covenants that, in the performance of this Contract, it shall neither contract with nor employ any person having any such interest.

17. Transactions With State Officials, Ethics: The parties hereto certify that the provisions of law contained in the Act prohibiting full-time appointive officials and employees of the State from engaging in certain transactions affecting the State as defined in O.C.G.A. §§45-10-20–26 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.

18. No Assignment: This Contract and the proceeds of this Contract may not be assigned or sublet as a whole, nor may the performance thereunder be assigned, without the prior written consent of the Owner.

19. No Waiver: The failure of the Owner at any time to require performance by the Contractor of any provision hereof, shall in no way affect the right of the Owner thereafter to enforce any provision or any part of the Contract, nor shall the failure of the Owner to enforce any breach of any provision hereof to be taken or held to be a waiver of such provision, or as a waiver, modification or rescission of the Contract itself.

20. Full Agreement. The Contract Documents supersede all prior negotiations, discussion, statements, and agreements between Owner and Contractor and constitute the full, complete, and entire agreement between Owner and Contractor. There can be no changes to this Contract by oral means, nor by course of conduct of the parties, nor by custom of the trade. No changes to this Contract will be binding on either party hereto unless such change is properly authorized, in writing, in accordance with Section 3, Part 2 of the General Conditions.

[Remainder of Page Intentionally Left Blank]

[Signatures Begin on Next Page]

IN WITNESS WHEREOF the parties hereto have executed this Contract the day and year first written above.

Contractor

ATTEST:

_____ (L.S.)

_____, SECRETARY

(SEAL, OVER SIGNATURE)
(If not a corporation, signature must be notarized.)

BY: _____ (L.S.)

_____, PRESIDENT

APPROVED: USING AGENCY

BY: _____
Dr. Paul A. Jones, PRESIDENT
FORT VALLEY STATE UNIVERSITY

WITNESS: _____

_____
(PRINT NAME / TITLE)

Attachments:
1. General Conditions and Forms
2. Supplementary General Conditions

BID REQUIREMENTS

BID FORM

To: OWNER _____ _____

_____ _____

Re: Project Name and No. FH100, FVSU FIELD HOUSE MODIFICATIONS

Bid Date: June 30, 2026, 2:00 pm

THE BID:

Bid. Having carefully examined the Specifications entitled **PROJECT NO. FH100, FVSU FIELD HOUSE MODIFICATIONS**, and the Bidding Documents and Addendum (a) No.(s) A1, _____, 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 (see section 01 2300, Alternates) be accepted and be incorporated in the Contract, the Bid will be altered in each case as follows:

Alternate No. 1 – To remove all work associated with the Plumbing as defined in section 01 2300 1.4, A.

DEDUCT the sum of _____

Dollars ($_____)

Alternate No. 2 – To remove all work associated with the Doors and Hardware as defined in section 01 2300 1.4, B.

DEDUCT the sum of _____

Dollars ($_____)

Alternate No. 3 – To remove all work associated with the Painting as defined in section 01 2300 1.4, C.

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 **Two Hundred Ten (210)** 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 (P.O. BOX IS INSUFFICIENT)

_____
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:
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.

SECTION 01 2300

ALTERNATES

PART 1GENERAL

1.1 SUMMARY

A. Section Includes
1. Documentation of changes to Contract Sum and Contract Time.

B. Contract Documents contain pertinent requirements for materials and methods to accomplish work described herein.

C. Provide alternate costs for inclusion in Contract Sum if accepted by Owner.

1.2 RELATED REQUIREMENTS

A. Owner/Contractor Agreement: Alternates accepted by Owner are to be deducted from the base bid.

1.3 PROCEDURES

A. Alternates will be exercised at the option of Owner in any order.

B. Coordinate related work and modify surrounding work as required to complete the work, including changes under each Alternate, when acceptance is designated in Owner/Contractor Agreement.

