

ADDENDUM NO. 2

October 22, 2018

**To the Contract Documents for the
Highlands Elementary School
HVAC Replacement Project**

PROJECT: Highlands Elementary School HVAC Replacement Project
Date: October 22, 2018
4141 Harbor Street
Pittsburg, CA 94565

OWNER: Pittsburg Unified School District
2000 Railroad Avenue
Pittsburg, California, 94565

DSA File No: 7-36
DSA APP. NO.: 01-116978

TO ALL BIDDERS:

This Addendum forms a part of the Contract and modifies the Contract Documents. It is intended that all work affected by the following modifications shall conform with related provisions of the Contract Documents, including the original drawings and specifications. Modify the following items wherever appearing in any drawings or sections of the specifications. Acknowledge receipt of all Addenda in the space provided on the Bid Form and Proposal. Failure to do so may subject bidder to disqualification.

CHANGES TO THE SPECIFICATIONS PROJECT MANUAL:

1. **Item No. PM-1**
Reference: Section 00 41 13 – Bid Form and Proposal
Description: Replace this Spec Section in its entirety with the attached revised Spec. Section 00 41 13 – Bid Form and Proposal.

2. **Item No. PM-2**
Reference: Section 01 11 00 – Summary of Work
Description: Add Paragraph 1.12, Project Coordination, to this Spec. Section. Paragraph 1.12 shall state - The successful bidder will be required to coordinate the work of this Contract, as per Article 8 of the Contract General Conditions, with the successful bidder on the Highlands ES – Window Replacement In-Kind Project at each one of the Classrooms where the existing HVAC Wall Units, and the existing ductwork soffits, are being removed. Note that the new windows cannot be furnished & installed, at these locations, until such time as the successful bidder on the this Project has begun their work and removed these HVAC Wall Units and the existing ductwork soffits. The work of the successful bidder, on the Highlands ES – HVAC Equipment Replacement Project, will not begin until 06/10/19. This successful bidder will be required to schedule the removal of the existing HVAC Wall Units, and the existing ductwork soffits, as the first work task of the construction work on this Project. All other work, under this Contract, may proceed as scheduled.

3. **Item No. PM-3**
Reference: Section 23 01 01 – Energy Management and Temperature Control System
Description: Replace this Spec Section in its entirety with the attached revised Spec. Section 23 01 01 - Energy Management and Temperature Control System.
4. **Item No. PM-4**
Reference: Section 23 01 02 – EMTCS/DDC Software
Description: Replace this Spec Section in its entirety with the attached revised Spec. Section 23 01 02 - EMTCS/DDC Software.

CHANGES TO THE DRAWINGS:

1. **Item No. DWG-1**
Reference: Sheet M0.2 - Mechanical Schedules
Description: Condensing Furnace Schedule:
Add economizer and demand control ventilation cfm air quantities.
Add note 5 regarding air balancing settings when system is in full economizer mode.
2. **Item No. DWG-2**
Reference: Sheet M0.4 - Mechanical Schedules
Description: Air Conditioning Unit Schedule:
Revise Note 1.B. to include factory installed application specific controller (ASC) for control of HVAC unit functions.
3. **Item No. DWG-4**
Reference: Sheet M2.3 - Mechanical Floor Plans - Buildings 4A and 4B
Description: Update sheet note 13 regarding new controls to be installed onto existing unit.
4. **Item No. DWG-4**
Reference: Sheet M3.1 - Mechanical Partial Floor Plans
Description: Delete manual balancing damper in outside air ducts.
Add modulating dampers to outside air and return air ducts.
Add economizer and demand control ventilation (CO2) controls to F-20, F-21, and F-22 systems.
5. **Item No. DWG-5**
Reference: Sheet M3.2 - Mechanical Partial Floor Plans
Description: Update sheet note 22 to add economizer control requirement for modulating dampers.
6. **Item No. DWG-6**
Reference: Sheet M3.3 - Mechanical Partial Floor Plans
Description: Update sheet note 19 to add economizer control requirement for modulating dampers.

7. **Item No. DWG-7**
Reference: **Sheet M3.4 - Mechanical Partial Floor Plans**
Description: Update sheet note 23 to add economizer control requirement for modulating dampers.
Update 2/M3.4 to clearly indicate modulating damper in return air duct.
8. **Item No. DWG-8**
Reference: **Sheet M5.1 - Mechanical Control Diagrams**
Description: 1/M5.1 - EMS System Network diagram:
Revise to Carrier i-VU controls and riser structure.
Add note 11. to reference lighting control diagram, 2/M5.3.
Update diagram to indicate that existing EMS network wiring is to be reused.
2/M5.1 - Exhaust Fan Schematic Control Diagram:
Revise to Carrier i-VU controller.
Update diagram to indicate that existing EMS network wiring is to be reused.
Revise sequence of operation to Carrier i-VU pre-determined sequences.
3/M5.1 - Split System Schematic Control Diagram:
Add note 4. to reference temperature alarm diagram, 5/M5.1.
5/M5.1 - Temperature Alarm Schematic Control Diagram:
New detail added to sheet.
EMS/DDC Control Diagram Notes and Symbols:
Add note 8. regarding use of existing network control wiring.
9. **Item No. DWG-9**
Reference: **Sheet M5.2 - Mechanical Control Diagrams**
Description: 1/M5.2 - Furnace System Schematic Control Diagram:
Revise to Carrier i-VU controller.
Update diagram to indicate that existing EMS network wiring is to be reused.
Add filter status monitoring.
Add room occupancy monitoring.
Add outside air temperature monitoring.
Add mixed air temperature monitoring.
Revise sequence of operation to Carrier i-VU pre-determined sequences.
Add note regarding existing door contacts to be removed.
2/M5.2 - Exhaust Fan Schematic Control Diagram:
Revise to Carrier i-VU controller.
Update diagram to indicate that existing EMS network wiring is to be reused.
10. **Item No. DWG-10**
Reference: **Sheet M5.3 - Mechanical Control Diagrams**
Description: 1/M5.3 - Air Conditioning Unit Schematic Control Diagram:
Revise to Carrier i-VU controller.
Update diagram to indicate that existing EMS network wiring is to be reused.
Add filter status monitoring.
Add room occupancy monitoring.
Add outside air temperature monitoring.
Add mixed air temperature monitoring.
Revise sequence of operation to Carrier i-VU pre-determined sequences.

Add note regarding existing door contacts to be removed.

2/M5.3 - Lighting Control Diagram:

New detail added to sheet.

11. **Item No. DWG-11**
Reference: **Sheet E2.1 - Demolition Plan - Buildings 1A and 1B**
Description: Add Existing Circuit Notes regarding direction for existing electrical circuits that may bypass the unit disconnects.
12. **Item No. DWG-12**
Reference: **Sheet E2.2 - Demolition Plan - Buildings 2 & 3**
Description: Add Existing Circuit Notes regarding direction for existing electrical circuits that may bypass the unit disconnects.
13. **Item No. DWG-13**
Reference: **Sheet E2.3 - Demolition Plan - Buildings 4A & 4B**
Description: Add Existing Circuit Notes regarding direction for existing electrical circuits that may bypass the unit disconnects.
14. **Item No. DWG-14**
Reference: **Sheet E2.4 - Demolition Plan - Building 5**
Description: Add Existing Circuit Notes regarding direction for existing electrical circuits that may bypass the unit disconnects.

ATTACHMENTS:

- **Spec. Section 00 41 13**
- **Spec. Section 23 01 01**
- **Spec. Section 23 01 02**
- **Drawing M0.2**
- **Drawing M0.4**
- **Drawing M2.3**
- **Drawing M3.1**
- **Drawing M3.2**
- **Drawing M3.3**
- **Drawing M3.4**
- **Drawing M5.1**
- **Drawing M5.2**
- **Drawing M5.3**
- **Drawing E2.1**
- **Drawing E2.2**
- **Drawing E2.3**
- **Drawing E2.4**

END OF ADDENDUM

BID FORM AND PROPOSAL

Pittsburg Unified School District ("District" or "Owner")

From: _____
(Proper Name of Bidder)

The undersigned declares that Bidder has read and understands the Contract Documents, including, without limitation, the Notice to Bidders and the Instructions to Bidders, and agrees and proposes to furnish all necessary labor, materials, and equipment to perform and furnish all work in accordance with the terms and conditions of the Contract Documents, including, without limitation, the Drawings and Specifications of Bid No. 18-008.

