Hultz/BHU Engineers
1111 Fawcett Avenue, Suite 100
Tacoma, WA 98402
(253) 383-3257

WASHINGTON MILITARY DEPARTMENT
CAMP MURRAY BLDGS 1 & 20B
HVAC REPLACEMENT
STATE PROJECT NO. 2020-608 G (1-1)
HBHU Project No. 20-107

ADDENDUM NO. 2

9-14-20

This Addendum forms a part of the Contract Documents and modifies the original Contract Documents as described. Acknowledge receipt of this Addendum in the space provided on the Form of Proposal. Failure to do so may subject Bidder to disqualification. There are 26 pages to this addendum including all attachments. This Addendum is issued to all known Plan Holders.

PRE-BID MEETING

1. A second pre-bid walk-through was held Thursday, September 10, 2020 on site. See attached sheet for a list of attendees. Items requiring clarification or revisions are covered in this Addendum.

ADVERTISEMENT FOR BID

1. **REVISE** Bid Date and Time to "Prior to 2:00 P.M., September 22, 2020."

BID FORM

1. **REPLACE** the Bid Form with the attached Bid Form. Alternate Bid No. 1 has been deleted.

SPECIFICATIONS

1. Section 01 03 00: Paragraph 1.04: **DELETE** Alternate Bid 1.

2. Section 01 03 00: Paragraph 1.04, ALTERNATE BID NO. 2: **REVISE** to read:

   ALTERNATE BID NO. 2 – BLDG 20B NEW CONTROLS PER 25 50 00

   Building 20B Base Bid: Disconnect/Reconnect existing stand-alone controls per Section 23 09 33. Modify to accommodate new equipment. Provide the Sequences of Operation per Section 23 09 93.

   Alternate Bid: Provide new controls for all new and existing mechanical equipment in compliance with Section 25 50 01. Provide the Sequences of Operation per Section 25 90 00.

3. Section 01 50 00: Paragraph 1.04, A., **REVISE** to read "Contractor may utilize Owner's convenience power where it is available and of adequate capacity."

4. Section 01 50 00: Paragraph 1.08, A., **REVISE** last sentence in to read: "Existing building restrooms may be used by construction personnel provided they are kept in a clean and sanitary condition. If left in poor condition, requiring cleaning by the Owner, the contractor will be charged $100.00 per hour to cover the cleaning costs for each man hour spent in cleaning.

5. Section 23 09 33: Paragraph 1.03, A., **DELETE** sub-paragraph 2.

6. Section 23 33 00: Paragraph 2.05, A., **REVISE** “Division 26” to read “Division 28”.

7. Section 25 50 00: Paragraph 1.03, A., **DELETE** sub-paragraph 2.

8. Section 25 50 00: Paragraph 1.04, C.: **ADD** “Contact Eric Shimmin (425) 877-6762.”

9. Section 25 50 01: **REPLACE** section in its entirety with attached Section 25 50 01.

DRAWINGS

1. G1.0, Project Description: **DELETE** Alternate Bid No. 1.

2. G1.0, Work Limitations: **ADD**

    4. Roof access from inside of Building 20B will not be available for contractor’s use during construction. Provide temporary scaffolding for exterior access to the roof.

    5. Demolition work may not proceed until new HVAC units are on site. Work shall be phased such that no two units serving adjacent spaces will be down or off-line at the same time. Each space shall be cleaned and ready for Owner’s occupancy before moving on to the next unit. Contractor shall provide and maintain schedule showing proposed demolition and installation dates for each unit for review prior to ordering equipment; schedule will be updated and distributed on a weekly basis with all changes highlighted.

    6. Contractor shall notify Owner a minimum of 7 working days prior to starting demolition of any unit.

3. G1.0, General Notes: **ADD** Note “8. Dedicated staging/laydown area will be provided for the contractor’s use in the vicinity of each building. Contractor will be responsible for providing temporary fencing surrounding the staging/laydown area.”

4. All Building 1 Plan Sheets: **DELETE** Alternate Bid - DDC Control Replacement Note (includes sheets M1.10, M1.11, M1.12, M4.10, M4.11, and M4.12).

5. ME0.1, Electrical Equipment Connection Notes: **ADD** to Note 4: Revise disconnect locations shown on plans as necessary to provide required NEC clearances. Locations shown on plans are preliminary. Locations may shift up to 30’ from where shown on plans to accommodate NEC clearance requirements.