1.4 DESCRIPTION OF ALTERNATES

A. **Alternate No. 1**–The contractor shall state in his proposal the amount that may be deducted if all work shown on the plumbing documents is deleted from the contract. In addition all architectural work associated with the plumbing, to include, Toilet partitions, concrete repair, CMU repair, new plastic laminate cabinets/counter and toilet accessories shall also be deleted from the contract.

B. **Alternate No. 2**-The contractor shall state in his proposal the amount that may be deducted if all doors and hardware are deleted from the contract.

C. **Alternate No. 3**-The contractor shall state in his proposal the amount that may be deducted if all painting associated with the existing building is deleted from the contract. This means that the painting for new work associated with the HVAC work would remain in the contract. This would include new HVAC chase walls and any new gypsum board ceilings or walls that were replaced due to HVAC work.

PART 2 PRODUCTS

Not used

PART 3 EXECUTION

Not used

END OF SECTION

SECTION 23 0923
DIRECT-DIGITAL CONTROL SYSTEM FOR HVAC

PART 1 GENERAL

1.1 SECTION INCLUDES

A. System description.

B. Controllers.

C. Power supplies and line filtering.

D. Controller software.

E. Software set-up and application programming.

F. Owner demonstration and training.

1.2 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 23 0994 - HVAC Sequence of Operation.

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

1.3 REFERENCE STANDARDS

A. MIL-STD-810 - Environmental Engineering Considerations and Laboratory Tests; Revision G, 2014.

B. NFPA 70 - National Electrical Code; 2023 Edition with 2026 Georgia Amendments.

1.4 SUMMARY

A. The campus building automation system (BAS) is a Tridium Niagara 4 supervisor with JACE 8000 panels as the Building Point of Connection (BPOC). New programmable controllers shall be individually licensed controllers (ILC). Communication from the JACE panel to the new controllers shall be BACnet MSTP.

1.5 SYSTEM DESCRIPTION

A. Automatic temperature control field monitoring and control system using field programmable micro-processor based units.

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.

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 be responsible for all equipment, cables, installation, and programming to implement the required interface with the campus network.

F. Include installation and calibration, supervision, adjustments, and fine tuning necessary for complete and fully operational system.

1.6 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 indicating 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 of DDC controllers (existing and new), fan coil unit controllers, and hardware and wiring for connections to networks external to the building.

5. Provide floor plans in electronic and hard copy format locating all controls units (existing and new), existing workstations, existing servers, LAN interface devices, existing gateways, etc. Include all WAN and LAN communication wiring routing, power wiring, power originating sources, and low voltage power wiring. Indicate network 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 drawing 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, fan coil unit controllers, protection devices, 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 of control instruments with terminal and control device designations, actuators and motors, color 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.

D. 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:

1. Controlled system

2. Point abbreviation/acronym

3. Point description

4. Engineering unit to be displayed with the point

5. Control point or set-point (Yes / No)

6. Monitoring point (Yes / No)

7. Intermediate point (Yes / No)

8. Calculated point (Yes / No)

E. Proposed Graphics: Submittal shall include all proposed displays and proposed revisions to existing displays as required by the project documents and specifications.

F. 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:

1. Equipment start-up sequences.

2. Warm-up mode sequences.

3. Normal operating mode sequences.

4. Detailed sequences for all control strategies, e.g., economizer control, optimum start/stop, capacity control, staging, optimization, etc.

5. Temperature and pressure control: setbacks, setups, resets, etc.

6. Shutdown sequences.

7. Unoccupied mode sequences.

8. Sequences for all alarms and emergency shut downs.

9. Effects of power or equipment failure with all standby component functions.

10. Seasonal operational differences and recommendations.

11. 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.

12. Schedules, if known.

13. 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

G. BACnet Systems:

1. BACnet object description, object ID, and device ID, for each I/O point.

2. Documentation for any non-standard BACnet objects, properties, or enumerations used detailing their structure, data types, and any associated lists of enumerated values.