PROJECT: **Highlands Elementary School – HVAC Equipment Replacement**

("Project" or "Contract") and will accept in full payment for that Work the following total lump sum amount, all taxes included:

_____ dollars \$ _____
BASE BID
<i>Bidder acknowledges and agrees that the Base Bid accounts for any and all Allowance(s) and Total Cost for Unit Prices.</i>

Additive/Deductive Alternates:

NOT USED

Additional Detail Regarding Calculation of Base Bid

1. **Unit Prices.** The Bidder's Base Bid includes the following unit prices, which the Bidder must provide and the District may, at its discretion, utilize in valuing additive and/or deductive change orders (Unit Prices shall include all labor, materials, services, profit, overhead, insurance, bonds, taxes, and all other incidental costs of Contractor, subcontractors, and suppliers):

SCHEDULE OF UNIT PRICES

<u>Item No.</u>	<u>Description</u>	<u>Unit of Measure</u>	<u>Unit Price</u>	<u>Total Cost = Unit Price x Estimated Quantity (Included in Base Bid)</u>
1	Removal of existing roof mounted exhaust fan with asbestos containing (AC) mastics/sealants	Each	\$	\$
2	Removal of AC expansion joint cloth at mechanical equipment	Each	\$	\$
3	Removal of 12" x 12" non-asbestos containing (NAC) acoustic ceiling tile, NAC ceiling tile mastic, NAC gypsum board, NAC joint compound, AC spray-on acoustic ceiling plaster, NAC gypsum board lath and AC spray-on acoustic overspray and debris. Work includes the application of a bridging encapsulant at newly cut edges of AC spray-on acoustic ceiling plaster and NAC gypsum board lath underlayment. All work shall be performed within a negative pressure enclosure (NPE).	Daily Rate	\$	\$

4	Drill, core, anchor, attach and/or affix to 12" x 12" NAC acoustic ceiling tile, NAC ceiling tile mastic, NAC gypsum board , NAC joint compound, AC spray-on acoustic ceiling plaster and NAC gypsum board lath. All incidental hazardous materials related work (i.e., drilling, coring, anchoring and/or affixing) to the above ceiling finish system shall be performed by using tools and equipment equipped with a shroud and attached to a functioning DOP tested HEPA vacuum during all related operations.	Daily Rate	\$	\$
	Total Unit Cost Bid Amount			\$

Where scope of Work is decreased, all Work pertaining to the item, whether specifically stated or not, shall be omitted, and where scope of Work is increased, all work pertaining to that item required to render same ready for use on the Project in accordance with intentions of the Drawings and Specifications shall be included in the above agreed-upon price amount.

2. **Allowance.** The Bidder's Base Bid shall include -

- a. **\$25,000.00 Allowance** for any/all unforeseen dry-rot repair.
- b. **\$25,000.00 Allowance** for correction of electrical power sources which bypass the existing HVAC Unit disconnects.

The above allowance shall only be allocated for unforeseen items relating to the Work. Contractor shall not bill for or be due any portion of this allowance unless the District has identified specific work, Contractor has submitted a price for that work or the District has proposed a price for that work, the District has accepted the cost for that work, and the District has prepared a change order incorporating that work. Contractor hereby authorizes the District to execute a unilateral deductive change order at or near the end of the Project for all or any portion of the allowance not allocated.

3. The undersigned has reviewed the Work outlined in the Contract Documents and fully understands the scope of Work required in this Proposal, understands the construction and project management function(s) is described in the Contract Documents, and that each Bidder who is awarded a contract shall be in fact a prime contractor, not a subcontractor, to the District, and agrees that its Proposal, if accepted by the District, will be the basis for the Bidder to enter into a contract with the District in accordance with the intent of the Contract Documents.

PITTSBURG UNIFIED SCHOOL DISTRICT
 Highlands Elementary School
 HVAC Equipment Replacement
 McCracken & Woodman, Inc.

**BID FORM AND PROPOSAL
 DOCUMENT 00 41 13-3**

4. The undersigned has notified the District in writing of any discrepancies or omissions or of any doubt, questions, or ambiguities about the meaning of any of the Contract Documents, and has contacted the Construction Manager before bid date to verify the issuance of any clarifying Addenda.
5. The undersigned agrees to commence work under this Contract on the date established in the Contract Documents and to complete all work within the time specified in the Contract Documents.
6. The liquidated damages clause of the General Conditions and Agreement is hereby acknowledged.
7. It is understood that the District reserves the right to reject this bid and that the bid shall remain open to acceptance and is irrevocable for a period of ninety (90) days.
8. The following documents are attached hereto:
 - Bid Bond on the District's form or other security
 - Designated Subcontractors List
 - Site Visit Certification
 - Non-Collusion Declaration
 - Iran Contracting Act Certification

Receipt and acceptance of the following Addenda is hereby acknowledged:

No. _____, Dated _____	No. _____, Dated _____
No. _____, Dated _____	No. _____, Dated _____
No. _____, Dated _____	No. _____, Dated _____

9. Bidder acknowledges that the license required for performance of the Work is a B or C-20 license.
10. The undersigned hereby certifies that Bidder is able to furnish labor that can work in harmony with all other elements of labor employed or to be employed on the Work.
11. Bidder specifically acknowledges and understands that if it is awarded the Contract, that it shall perform the Work of the Project while complying with all requirements of the Department of Industrial Relations [and with all requirements of the Project Services Agreement].
12. The Bidder represents that it is competent, knowledgeable, and has special skills with respect to the nature, extent, and inherent conditions of the Work to be performed. Bidder further acknowledges that there are certain peculiar and inherent

conditions existent in the construction of the Work that may create, during the Work, unusual or peculiar unsafe conditions hazardous to persons and property.

13. Bidder expressly acknowledges that it is aware of such peculiar risks and that it has the skill and experience to foresee and to adopt protective measures to adequately and safely perform the Work with respect to such hazards.
14. Bidder expressly acknowledges that it is aware that if a false claim is knowingly submitted (as the terms "claim" and "knowingly" are defined in the California False Claims Act, Gov. Code, § 12650 et seq.), the District will be entitled to civil remedies set forth in the California False Claim Act. It may also be considered fraud and the Contractor may be subject to criminal prosecution.
15. The undersigned Bidder certifies that it is, at the time of bidding, and shall be throughout the period of the Contract, licensed by the State of California to do the type of work required under the terms of the Contract Documents and registered as a public works contractor with the Department of Industrial Relations. Bidder further certifies that it is regularly engaged in the general class and type of work called for in the Contract Documents.

Furthermore, Bidder hereby certifies to the District that all representations, certifications, and statements made by Bidder, as set forth in this bid form, are true and correct and are made under penalty of perjury.

Dated this _____ day of _____ 20 ____

Name of Bidder: _____

Type of Organization: _____

Signed by: _____

Title of Signer: _____

Address of Bidder: _____

Taxpayer Identification No. of Bidder: _____

Telephone Number: _____

Fax Number: _____

E-mail: _____ Web Page: _____

Contractor's License No(s): No.: _____ Class: _____ Expiration Date: _____

No.: _____ Class: _____ Expiration Date: _____

No.: _____ Class: _____ Expiration Date: _____

Public Works Contractor Registration No.: _____

END OF DOCUMENT

ENERGY MANAGEMENT AND TEMPERATURE CONTROL SYSTEM

PART 1 - GENERAL

1.01 GENERAL CONDITIONS

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

1.02 SUMMARY

- A. An existing Direct Digital Control (DDC) system is currently in place at the Highlands Elementary School campus. The existing DDC system is to be replaced in its entirety at the project site with a Carrier OPEN BACnet i-VU web-based DDC system. The Energy Management and Temperature Control System (EMTCS) Contractor is to provide a full and functioning system in accordance with Sections 23 01 01 and 23 01 02.
- B. The work shall consist of furnishing all labor, material, and equipment required to complete the installation of the EMTCS as indicated on the drawings and described herein, including all incidental work necessary to make it a complete, satisfactory, and fully functioning DDC system. Electric, electronic, pneumatic, or other non-DDC control components or systems are not allowed. Work shall include, but not be limited to, the following principal items:
 - 1. Full stand-alone DDC system, including controllers, sensors, and main processor control panel. System to include low voltage wiring and all conduit required for low voltage wiring.
 - 2. All components shall be BACnet compliant in accordance with ASHRAE Standard 135-2004.
 - 3. A dedicated data communications network including electric isolation from processors and protection from electrical interference.
 - 4. Connection of main processor control panel to existing PC (connected to Owner's LAN system). Verify the location with the Owner.
 - 5. Project management for managing system installation including, but not limited to:
 - a. Design, installation, equipment delivery, coordination with other trades, labor management, commissioning and acceptance testing.
 - 6. Coordination with Contractor's on control requirements for each piece of equipment and each system controlled.
 - 7. Testing of control system to ensure required control sequence has been provided for each piece of equipment and each system controlled.
 - 8. Software required for a complete and operational EMTCS as specified in Section 23 01 02 - EMTCS/DDC Software.
 - 9. Onsite training of maintenance personnel and system users.
 - 10. Miscellaneous control wiring, including but not limited to:
 - a. Power wiring from Division 26 outlets to control transformers.
 - b. Interlock wiring.

11. Include all carbon-dioxide (CO₂) sensors/controllers including provision of training, instructions, and apparatus as required for calibration to the Owner.
12. Warranty of system, including all associated materials, labor, and services for a period of one (1) year from the date of final acceptance.

1.03 RELATED WORK

- A. Heating, Ventilating and Air Conditioning Systems, Section 23 00 00.
- B. EMTCS/DDC Software, Section 23 01 02.
- C. Plumbing Systems, Section 22 00 00.
- D. Electrical Systems, Division 26.

1.04 GENERAL REQUIREMENTS

- A. Verification of conditions: Prior to installation of EMTCS work, inspect all surfaces to receive said work and arrange for the satisfactory correction of all defects in workmanship and/or material that could interfere with the work specified herein. Installation of any air conditioning work or materials on any surface shall constitute acceptance of such surfaces as being in proper condition to receive herein specified materials.
- B. Codes: Work must comply with the Applicable Code Requirements.
- C. Reference standards: Published specifications, standards, tests, or recommended methods of trade, industry, or governmental organizations apply to work of this Section where cited below:
 1. Air Moving and Conditioning Association (AMCA).
 2. American Society of Heating, Refrigerating, and Air Conditioning Engineers (ASHRAE).
 3. American Society of Mechanical Engineers (ASME).
 4. American Society of Plumbing Engineers (ASPE).
 5. Associated Air Balance Council (AABC).
 6. National Electrical Manufacturers Association (NEMA).
 7. National Fire Protection Association (NFPA).
 8. Sheet Metal and Air Conditioning Contractors National Association (SMACNA).
 9. California Building Code (CBC).
 10. State of California - OSHA.
 11. California Mechanical Code (CMC).
 12. 2016 California Building Energy Efficiency Standards (Title 24).
 13. State Fire Marshal requirements (SFM).
 14. Air Conditioning and Refrigeration Institute (ARI).
 15. State of California Environmental Quality Act.
 16. American Society of Testing and Materials (ASTM).
 17. Underwriters Laboratories (UL).
 18. Occupational Safety and Health Act (OSHA).
 19. National Bureau of Standards (NBS).
 20. American National Standards Institute (ANSI).

23. AMCA Standard 99: Standards Handbook.
 24. AMCA/ANSI Standard 204: Balance Quality and Vibration Levels for Fans.
 25. AMCA Standard 210: Laboratory Methods of Testing Fans for Ratings.
 26. AMCA Standard 300: Reverberant Room Method for Sound Testing of Fans.
 27. AMCA Standard 500: Test Methods for Louvers, Dampers and Shutters.
 28. ARI Standard 410: Forced-Circulation Air-Cooling and Air-Heating Coil.
 29. ANSI/ASHRAE 15: Safety Code for Mechanical Refrigeration.
 30. ASHRAE Standard 52: Gravimetric and Dust Spot Procedures for Testing Air Cleaning Devices Used in General Ventilation for Removing Particulate Matter.
 31. ASHRAE/ANSI Standard 111: Practices for Measurement, Testing, Adjusting and Balancing of Building Heating, Ventilation, Air-Conditioning and Refrigeration Systems.
 32. ASME Section VIII: Unified Pressure Vessel Code.
 33. UL Standard 1995: Heating and Cooling Equipment.
 34. ASTM A-525: Specification for General Requirements for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process.
 35. ASHRAE Standard 62.1-2016: Ventilation For Acceptable Indoor Air Quality.
 36. ANSI/ASHRAE Standard 55-2013: Thermal Environmental Conditions for Human Occupancy.
- D. Materials and workmanship:
1. All materials and equipment to be new and in perfect condition. Materials or equipment for similar uses are to be of same type and manufacturer.
 2. Workmanship shall be of best standard practice of the trade.
- E. Protection of equipment: The Contractor shall be responsible for any damage to any of the work of this Section until final acceptance. Cover all duct, pipe and equipment openings, and cover all apparatus, equipment, and appliances both before and after being set in place to prevent misuse or disfigurement of the apparatus, equipment, or appliances.
- F. Openings:
1. Cooperate with other trades in providing information as to openings required in walls, floors, and roof for ducts and equipment.
 2. Pay all extra costs for cutting of openings as a result of incorrect, delayed, or neglected information.
 3. Make absolutely watertight any openings through waterproofed construction caused by the penetration of ductwork or piping, in a manner approved by the Engineer.
- G. Cleanup:
1. Thoroughly clean all parts of the apparatus and equipment. Exposed parts, which are to be painted shall be thoroughly cleaned of cement, plaster, and other materials, and all grease and oil spots removed with cleaning solvent.
 2. Inside of all pipes, ducts, etc., shall be flushed or cleaned before being placed in operation, and all strainers shall be cleaned after operational tests.

3. Remove all debris and surplus equipment and leave installation in perfect condition ready for use.
- H. Construction review:
1. All services rendered by the Engineer or any of his consultants consist of professional opinions and recommendations made in accordance with generally accepted architectural practice.
 2. Under no circumstances is it the intent of the Engineer or any of his consultants to directly control the physical activities of the Contractor or the Contractor's workmen in the accomplishment of the Work.
 3. The presence of the field representative of the Engineer or any of his consultants at the site is to provide to the Owner and/or Engineer an additional source of professional advice, opinions, and recommendations based upon the field representative's observations.
- I. Safety:
1. In accordance with generally accepted construction practices, the Contractor will be solely and completely responsible for conditions on the project site including safety of all persons and property during performance of the work. This requirement will apply continuously and not be limited by normal working hours.
 2. Construction review by the Engineer or any of his consultants is not intended to include review of the adequacy of the Contractor's safety measures in, on, or near the project site or at any other location.

1.05 QUALITY ASSURANCE

- A. The supplier of the EMTCS shall be responsible for inspection and quality assurance for all materials and workmanship furnished by him. Provide all testing and calibration necessary to ensure reliability and accuracy of the EMTCS.
- B. Comply with all applicable code requirements.

1.06 WARRANTY

- A. This Contractor shall furnish a written guarantee to the Owner that the materials, hardware, software, and installation are new, free from mechanical defects, noiseless, and are in perfect operating condition.
- B. The Contractor shall guarantee to replace and repair at his own expense any and all unsatisfactory and defective work and items to the satisfaction of the Owner for a period of at least one (1) year after final acceptance of work.
 1. The Contractor shall also furnish the Owner with all manufacturer's written guarantees of materials and equipment.
- C. The warranty shall be submitted to the Engineer and shall be included in the maintenance and operation manual for the EMTCS system.
- D. Also comply with the requirements of Division 01 - General Requirements.