3. Submit PICS indicating the BACnet functionality and configuration of each controller.

H. Electronic Submittals: While all requirements for hard copy submittal apply, control submittals and O&M information shall also be provided in electronic format as follows:

1. Drawings and Diagrams: Schematic flow diagrams and system architecture diagrams shall be provided on electronic media as AutoCAD 2005 or later version drawing files. Other drawings and diagrams may be provided as either AutoCAD files or PDF files, as most appropriate.

2. Other submittals: All other submittals shall be provided in Adobe Portable Document Format.

I. Manufacturers' Instructions: Indicate manufacturer's installation instructions for all manufactured components.

J. Project Record Documents: Record actual locations of control components, including control units, thermostats, and sensors.

K. 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 the 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 (existing and new) 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 (existing and new).

11. Complete original issue diskettes for all software provided, including operating systems, programming language, back up 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.

L. Observation by the Design Professional: Provide an affidavit to the Design Professional stating the Controls Systems are performing in accordance with the contract documents prior to Request for Material Completion.

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

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

1.7 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.

1.8 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.

1.9 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 restriction shall be placed on the licensing. All operator interfaces, programming environment, networking, database management and any other user 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

2.1 MANUFACTURERS

A. Delta Controls by Control Concepts.

B. KMC Controls by ESS.

2.2 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 commissioning and 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 saving 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 (Conformance 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 WriteMultiplePropery
7. Calendar
8. Schedules

2.3 CONTROLLERS

A. Arrange Controllers and Unit I/O so that control unit functions continue if communications over network are lost.

2.4 BUILDING CONTROLLERS

A. Type: JACE 8000

B. General:

1. Manage global strategies by one or more, independent, standalone, microprocessor based controllers.
2. Provide sufficient memory to support controller's operating system, database, and programming requirements.
3. Share data between networked controllers.
4. Controller operating system manages input and output communication signals allowing distributed controllers to share real and virtual object information and allowing for central monitoring and alarms.
5. Utilize real-time clock for scheduling.
6. Continuously check processor status and memory circuits for abnormal operation.

7. Controller to assume predetermined failure mode and generate alarm notification upon detection of abnormal operation.

8. Communication with other network devices to be based on assigned protocol.

C. Communication:

1. Controller to reside on a BACnet network using ISO 8802-3 (ETHERNET) Data Link/Physical layer protocol.

2. Perform routing when connected to a network of custom application and application specific controllers.

3. Provide service communication port for connection to a portable operator's terminal or hand held device with compatible protocol.

D. Anticipated Environmental Ambient Conditions:

1. Outdoors and/or in Wet Ambient Conditions:

a. Mount within waterproof enclosures.

b. Rated for operation at 40 to 150 degrees F.

c. Conditioned Space:

1) Mount within dustproof enclosures.

2) Rated for operation at 32 to 120 degrees F.

E. Provisions for Serviceability:

1. Diagnostic LEDs for power, communication, and processor.

2. Make all wiring connections to field removable, modular terminal strips, or to a termination card connected by a ribbon cable.

F. Memory: In the event of a power loss, maintain all BIOS and programming information for a minimum of 72 hours.

G. Power and Noise Immunity:

1. Maintain operation at 90 to 110 percent of nominal voltage rating.

2. Perform orderly shutdown below 80 percent of nominal voltage.

3. Operation protected against electrical noise of 5 to 120 Hz and from keyed radios up to 5 W. at 3 feet.

2.5 APPLICATION SPECIFIC CONTROLLERS

A. General:

1. Not fully user programmable, microprocessor based controllers dedicated to control specific equipment.

2. Customized for operation within the confines of equipment served.

3. Communication with other network devices to be based on assigned protocol.

B. Communication:

1. Controller to reside on a BACnet network using MS/TP Data Link/Physical layer protocol.

2. Provide service communication port for connection to a portable operator's terminal or hand held device with compatible protocol.

C. Anticipated Environmental Ambient Conditions:

1. Outdoors and/or in Wet Ambient Conditions:

a. Mount within waterproof enclosures.

b. Rated for operation at 40 to 150 degrees F.

c. Conditioned Space:

1) Mount within dustproof enclosures.