1.07 SUBMITTALS

- A. Review of drawings and materials submitted for approval shall not be construed as a complete check or constitute a waiver of the requirements of the plans and specifications but will indicate that the material submitted is acceptable in quality, utility, and capacity. Contractor agrees that shop drawing submittals processed by the Engineer do not become contract documents and are not change orders; that the purpose of the shop drawing review is to establish a reporting procedure and is intended for the Contractor's convenience in organizing his work and to permit the Engineer to monitor the Contractor's progress and understanding of the design. If deviations, discrepancies, or conflicts between shop drawing submittals and the contract documents are discovered either prior to or after the shop drawing submittals are processed by the Engineer, the Contractor agrees that the contract documents shall control and shall be followed.
- B. Submittal lists shall include the identifying marks assigned to the items. Give name of manufacturer, brand name, and catalog number of each item. Submit complete list at one time with items arranged and identified in numerical sequence within each section and article of the specifications. Listing items "as specified" without both make and model or type designation is not acceptable, except as noted. Descriptive Data: Submit complete description, information, and performance data covering equipment which is specified but for which catalog plate numbers, brand names, or specific models have not been used. Include images of data display screens as part of the controls submittal for review prior to commencement of work.
- C. Sequence of operation - The sequences of operation included in the design documents are intended only to communicate the general control intent and are not to be used as a direct reference for programming of the EMTCS system. Verbatim duplication of the Sequence of Operation on the submittals is discouraged and may result in non-approval to the submittal. Sequence of Operation on submittals shall accurately detail the system's intended programming, and shall include details of all enhancements, adjustments, or deviations from the Sequence of Operation shown on the design documents. Submitted Sequence of Operation shall be written with a logical and organized format and flow. Sequence of Operation language shall be detailed, clear, and unambiguous. Point descriptors and point nomenclature referenced in the submitted Sequence of Operation shall match those (to be) actually programmed. As-built submittal Sequence of Operation shall include all modifications to the programming made as a result of any addendum, bulletins, RFI's, change orders, and commissioning.
- D. Also comply with the requirements of Division 01 - General Requirements.

1.08 SHOP DRAWINGS

- A. Submit shop drawings and material list in six (6) copies. Submit material list and shop drawings after official award of contract. Obtain approval of the Engineer before installation. Shop drawings shall be submitted for all materials, equipment, and controls. Check shop drawings and submittals before

forwarding to Engineer and ascertain that submittals meet all requirements of drawings and specifications.

- B. Also comply with the requirements of Division 01 - General Requirements.

1.09 PRODUCTS FURNISHED UNDER THIS SECTION, INSTALLED UNDER SECTION 23 00 00

- A. Equipment power wiring shall be furnished and installed under Division 26. Where control involves 120V control devices controlling 120V equipment, Division 26 Contractor shall extend power wiring to the equipment. The EMTCS Contractor shall coordinate the location of the control device with the Div. 26 Contractor. The Div. 26 Contractor shall wire only the power side of the original device. The EMTCS Contractor shall provide all control side wiring, whether line or low voltage. The EMTCS Contractor shall provide all power wiring to the control transformers.

1.10 COORDINATION

- A. It is the responsibility of the EMTCS Contractor to read and conform to all sections of the specification and to coordinate with other Contractor's on control requirements and wiring diagrams or equipment supplied and installed as a part of their work.
- B. EMTCS Contractor is fully responsible for coordination of location and positioning of EMTCS products furnished under this section and installed under other sections.

1.11 QUALIFICATIONS

- A. Manufacturer/Contractor must have installed a minimum of ten (10) EMTCS of similar type and magnitude in the local area within the last three (3) years and shall have been in operation a minimum of five (5) years in the State of California.

1.12 OPERATIONS, MAINTENANCE, AND PROGRAMMING MANUALS

- A. Prepare operation, maintenance and programming manuals for the EMTCS. The operation, maintenance and programming manuals are to provide the Owner with all required information on the hardware, software and programming of the EMTCS. The operation, maintenance and programming manuals are to include, but not limited to, the following:
 1. Owning and operating manuals for the EMTCS and all equipment and systems controlled by it, bound together in one or more books.
 2. Records of initial settings and test results.
 3. Training of the maintenance and operation personnel.
 4. Copies of applicable warranties.
 5. Service contact telephone numbers, email addresses and websites including emergency contact information during off-hours, weekends and holidays.

- B. General requirements:

PITTSBURG UNIFIED SCHOOL DISTRICT
Highlands Elementary School
HVAC Equipment Replacement
McCracken & Woodman, Inc.

**ENERGY MANAGEMENT AND TEMPERATURE
CONTROL SYSTEM
DOCUMENT 23 01 01-6**

1. Submit two (2) draft copies of manuals for review. After review by the Engineer, make corrections and submit six (6) final copies to Engineer for distribution to Owner.
 2. Assemble all manuals into binders. All manuals are to include names, addresses, and telephone numbers for the following: project name, Owner, EMTCS Contractor (including project manager's name and service telephone number), Engineer, and Mechanical Contractor.
 3. Operations, maintenance, and programming manuals are to serve as training and reference manuals for EMTCS.
- C. Programming manual:
1. Provide Programming Manual to serve as training and reference manual for all aspects of EMTCS programming:
 - a. Complete programming manuals and reference guides.
 - b. Software troubleshooting procedures.
 - c. Details of any special software packages and compilers supplied with system.
 - d. Documentation of application and DDC programs: Flow charts, equations, parameters.
 - e. Information required for independent programming of system.
 - f. Input/Output Point schedule: Include all points, real and virtual. Identify point function, type, and location.
- D. Operating manual:
1. Provide Operating Manual to serve as training and reference manual for all aspects of day-to-day operation of the system. Manual shall include, but not be limited to, the following:
 - a. Sequence of Operation for automatic and manual operating modes. The sequences shall cross reference the system point names.
 - b. Description of manual override operation of control points.
 - c. System manufacturer's complete operating manuals.
 - d. Control flow diagrams.
 - e. System block diagram showing quantity and location of all hardware, including main processor control panel, equipment controllers, and room sensors.
 - f. Interfaces (software and hardware) with equipment provided in other sections of specifications.
 - g. Narrative description of operation for each system, enumerating and describing the function of each component. Include alarm and emergency sequences and equipment interlocks.
- E. Maintenance manual:
1. Provide Maintenance Manual to serve as training and reference manual for all aspects of day-to-day maintenance and major system repairs. Manual shall include, but not be limited, to the following:
 - a. Complete as-built drawings for installation of each system.
 - b. Drawings and photographs showing installation details and locations of equipment.
 - c. Manufacturer's operating setup, maintenance and catalog literature for each piece of equipment.
 - d. Maintenance and repair instructions.

- e. Parts lists with manufacturer's catalog numbers and ordering information.
- f. Calibration procedures, routine preventive maintenance procedures, and corrective diagnostic troubleshooting procedures.
- g. Charts showing normal operating conditions of all significant equipment and significant points such as electrical test points.
- h. Field test reports.
- i. Lists of ordinary and special tools, operating materials supplies and test equipment recommended for operation and servicing.
- j. Overall system electrical power supply scheme indicating source of electrical power for each system component. Indicate which components are on emergency power and indicate all battery backup provisions.
- k. Overall system shielding and grounding scheme indicating all major components and ground paths.

F. Also comply with the requirements of Division 01 – General Requirements.

1.13 SYSTEM DESCRIPTION

A. System configuration:

- 1. The EMTCS shall perform both monitoring and control of HVAC equipment for building management, energy conservation, and environmental control.
- 2. The EMTCS control philosophy is to be direct digital control and be implemented by a distributed digital system.
- 3. The Direct Digital Controllers are to communicate through dedicated communications network(s). All communications on network shall be by digital signals only. Information from all controllers is to be processed through a local area network interface device (main processor control panel).
- 4. The EMTCS is to perform remote data acquisition and process control. EMTCS panels shall be locally mounted, completely self-contained, field programmable, real-time microprocessor based controllers capable of stand alone operation.
- 5. The EMTCS is to be connected to its particular controlled environment through field I/O instrumentation.

B. General:

- 1. All settings to be accessible and adjustable from the Owner workstations.
- 2. Data displays shall allow owner to change all field-resident functions associated with the project, such as setpoints, weekly schedules, etc. from the owner workstations.
- 3. Data displays shall render standard object types for all equipment and devices shown on the drawings and shall be accessed and adjustable by the owner workstations. These shall include as a minimum: analog value, analog input, analog output, binary value, binary input, binary output, calendar, device, event enrollment, file, notification class, program, and schedule object types.
- 4. Data connections including but not limited to Bacnet, Lonworks, and Modbus data connections to all equipment (including lighting control

panels) shall include mapping of all available equipment points. These points shall be accessible and adjustable from the owner workstations.

5. Include images of data display screens as part of the controls submittal for review prior to commencement of work.

C. Design and performance criteria:

1. Response time:
 - a. Time between occurrence of alarm, status change or change of value and its processing, display or printout shall not exceed 10 seconds, irrespective of other system activities.
 - b. Time between an operator's command and the associated system output shall not exceed the following times, irrespective of other system activities:
 - 1) Point Command (Start Stop, Setpoint, etc.)
 - 2) Log Request
 - 3) Graphics Request
 - 4) Program or Database Modification
 - c. Provide stable control of all connected systems with a closed loop control accuracy not to exceed:
 - 1) Temperature: $\pm 2\%$ of sensor span
 - 2) Pressure: $\pm 2\%$ of sensor span
 - 3) Flow: $\pm 3\%$ of sensor span
 - d. Environmental conditions:
 - 1) The EMTCS field equipment panels and other equipment shall operate under ambient environmental conditions of 35° to 122° F dry bulb and 10% to 95% relative humidity, noncondensing as a minimum. Sensors and control elements shall operate under the ambient environmental temperature, pressure, humidity, and vibration conditions encountered in the installed locations.
 - 2) Other equipment, such as computers and printers, shall, unless designated otherwise, operate properly under ambient environmental conditions of 50° to 104°F and a relative humidity of 20% to 80%.
 - e. Materials and equipment:
 - 1) Where multiple units of the same type are required, the units shall be products of a single manufacturer. However, the component parts of the system need not be the products of a single manufacturer. The components shall not require customizing other than setting jumpers and switches and adding firmware. Each major component of equipment shall be labeled with the manufacturer's name, address, model and serial number.
 - 2) All systems and components shall have been thoroughly tested and proven in actual use.
 - f. Total system shall be immune to internal and external generated sources of electrical noise.
 - g. The system shall be capable of two-way communication over voice grade telephone lines.

1.14 EXAMINATION OF SITE

- A. Examine site prior to bidding. Compare it with drawings and specifications. Check conditions and take measurements which may affect work. No allowance shall subsequently be made for any extra expense due to failure to make such examination.

1.15 COOPERATION WITH OTHER TRADES

- A. Schedule work and cooperate with other divisions to avoid delays, interferences, and unnecessary work, conforming to construction schedule and making installation when and where required. If installed work is later found to interfere with work of other divisions, make all necessary changes at Contractor's expense.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURER OF EMTCS

- A. Carrier OPEN BACnet i-VU, web-based (No exceptions).

2.02 SYSTEM LISTING COMPLIANCE

- A. Locally manufactured control panels shall meet all requirements as outlined by UL 508A standard and shall be both approved and listed by Underwriters Laboratories, Inc.

2.03 COMMUNICATION

- A. Controller and operator interface communication shall conform to 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. Use owner provided Ethernet backbone for network segments

2.04 CONTROLLERS

- A. General. The control system shall be available as a complete package with the required input sensors and devices readily available. Provide BACnet Building Controllers (BC), Advanced Application Controllers (AAC), Application Specific Controllers (ASC), and Sensors (SEN) as required.
- B. Stand-Alone operation. Each piece of equipment shall be controller by a single controller to provide stand-alone control in the event of communication failure.
- C. Serviceability. Controllers shall have diagnostic LEDs for power, communication, and processor.

- D. Rooftop Unit Controller (RTC). Defined as Application Specific Controllers (ASC), shall be factory installed on new units by the HVAC manufacturer and shall control all associated HVAC rooftop equipment functions in a single zone application or as part of a zoning system application.
 - 1. Capacity control shall be based by the RTC internal time clock and setpoints (cooling and heating) coupled with a communicating room sensor. The controls shall provide separate occupied and unoccupied cooling and heating setpoints.
 - 2. RTC shall utilize up to 2 speed of fan control, up to 3 stages of cooling, and up to 4 stages of heating.
 - 3. RTC shall provide economizer control that has been certified for Fault Detection and Diagnostics (FDD) by California Energy Commission (CEC). The FDD system shall detect the following faults:
 - a. Air temperature sensor failure/fault
 - b. Not economizing when it should
 - c. Economizing when it should not
 - d. Damper not modulating
 - e. Excess outdoor air

- E. Exhaust Fan Controller (EFC). Defined as Advanced Application Controller (AAC) shall be a solid state micro-controller with pre-tested and factory configured software designed for controlling building equipment using DDC algorithms and facility management routines. The controller shall be capable of operating in either a stand-alone mode or as part of a network.
 - 1. Controller shall have multiple binary outputs to enable fans based on command from BMS. Controller shall be able to monitor multiple binary inputs for fan status current switch.

- F. General Purpose Controller. Defined as Advanced Application Controller (AAC) shall be a solid state micro-controller with pre-tested and factory configured software designed for controlling building equipment using DDC algorithms and facility management routines. The controller shall be capable of operating in either a stand-alone mode or as part of a network.

2.05 FIELD INSTALLED SENSORS

- A. Space Temperature Sensors shall communicate to the controller over a 4-wire communication network and have setpoint adjustment, after hours override, LCD display and a communication service port.
- B. Carbon dioxide (CO2) sensor shall be integrated into the Space Temperature Sensors and have integral programming to perform automatic baseline calibration without user interface. The recommended manual recalibration period shall not be less than five years.
- C. Status indication for fans or pumps shall be provided by a split core design current sensing sensor. The sensor shall be installed at the motor starter or motor to provide load indication. The unit shall consist of a current transformer, a solid state current sensing circuit (with adjustable set point) and a solid state switch. A light emitting diode (LED) shall indicate the on off status of the unit.

2.06 CONTROL PANELS

- A. Provide single-door, UL 508A Listed; Type 4, wall-mount enclosures for each system under automatic control. Mount relays, switches, and controllers in cabinet and indicators, pilot lights, push buttons and switches flush on enclosure exterior face as required.
- B. Fabricate panels from 16 gauge steel with ANSI 61 gray finish and shall include one (1) black padlock handle that will accommodate a padlock with up to a 5/16-in. locking bar for secure access to the enclosure contents. All additional latches shall be black non-locking handle type.
- C. Provide engraved name plates that identify each control panel and for each component mounted to the exterior of the enclosure.
- D. Provide a complete wiring diagram, bill of material for all components and markings with the following information:
 - 1. Manufacturer's name or trademark
 - 2. Supply voltage, number of phases, frequency, and full-load current for each incoming supply circuit
 - 3. Enclosure type number

PART 3 - EXECUTION

3.01 INSTALLATION OF COMPONENTS

- A. Locate and install components for easy accessibility. In general, mount 48 inches above floor with minimum 3'- 0" clear access space in front of units.
- B. All instruments, switches, transmitters, etc., shall be suitably wired and mounted to protect them from vibration and high temperatures.
- C. Line and low voltage control, signal and communication wiring including conduit required for line and low voltage control, signal, and communication wiring shall be the responsibility of the EMTCS Contractor. Wiring may be run using plenum rated cable in nonexposed area. In mechanical rooms and electrical rooms, wiring must be in EMT conduit. In outdoor areas, wiring must be in EMT conduit with raintight fittings and NEMA 3R enclosures.