2) Rated for operation at 32 to 120 degrees F.

D. Provisions for Serviceability:

1. Diagnostic LEDs for power, communication, and processor.

2. Make all wiring connections to field removable, modular terminal strips, or to a termination card connected by a ribbon cable.

E. Memory: In the event of a power loss, maintain all BIOS and programming information for a minimum of 72 hours.

F. Power and Noise Immunity:

1. Maintain operation at 90 to 110 percent of nominal voltage rating.

2. Perform orderly shutdown below 80 percent of nominal voltage.

3. Operation protected against electrical noise of 5 to 120 Hz and from keyed radios up to 5 W at 3 feet.

2.6 INPUT/OUTPUT INTERFACE

A. Hardwired inputs and outputs tie into the DDC system through building, custom application, or application specific controllers.

B. All Input/Output Points:

1. Protect controller from damage resulting from any point short-circuiting or grounding and from voltage up to 24 volts of any duration.

2. Provide universal type for building and custom application controllers where input or output is software designated as either binary or analog type with appropriate properties.

C. Binary Inputs:

1. Allow monitoring of On/Off signals from remote devices.

2. Provide wetting current of 12 mA minimum, compatible with commonly available control devices and protected against the effects of contact bounce and noise.

3. Sense dry contact closure with power provided only by the controller.

D. Pulse Accumulation Input Objects: Conform to all requirements of binary input objects and accept up to 10 pulses per second.

E. Analog Inputs:

1. Allow for monitoring of low voltage 0 to 10 VDC, 4 to 20 mA current, or resistance signals (thermistor, RTD).

2. Compatible with and field configurable to commonly available sensing devices.

F. Binary Outputs:

1. Used for On/Off operation or a pulsed low-voltage signal for pulse width modulation control.

2. Outputs provided with three position (On/Off/Auto) override switches.

3. Status lights for building and custom application controllers to be selectable for normally open or normally closed operation.

G. Analog Outputs:

1. Monitoring signal provides a 0 to 10 VDC or a 4 to 20 mA output signal for end device control.

2. Provide status lights and two position (AUTO/MANUAL) switch for building and custom application controllers with manually adjustable potentiometer for manual override on building and custom application controllers.

3. Drift to not exceed 0.4 percent of range per year.

H. Tri State Outputs:

1. Coordinate two binary outputs to control three point, floating type, electronic actuators without feedback.

2. Limit the use of three point, floating devices to the following zone and terminal unit control applications:

   a. VAV terminal units.

   b. Duct mounted heating coils.

3. Control algorithms run the zone actuator to one end of its stroke once every 24 hours for verification of operator tracking.

I. System Object Capacity:

1. System size to be expandable to twice the number of input output objects required by providing additional controllers, including associated devices and wiring.

2. Hardware additions or software revisions for the installed operator interfaces are not to be required for future, system expansions.

2.7 POWER SUPPLIES AND LINE FILTERING

A. Power Supplies:

1. Provide UL listed control transformers with Class 2 current limiting type or over-current protection in both primary and secondary circuits for Class 2 service as required by the NEC.

2. Limit connected loads to 80 percent of rated capacity.

3. Match DC power supply to current output and voltage requirements.

4. Unit to be full wave rectifier type with output ripple of 5.0 mV maximum peak to peak.

5. Regulation to be 1 percent combined line and load with 100 microsecond response time for 50 percent load changes.

6. Provide over-voltage and over-current protection to withstand a 150 percent current overload for 3 seconds minimum without trip-out or failure.

7. Operational Ambient Conditions: 32 to 120 degrees F.

8. EM/RF meets FCC Class B and VDE 0871 for Class B and MIL-STD 810 for shock and vibration.

9. Line voltage units UL recognized and CSA approved.

B. Power Line Filtering:

1. Provide external or internal transient voltage and surge suppression component for all workstations and controllers.

2. Minimum surge protection attributes:

a. Dielectric strength of 1000 volts minimum.

b. Response time of 10 nanoseconds or less.

c. Transverse mode noise attenuation of 65 dB or greater.

d. Common mode noise attenuation of 150 dB or greater at 40 to 100 Hz.