3.02 ON-SITE EMTCS OPERATOR TRAINING

- A. Provide two (2) days, eight (8) hours per day, of on-site training for up to seven (7) people. The first eight (8) hour training session is to include detailed training on the equipment control, control sequences and EMTCS hardware including hands-on instruction on the troubleshooting of problems and how the EMTCS is wired, physically installed and the control components installed. The second eight (8) hour training session is to include detailed training on the EMTCS software, how to navigate the graphical user interface, the password protection system and how to set each level of password protection and making user changes to setpoints and operating schedules.

- B. The instructor for the EMTCS training is to have extensive experience in the EMTCS and is to be experienced in conducting similar training classes.
- C. Training is to occur within four (4) weeks after the completion of commissioning. Coordinate the time and date for training with the Owner's representative. The training is to take place at the project site.
- D. The agenda for the EMTCS training is to be submitted for review and comment to the Owner's representative and Engineer a minimum of ten (10) working days prior to the commencement of training.
- E. Provide up to seven (7) complete sets of the approved Operations, Maintenance and Programming Manuals to be used for training.
- F. The EMTCS Contractor's designated training personnel shall meet with the Owner's representative for the purpose of discussing and fine-tuning the training agenda prior to the first training session. Training agenda shall generally be as follows:
 - 1. Topic 1:
 - a. Brief walk-through of building, including identification of all controlled equipment and condensed demonstration of DDC controller local display capabilities.
 - b. Brief overview of the various parts of the O&M manual, including hardware and software programming and operating publications, catalog data, controls installation drawings, and DDC programming documentation.
 - c. Demonstration of workstation login/logout procedures, password setup, and exception reporting.
 - d. Demonstration of workstation menu penetration and broad overview of the various workstation features.
 - 2. Topic 2:
 - a. Introduction to DDC panel programming.
 - 3. Topic 3, 4 & 5:
 - a. Review of Sequence of Operation, DDC panel programming, standalone modes, fail modes and graphic workstation screen for each HVAC subsystem.
 - 4. Topic 6:
 - a. Review of alarm feature.
 - b. Review of diagnostics features.
 - c. Review of I/O hardware testing, calibration, and replacement.
 - 5. Topic 7:
 - a. Review of trend feature.
 - b. Review of workstation reports.
 - c. Review of setpoint optimization and fine-tuning concepts.
 - 6. Topic 8:
 - a. Review of all remaining miscellaneous workstation features.
 - b. Question and answer period.

3.03 SEQUENCE OF OPERATION

- A. Energy management applications:

1. System shall have the ability to perform all of the following energy management routines via preprogrammed function blocks or template programs.
2. All programs shall be executed automatically without the need for operator intervention and shall be flexible enough to allow operator customization. Programs shall be applied to building equipment as described below.
3. Refer to Section 23 01 02 – "EMTCS/DDC SOFTWARE" for time schedules and additional requirements.
4. Refer to the drawings for specific equipment Sequence of Operation.

END OF SECTION

EMTCS/DDC SOFTWARE

PART 1 - GENERAL

1.01 GENERAL CONDITIONS

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

1.02 SUMMARY

- A. An existing Direct Digital Control (DDC) system is currently in place at the Highlands Elementary School campus. The existing DDC system is to be replaced in its entirety at the project site with a Carrier OPEN BACnet i-VU web-based DDC system. The Energy Management and Temperature Control System (EMTCS) Contractor is to provide a full and functioning stand-alone system in accordance with Sections 23 01 01 and 23 01 02.
- B. The work shall consist of all labor, material and equipment required to complete the EMTCS/DDC Software, programming and graphics including all incidental work to make it a complete, satisfactory, and fully functioning Direct Digital Control (DDC) Energy Management and Temperature Control System (EMTCS). Work shall include, but not be limited to, the following principal items:
 - 1. System software
 - 2. Programming description
 - 3. Control algorithms
 - 4. Energy management applications
 - 5. Password protection
 - 6. Alarm reporting
 - 7. Trending
 - 8. Dynamic color graphics
 - 9. Management reporting
- C. The EMTCS Contractor is to provide a full and functioning system in accordance with Sections 23 01 01 and 23 01 02.
 - 1. Acceptable Manufacturers:
 - a. Carrier OPEN BACnet i-VU, web-based (no exceptions).

1.03 RELATED WORK

- A. Heating, Ventilating and Air Conditioning Systems, Section 23 00 00.
- B. Energy Management and Temperature Control System, Section 23 01 01.
- C. Electrical Systems, Division 26.
- D. Plumbing Systems, Section 22 00 00.

1.04 DESCRIPTION OF WORK

- A. Furnish, provide, and install all software, programming and dynamic color graphics for a complete and fully functioning EMTCS as specified and as shown on the drawings.
- B. Control System Software shall be BACnet based system architecture compliant with ASHRAE Standard 135-2004.
- C. All settings to be accessible and adjustable from the owner workstations.
- D. Data displays shall allow owner to change all field-resident functions associated with the project, such as setpoints, weekly schedules, etc. from the owner workstations.
- E. Data displays shall render standard object types for all equipment and devices shown on the drawings and shall be accessed and adjustable by the owner workstations. These shall include as a minimum: analog value, analog input, analog output, binary value, binary input, binary output, calendar, device, event enrollment, file, notification class, program, and schedule object types.
- F. Data connections including but not limited to Bacnet, Lonworks, and Modbus data connections to all equipment (including lighting control panels) shall include mapping of all available equipment points. These points shall be accessible and adjustable from the owner workstations.
- G. Include images of data display screens as part of the controls submittal for review prior to commencement of work.

1.05 Licensing

- A. Include licensing for all project specific software programming at all required workstations.
- B. Include licensing for workstation operating systems, and all required third party software.
- C. Provide licensing and original software copies for each specified workstation.
- D. Licenses for remote graphic workstations shall allow for access to any site and shall not be restricted to accessing only the Primary Control Unit LAN's included in this project.
- E. Owner to designate computers on which software is to be installed.

PART 2 - PRODUCTS

2.01 SYSTEM SOFTWARE - GENERAL

- A. Functionality and completeness: The Contractor shall furnish and install all software and programming necessary to provide a complete and functioning

system as specified and as shown on the drawings. The Contractor shall include all software and programming not specifically itemized in these specifications, which is necessary to implement, maintain, operate, and diagnose the system in compliance with these specifications.

- B. Contractor to furnish and install workstation software onto any building Owner's personal computer(s) at building site as requested by Owner. Contractor to furnish three (3) media software copies and three (3) licenses to the Owner for his use.
- C. Configuration: The software shall support the system as a distributed processing network configuration.
- D. System management and supervision: The system software shall allow centralized overall system supervision, operator interface, management report generation, alarm annunciation, and communication with control units. It shall allow system operators to perform the following functions from the Operator Interface, portable operators terminal, and hand held operating device.
 - 1. Monitor and supervise control of all points.
 - 2. Add new points and edit the system database.
 - 3. Change control setpoint, timing parameters, and loop-tuning constants in all control units.
 - 4. Enter programmed start/stop time schedules.
 - 5. View alarms and messages.
 - 6. Modify existing control programs in all control units
 - 7. Upload/Download programs, database, etc. as specified.