2.8 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.

2.9 CONTROLLER SOFTWARE

A. Supervisory Software Manufacturer: Tridium Niagara 4

B. All applications reside and operate in the system controllers and editing of all applications occurs at the operator workstation.

C. System Security:

1. User access secured via user passwords and user names.

2. Passwords restrict user to the objects, applications, and system functions as assigned by the system manager.

3. User Log On/Log Off attempts are recorded.

4. Automatic Log Off occurs following the last keystroke after a user defined delay time.

D. Object or Object Group Scheduling:

1. Weekly Schedules Based on Separate, Daily Schedules:

a. Include start, stop, optimal stop, and night economizer.

b. 10 events maximum per schedule.

c. Start/stop times adjustable for each group object.

E. Provide standard application for equipment coordination and grouping based on function and location to be used for scheduling and other applications.

F. Alarms:

1. Binary object is set to alarm based on the operator specified state.

2. Analog object to have high/low alarm limits.

3. All alarming is capable of being automatically and manually disabled.

4. Alarm Reporting:

a. Operator determines action to be taken for alarm event.

b. Alarms to be routed to appropriate workstation.

c. Reporting Options:

G. Maintenance Management: System monitors equipment status and generates maintenance messages based upon user-designated run-time limits.

H. Sequencing: Application software based upon specified sequences of operation in Section 23 0993.

I. PID Control Characteristics:

1. Direct or reverse action.

2. Anti-windup.

3. Calculated, time-varying, analog value, positions an output or stages a series of outputs.

4. User selectable controlled variable, set-point, and PED gains.

J. Staggered Start Application:

1. Prevents all controlled equipment from simultaneously restarting after power outage.

2. Order of equipment startup is user selectable.

K. Energy Calculations:

1. Accumulated instantaneous power or flow rates are converted to energy use data.

2. Algorithm calculates a rolling average and allows window of time to be user specified in minute intervals.

3. Algorithm calculates a fixed window average with a digital input signal from a utility meter defining the start of the window period that in turn synchronizes the fixed-window average with that used by the power company.

L. Anti-Short Cycling:

1. All binary output objects protected from short-cycling.

2. Allows minimum on-time and off-time to be selected.

M. On-Off Control with Differential:

1. Algorithm allows binary output to be cycled based on a controlled variable and set-point.

2. Algorithm to be direct-acting or reverse-acting incorporating an adjustable differential.

N. Run-Time Totalization:

1. Totalize run-times for all binary input objects.

2. Provides operator with capability to assign high run-time alarm.

2.10 HVAC CONTROL PROGRAMS

A. General:

1. Support Inch-pounds and SI (metric) units of measurement.

2. Identify each HVAC Control system.

B. Optimal Run Time:

1. Control start-up and shutdown times of HVAC equipment for both heating and cooling.

2. Base on occupancy schedules, outside air temperature, seasonal requirements, and interior room mass temperature.

3. Start-up systems by using outside air temperature, room mass temperatures, and adaptive model prediction for how long building takes to warm up or cool down under different conditions.

4. Use outside air temperature to determine early shut down with ventilation override.

2.11 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

3.1 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.

3.2 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. Update existing 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:

2. Logging, reporting and graphing of user defined system trends on disk file and printer as directed by user.

3. Organize data in each trend logs to facilitate documenting system operation in compliance with Sequence of Operation.

4. Alarms: Logging, reporting and printing of user defined system alarms on disk file and printer as directed by user.

5. 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.

3.3 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. 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.

2. Mounting: Attach nameplates with epoxy cement or non-ferrous screws after final painting.

3. Conduit/Cable Markers:

4. Color coded, sunlight resistant cable ties.

5. Location: Install on all conduit and raceways exposed or above ceilings in a visible location at:

a. Connections to junction, pull boxes, or manholes. Label box cover with nominal system voltage, circuit number and panel identification legibly written with permanent marker.

b. Connections to equipment.

c. Each side of a wall, roof or floor penetration.

d. Along straight runs at 50 feet intervals.

e. At changes of direction.

f. Parallel Conduits: Group markers on each conduit in-line with the adjacent marker.

6. Color: Baby Blue.

7. Color code cable with both ends identified with manufactured alpha-numeric self-adhesive vinyl tags, 3 mils thick, minimum, keyed to termination points.

C. Electrical wiring:

1. No splices between control panels are permitted.

2. All terminations of field wiring shall be to terminal strips.

3. 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.

4. Analog input and output cable shall be shielded with panel connection grounded to comply with Part 15, Sub-part J of FCC Rules and Regulations.

5. All Wiring materials and methods shall comply with Division 26 except:

   a. Minimum wire size shall be 18 AWG(copper).

   b. Conduit for concealed low voltage wiring above accessible ceilings may be omitted and plenum rated cable substituted.

D. Provide conduit and electrical wiring in accordance with Section 26 2717. Electrical material and installation shall be in accordance with appropriate requirements of Division 26.

3.4 COMMISSIONING SUPPORT REQUIREMENTS:

A. The contractor is to include and specifically itemize the cost of commissioning in the contract price.

B. The Contractor shall attend a preliminary commissioning scoping meeting and other commissioning coordination meetings during the construction process as necessary to facilitate the commissioning process. Contractor is to keep the Commissioning Authority and mechanical Commissioning Supervisor informed of progress with the Project and of changes to the proposed installation, programming and test plan.

C. The Contractor shall provide assistance to the Commissioning Authority (CxA) for scheduling and witnessing of testing. Review the Prefunctional and Functional test procedures to ensure feasibility, safety, and equipment protection.

D. Preparation of a written start-up and initial checkout plan indicating in a step-by-step manner the procedures that will be followed to test, check-out, and adjust the control system prior to beginning functional testing. Submit the proposed plan to the Commissioning Authority and mechanical Commissioning Supervisor for review and approval prior to startup. At minimum, the plan shall include for each type of equipment controlled by the automatic controls:

   1. Step-by-step procedures for testing each type controller after installation, including:

      a. Process of verifying proper hardware and wiring installation.

      b. Process of downloading programs to load controllers and verifying that they are addressed correctly.

      c. Process of verifying proper hardware and wiring installation.

      d. Process of performing operational checks of each controlled component.

      e. Plan and process for calibrating valve and damper actuators and sensors.

f. A description of the expected field adjustments for transmitters, controllers and control actuators should control responses fall outside of expected values.

g. A copy of the log and field check-out sheets that will document the process. This log shall include a place for initial and final values read during calibration of each point and clearly indicate when a sensor or controller has passed and is operating within the contract parameters. Notification of any equipment failures shall be documented.

h. A description of the expected field adjustments for transmitters, controllers and control actuators should control responses fall outside of expected values.

i. A description of the instrumentation required for testing, including a certification of calibration for each test instrument.

j. Identify which tests and systems should be completed prior to using the control system for test, adjustment, and balance work.

k. The Commissioning Agent may request further documentation necessary for the commissioning process.

2. Provide the Commissioning Authority and mechanical Commissioning Supervisor complete system logic diagrams, describing the proposed system programming, with programmed attributes shown. These diagrams shall be updated with field modifications from the start-up, check-out, and pre-functional testing prior to the beginning of the functional testing of the DDC system. Provide a copy of each proposed graphical interface screen with interface points shown for the entire system. Provide assistance to the Commissioning Authority in preparing the specific functional performance test procedures required, to include normal cut sheets and shop drawing submittals of commissioned equipment and any additional requested documentation, prior to normal O&M manual submittals. Review test procedures to ensure feasibility, safety and equipment protection and provide necessary written alarm limits to be used during the tests.