2.02 OPERATOR INTERFACE

- A. Description. The control system shall be as shown and consist of a high-speed, peer-to-peer network of DDC controllers and a stand-alone web server operator interface. Depict each mechanical system and building floor plan by a point-and-click graphic. A web server shall gather data from this system and generate web pages accessible through a conventional web browser on each PC connected to the network. Operators with sufficient access level shall have an ability to make changes to all system and equipment graphics in the web server in addition to having full DDC system access to make configuration changes to the control system. Any tools required for making graphic changes shall be provided with web server.
- B. Operator Interface. Furnish one (1) Web server interface as show on the system drawings.
 - 1. With the use of an owner provided remote SMTP email server the operators interface web server shall notify personnel of an alarm and record information about an alarm in the DDC system.
 - 2. Any required installation or commissioning software shall be provided to the Owner.
- C. Operator Functions. Operator interface shall allow each authorized operator to execute the following functions at a minimum:
 - 1. Log In and Log Out
 - 2. Point-and-Click Navigation

3. View and Adjust Equipment Properties
 4. View and Adjust Operating Schedules
 5. View and Respond to Alarms
 6. View and Configure Trends
 7. Manage Control System Hardware
 8. Manager Operator Access
- D. System Graphics. Operator interface shall be graphical and shall include at least one graphic per piece of equipment and graphics that summarize conditions on each floor of each building included in this contract. Indicate thermal comfort on floor plan summary graphics using dynamic colors to represent zone temperature relative to zone setpoint.
- E. Energy Dashboard. Provide a dashboard to display and analyze energy consumption (kWh), energy demand (kW), current (Amps) and Voltage and for each electrical meter with simple graphical presentation to make it easy for users to monitor energy usage in different time scales (daily, weekly, monthly and yearly).
- F. Trend Configuration: Operator shall be able to configure trend sample or change of value (COV) interval, start time, and stop time for each system data object and shall be able to retrieve data for use in spreadsheets and standard database programs.
- G. Reports and Logs. Operator shall be able to select, to modify, to create, and to print reports and logs. Furnish the following standard system reports:
1. Alarm Reports
 2. Schedule Reports
 3. Security Reports
 4. Commissioning Reports
 5. Equipment Reports
- H. Energy Conservation
1. Outside Air Lockout. Lock out heating or cooling modes based on configurable outside air temperature limits.
 2. Demand Limiting
 - a. System shall monitor building power consumption from building power meter pulse generator signals or from building feeder line watt transducer or current transformer.
 - b. The system shall include all required hardware and software necessary to receive an Automated Demand Response (ADR) signal from the utilities Demand Response Automation Server (DRAS).
 - c. When power consumption exceeds adjustable levels, or the system receives an ADR signal from the utility, the system shall automatically adjust set points, and take other programmatic actions to reduce demand.
 3. Optimal Start. The system shall bring the conditioned space to within occupied set points prior to the occupied time period to ensure occupant comfort.
 4. Demand Control Ventilation (DCV). Each controlled space shall have a Carbon Dioxide (CO₂) sensor and shall maintain a ventilation setpoint through a DCV algorithm to fulfill the requirements of ASHRAE standard,

62-1989 "Ventilation for Acceptable Indoor Air Quality" (including Addendum 62a-1990).

PART 3 - EXECUTION

3.01 SYSTEM CONFIGURATION

- A. Thoroughly configure EMTCS software, network communications, operator workstations, portable operators terminals, printers, and remote communications.

3.02 SITE SPECIFIC APPLICATION PROGRAMMING

- A. Provide all database creation and site specific application control programming as required by these specifications, national and local standards and for a fully functioning system. Contractor shall provide all initial site specific application programming and thoroughly document programming. Generally meet the intent of the written sequences of operation. It is Contractor's responsibility to request clarification on sequence issues that require such clarification.

3.03 PASSWORD SETUP

- A. Set up the following password levels to include the specified capabilities:
 - 1. Level 1: (Owner's EMTCS Administrator)
 - a. Level 5 capabilities
 - b. View, add, change and delete user names, passwords, password levels
 - 2. Level 2: (Programmer)
 - a. Level 3 capabilities
 - b. Configure system software
 - c. Modify control unit programs
 - d. Modify graphic software
 - e. Essentially unrestricted except for viewing or modifying user names, passwords, password levels
 - 3. Level 3: (Senior HVAC Technician)
 - a. Level 4 capabilities
 - b. Override output points
 - c. Change setpoints
 - d. Change equipment schedules
 - e. Exit EMTCS software to use third party programs
 - 4. Level 4: (Junior HVAC Technician)
 - a. Level 5 capabilities
 - b. Acknowledge alarms
 - c. Temporarily override equipment schedules
 - 5. Level 5: (HVAC Technician Trainee)
 - a. Display all graphic data
 - b. Trend point data
- B. Assist Owner's operators with assigning user names, passwords and password levels.

- C. Level 1, 2, and 3 passwords shall not be enabled until after record documents of all control unit databases have been submitted in accordance with Section 23 01 01-Energy Management and Temperature Control System. This is to prevent unauthorized adjustment of panel software by Owner's operators before Contractor's record of final settings has been established.

3.04 POINT PARAMETERS

- A. Provide the following minimum programming for each analog input:
 - 1. Name
 - 2. Address
 - 3. Scanning frequency
 - 4. Engineering units
 - 5. Offset calibration and scaling factor for engineering units
 - 6. High and low alarm values and alarm differentials for return to normal condition
 - 7. High and low value reporting limits (reasonableness values) which shall prevent control logic from using shorted or open circuit values.
 - 8. Default value to be used when the actual measured value is not reporting. This is required only for points that are transferred across the primary and/or secondary networks and used in control programs residing in control units other than the one in which the point resides. Events causing the default value to be used shall include failure of the control unit in which the point resides, or failure of any network over which the point value is transferred.
 - 9. Selectable averaging function which shall average the measured value over a user selected number of scans for reporting.
- B. Provide the following minimum programming for each analog output:
 - 1. Name
 - 2. Address
 - 3. Output updating frequency
 - 4. Engineering units
 - 5. Offset calibration and scaling factor for engineering units
 - 6. Output Range
 - 7. Default value to be used when the normal controlling value is not reporting.
- C. Provide the following minimum programming for each digital input:
 - 1. Name
 - 2. Address
 - 3. Scanning frequency
 - 4. Engineering units (on/off, open/closed, freeze/normal, etc.)
 - 5. Debounce time delay
 - 6. Message and alarm reporting as specified.
 - 7. Reporting of each change of state, and memory storage of the time of the last change of state.
 - 8. Totalization of on time (for all motorized equipment status points), and accumulated number of off-to-on transitions.
- D. Provide the following minimum programming for each digital output:
 - 1. Name

2. Address
3. Output updating frequency
4. Engineering units (on/off, open/closed, freeze/normal, etc.)
5. Direct or Reverse action selection
6. Minimum on time
7. Minimum off time
8. Status association with a DI and failure alarming (as applicable)
9. Reporting of each change of state, and memory storage of the time of the last change of state.
10. Totalization of on time (for all motorized equipment status points), and accumulated number of off-to-on transitions.
11. Default value to be used when the normal controlling value is not reporting.

3.05 ALARMS

- A. Alarm priority levels: Alarm messages specified below and throughout Section 23 01 01–Energy Management and Temperature Control System shall be assigned to one of the following priority levels. Level 1 is the most critical. Level 5 is the least critical. Unless otherwise specified, alarm messages shall be assigned to priority level 5. If the EMTCS does not have the capability of displaying the entire specified message, it shall condense the message as necessary; if the entire meaning of the message cannot be included, the message shall reference a code number that refers to an alarm code list. The alarm code list shall be provided by the Contractor with a third party database, spreadsheet, or word processor software package in a format that is searchable using the alarm code number. Return to normal conditions for all alarms shall be reported at the same priority level. Alarm message reporting locations for each alarm priority level shall be as follows:
 1. Level 1: Fire and security office monitor
 2. Level 2: Central control station monitor and alarm logging printer
 3. Level 3: Controls maintenance shop monitor
 4. Level 4: Energy conservation engineer monitor
 5. Level 5: Filter changing crew alarm logging printer
- B. Override alarms: Any point that is overridden through the override feature of the graphic workstation software shall be reported as a Level 3 alarm. Any point overridden through the use of Control Unit hardware HOA switches shall be reported as a level 2 alarm.
- C. Analog input alarms: For each analog input, program an alarm message for reporting whenever the analog value is outside of the programmed alarm limits. Report a return to normal message after the analog value returns to the normal range, using a programmed alarm differential. The alarm limits shall be individually selected by the Contractor based on the following criteria:
 1. Space temperature, except as otherwise stated in sequence of operation: Level 2 (Also see drawings for additional requirements)
 - a. Low alarm: 68 degrees F
 - b. Low return to normal: 69 degrees F
 - c. High alarm: 78 degrees F
 - d. High return to normal: 77 degrees F

2. Controlled media temperature other than space temperature (e.g. air conditioning unit discharge air temperature. If controlled media temperature setpoint is reset, alarm setpoints shall be programmed to follow setpoint:
 - a. Low alarm: 3 degrees F below setpoint
 - b. Low return to normal: 2 degrees F below setpoint
 - c. High alarm: 3 degrees F above setpoint
 - d. High return to normal: 2 degrees F above setpoint.