3. Pre-functional tests: Provide skilled technicians to execute startup of equipment and to execute the pre-initial checkout as described by the approved plan. Ensure that they are available and present during the agreed upon schedules and for sufficient duration to complete the necessary tests, adjustments and problem solving. Verify and document the proper installation, addressing, calibration, programming, operation, and failure mode of DDC control points, sequences, and equipment and provide a copy to the commissioning authority. Provide a signed and dated certification to the Commissioning Authority and Commissioning Supervisor upon completion of the check-out of each controlled device, equipment, and system that installation, set-up, adjustment, calibration, and system programming is complete and as indicated on the Drawings, except functional testing. Completed pre-functional documentation of the system verification shall be submitted to the Commissioning Authority and Commissioning Supervisor for review and approval prior to the functional testing of the DDC control system or its being used in the testing of other equipment or systems, or other purposes. Copies of final field check-out sheets and trend logs shall be provided to the Commissioning Authority and Commissioning Supervisor for inclusion in the Commissioning Report.

4. Meet with the testing, adjusting, and balancing contractor prior to beginning the test, adjustment, and balance process and review the test, adjusting, and balancing plan to determine the capabilities and requirements of the control system in completing the testing, adjusting, and balancing process. For a given area, have all required pre-functional checklists, calibrations, startup and selected functional tests of the system completed and approved by the Commissioning Authority prior to beginning the testing, adjusting, and balancing effort. Provide the testing, adjusting, and balancing contractor with the appropriate software and any needed unique instruments for setting terminal units and instruct the testing, adjusting, and balancing contractor personnel in their use. Assist and cooperate with the testing, adjusting, and balancing contractor by providing a qualified technician to operate the controls as required to assist the testing, adjusting, and balancing contractor in performing his work, or alternatively, provide sufficient training for the testing, adjusting, and balancing contractor to operate the system without assistance. Verify the proper operation of affected controls at the completion of the test, adjustment, and balance procedure.

5. Address current A/E punch list items before functional testing. Air and water TAB shall be completed with discrepancies and problems remedied before functional testing of the control systems for the respective air- or water-related systems.

6. Functional tests: Conduct and document a functional test under the direction of the Commissioning Authority of the complete installed DDC control system. Functional testing is intended to begin upon completion of a system but may be conducted in phases or sections, as defined by the requirements of the Functional Test, or as approved by the Commissioning Authority. The DDC system, or applicable portions of the system, shall have completed pre-functional testing and be approved by the Commissioning Authority and Commissioning Supervisor before being used for other purposes, such as test and balance measurements, or in support of the functional testing of other systems.

    a. Provide technicians and or knowledgeable programming personnel as required to conduct the required functional testing. Assist the Commissioning Authority in resolving issues found during the functional testing process.

    b. Assist in the functional testing of equipment and systems by implementing trend logs and equipment monitoring as specified in the contract documents. The monitoring and data logging capabilities of the DDC system shall be available for use in the commissioning process. Assist the Commissioning Authority in the testing and documentation process by using the data logging and trending capability of the DDC system in monitoring the testing effort and recording the performance of systems and interpreting the monitoring data, as necessary.

    c. The controls contractor shall coordinate with the University Facilities personnel and provide and set up a temporary testing operator station to allow full operator station interface with the system during the entire functional testing process. This temporary operator station shall provide all functions required of the system at the operator station, including real time graphic displays and report generation.

7. Correct deficiencies (differences between specified and observed performance) as interpreted by the Commissioning Authority and Design Professional and retest the equipment.

E. Seasonal Adjustment:

1. Assist the Commissioning Authority and Commissioning Supervisor with the seasonal adjustment process. During this effort the Commissioning Authority and Commissioning Supervisor will:

a. Check and verify the calibration of temperature control devices and thermostats.

b. Test and verify control sequences for proper operation for the season.

c. Where deficient operation or defective equipment is discovered, provide corrective measures as required by the warranty provisions specified herein.

3.5 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.

3.6 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 the Owner.

END OF SECTION