- D. Motorized equipment failure alarms: Where "prove" operation is indicated in Section 23 01 01–Energy Management and Temperature Control System, it shall be defined as follows: monitor status of the associated device as indicated in the points list and on the drawings. If status does not prove the device is operational at any time after 15 seconds following start command for constant speed devices, remove and lock out the run command to that device and any other interlocked devices, and enunciate the following Level 2 alarm message as applicable:
 1. DEVICE XXXX FAILURE: Status has been lost on Device XXXX when it was commanded to run. Determine cause of failure, correct it, and then acknowledge this alarm so the device can be restarted.

- E. HOA switch tampering alarms: For motorized equipment where the HOA switch is indicated to be monitored directly by a digital input point, EMTCS shall also enunciate the following Level 2 alarm message if the motorized device HOA switch is placed in HAND position. Whenever any device HOA switch is placed in HAND position, the EMTCS shall perform the remaining sequence as specified.
 1. DEVICE XXXX HOA IN HAND: HOA switch is in HAND position. Acknowledge this alarm when the problem has been corrected.

- F. HOA switch tampering alarms: Program this alarm for motorized equipment where the HOA switch is not indicated to be monitored directly by a digital input point. The sequences of operation are based on the presumption that motor starter Hand-Off-Auto (HOA) switches are in the auto position. If a motorized equipment unit starts without a prior start command from the EMTCS, (as sensed by status sensing device), then EMTCS shall perform the remaining sequence as specified. EMTCS shall also enunciate the following Level 2 alarm message if status indicates a unit is operational when the run command is not present.
 1. DEVICE XXXX HOA IN HAND: Status is indicated on the device even though it has been commanded to stop. Check the HOA switch, control relay, status sensing device, contactors, etc. involved in starting the unit. Acknowledge this alarm when the problem has been corrected.

- G. Maintenance alarms: Enunciate Level 3 alarms when runtime accumulation exceeds a value specified by the operator
 1. DEVICE XXXX REQUIRES MAINTENANCE. Runtime has exceeded specified value since last reset.

- H. See requirements for additional equipment-specific alarms specified in Part 4 – Sequence of Operation, Section 23 01 01–Energy Management and Temperature Control System.

3.06 SITE SPECIFIC TRENDING

- A. Establish trends of the following values:
 - 1. Outside Air Temperature
 - 2. Outside Air Enthalpy
 - 3. Discharge Air Temperature on each air conditioning unit.
 - 4. Return Air Temperature on each air conditioning unit.

3.07 EQUIPMENT SCHEDULES:

- A. Program master schedules per Owner's required time schedules with the stated equipment assignments. Scheduling examples are as follows:
 - 1. Administrative: AHU- []
 - a. Weekdays: Occupied time: []
Unoccupied time: []
 - b. Weekends: Occupied time: []
Unoccupied time: []
 - c. Holidays: Occupied time: []
Unoccupied time: []
 - 2. Dining:
 - a. Seven days: Occupied time: []
Unoccupied time: []
 - b. Holidays: Occupied time: []
Unoccupied time: []
 - 3. Classroom:
 - a. Weekdays: Occupied time: []
Unoccupied time: []
 - b. Weekends: Occupied time: []
Unoccupied time: []
 - c. Holidays: Occupied time: []
Unoccupied time: []
 - 4. Other:
 - a. Weekdays: Occupied time: []
Unoccupied time: []
 - b. Weekends: Occupied time: []
Unoccupied time: []
 - c. Holidays: Occupied time: []
Unoccupied time: []

3.08 GRAPHIC SCREENS

- A. Floor plan screens:
 - 1. Provide graphic floor plan screens, which include each room of each building. Indicate the location of temperature sensors associated with each temperature controlled zone (i.e., VAV reheat terminals, etc.) on the floor plan screens. Alternatively, change zone background color based on the temperature offset from setpoint. Display the space temperature point adjacent to each temperature sensor symbol. Use a distinct line symbol to demarcate each terminal unit zone boundary. Use distinct colors to demarcate each air handling unit zone. Indicate room numbers as provided by the Owner. Provide a drawing link from each terminal unit

- temperature sensor symbol shown on the graphic floor plan screens to each corresponding equipment schematic graphic screen.
2. Provide graphic floor plan screens for each mechanical equipment room and a plan screen of the roof. Indicate the location of each item of mechanical equipment. Provide a drawing link from each equipment symbol shown on the graphic plan view screen to each corresponding mechanical system schematic graphic screen.
 3. If multiple floor plans are necessary to show all areas, provide a graphic building key plan. Use elevation views and/or plan views as necessary to graphically indicate the location of all of the larger scale floor plans. Link graphic building key plan to larger scale partial floor plans. Provide links from each larger scale graphic floor plan screen to the building key plan and to each of the other graphic floor plan screens.
 4. Provide a graphic site plan with links to and from each building plan. If multiple site plans are necessary to show all areas, provide a graphic site key plan. Provide links from each site plan screen to the site key plan and to each of the other site plan screens.
- B. System schematic screens: Provide graphic system schematic screen for each HVAC subsystem controlled with each I/O point in the project appearing on at least one graphic screen. System graphics shall include flow diagrams with status, setpoints, current analog input and output values, operator commands, etc. as applicable. General layout of the system shall be schematically correct. Input/output devices shall be shown in their schematically correct locations. Include appropriate engineering units for each displayed point value. Verbose names (English language descriptors) shall be included for each point on all graphics; this may be accomplished by the use of a pop-up window accessed by selecting the displayed point with the mouse. Indicate all adjustable setpoints on the applicable system schematic graphic screen or, if space does not allow, on a supplemental linked setpoint screen.
1. Provide graphic screens for each HVAC unit or system. Indicate outside air temperature and enthalpy, and mode of operation as applicable (i.e., occupied, unoccupied, warm-up, cool-down). Link screens for supply and exhaust systems if they are not combined onto one screen.
 2. Link screens for heating and cooling system graphics to utility history graphics showing current and monthly electric uses, demands, peak values, etc.
- C. Bar chart screens: On each graphic Bar Chart Screen, provide drawing links to the graphic air handling unit schematic screens.
1. Provide a graphic air conditioning unit status screen showing the current start or stop command and the status of all supply and return fans.
- D. Alarms: Each programmed alarm shall appear on at least one graphic screen. In general, alarms shall be displayed on the graphic system schematic screen for the system that the alarm is associated with (e.g., chiller alarm shall be shown on graphic cooling plant schematic screen). For all graphic screens, display analog values that are in a "high alarm" condition in a red color, "low alarm" condition in a blue color. Indicate digital values that are in alarm condition in a red color.

3.09 MANAGEMENT REPORTING

- A. Electrical utility use report: Provide and set up daily, weekly, monthly, and yearly reports for electrical demand and energy usage for the building.
 - 1. Daily report shall include for each hour, totalized kW-hr, peak kW, demand setpoint, outside air temperature, and outside air humidity. Daily report shall also include daily total kW-hr, hourly maximum kW-hr and time of occurrence, hourly maximum kW, time of occurrence, and corresponding outside air temperature and humidity, and daily total heating degree-days and cooling degree-days.
 - 2. Weekly, monthly, and yearly reports shall include totalized data from daily reports, maximum kW and kW-hr and their times of occurrence and corresponding outside air temperature and humidity.
 - 3. The reporting interval for monthly reports shall be selected to coincide with power company meter reading dates and billing periods.
- B. See requirements for additional equipment-specific reports specified in Section 23 01 01–Energy Management and Temperature Control System.
- C. Set up an export function to automatically save management reports on disk on a regular basis. Files shall be saved in delimited text file format that is readable into third party programs using Microsoft Dynamic Data Exchange (DDE) and Object Linking and Embedding (OLE).

END OF SECTION