6. ME0.1, Electrical Equipment Connection Notes: **ADD** Note 8: Provide four (4) weatherproof GFCI receptacles for servicing outdoor equipment. Each receptacle shall include 150’ #12 wiring and J-boxes as necessary. Connect to nearest panel board Locations of receptacles to be determined in field by Engineer.

7. ME4.10, **REVISE** location of disconnects serving HP-7, HP-11, HP-12 as necessary to maintain code required clearances. Disconnects shall not be located over existing louvers.

8. ME4.11, **REVISE** location of disconnect serving HP-03 as necessary to maintain code required clearances.

9. ME4.11, **ADD** note to HP-13: Contractor may, at their option, extend RG/RL piping up exposed inside corner of existing building pilaster/support column in lieu of running concealed inside

exposed pilaster. Provide minimum 20 gauge sheetmetal enclosure to completely conceal piping from ground to building entrance. Paint to match surrounding surfaces.

10. ME4.12, **ADD** note to AHU-2, AHU-3, AHU-4, AHU-5: Contractor shall disassemble new unit as necessary to move unit into location shown on plan. Contractor shall reassemble unit in place and connect to new/existing ducts as shown on plan. Disassembly and reassembly of unit shall be done by equipment manufacturer's authorized technicians. Existing attic access door may be removed to allow unit installation. Existing inside wall around equipment attic is structural; no studs may be cut or removed.

ATTACHMENTS

1. Pre-bid Walk-Thru No. 2 Sign-in Sheet, 1 page.

2. Revised Bid Form, 3 pages.

3. Section 25 50 01, 19 pages.

END OF ADDENDUM

HULTZ BHU
engineers inc

WMD Camp Murray Bldgs 1 and 20B HVAC Replacement

Pre-Bid Walk-Through No. 2 Sign-In
State Proj No. 2020-608 G (1-1)
HBHU Proj No. 20-107
September 10, 2020

Name	Representing	Phone	Email
Ron Cross	WMD	(253) 377-8284	ron.cross@mil.wa.gov
Tiffany Roberts	Hultz/BHU Engineers	(253) 383-3275	tiffanyr@hultzbhu.com
Brian White	Hultz/BHU Engineers	(253) 383-3275	brianw@hultzbhu.com
Dee Strodemier	Reliable Elect	360 943-1006	dees@reliableelectric.biz
JR Leerkamp	West Coast Mech.	253 514-0511	jrleerkamp@wcmshvac.com
Corey Colaize	Capital Heating and Cooling	3604917450	Cody@CapitalHeatingAndCooling.com
Eric Dawkins	Sno Valley Process Sol.	(425) 476 5914	EricD@SnovalleyProcess.com
Neal Evans	Trotter Morton	(360) 507-1106	nevans@TMLgroup.com
RANDY TRIMBLE	TRS MECHANICAL	253 539 0141	RANDY@TRSMECH.com
KYLE ROCK	ROCK MECH. INSULATION	253-431-3751	KYLE@ROCKMECHANICALINSULATION.com

Project Name: Washington Military Department – Building 1 & Building 20B HVAC Replacement

Project No.: 2020-608 G (1-1)

Contractor Name: _____

STATE OF WASHINGTON
DEPARTMENT OF ENTERPRISE SERVICES
ENGINEERING & ARCHITECTURAL SERVICES
MAIL OR HAND DELIVER TO:
Building #36 Quartermaster Road
Camp Murray, WA 98430-5050

B I D F O R M

In compliance with the contract documents, the following bid form is submitted:

1) BASE BID (*Including Trench Excavation Safety Provisions)*

_____ $_____
(Please print dollar amount in space above) **(do not include Washington State Sales Tax)**

2) BUILDING 1 BREAKOUT (*Of the amount listed above, indicate the dollar amount that applies to Building 1; the remainder of the bid amount will be assumed to apply to Building 20B)*

_____ $_____
(Please print dollar amount in space above) **(do not include Washington State Sales Tax)**

TRENCH EXCAVATION SAFETY PROVISIONS $ _____
(*Included also in Base Bid*)

If the bid amount contains any work which requires trenching exceeding a depth of four feet, all costs for trench safety shall be included in the Base Bid **and indicated above** for adequate trench safety systems in compliance with Chapter 39.04 RCW. 49.17 RCW and WAC 296-155-650. Bidder must include a lump sum dollar amount in blank above (even if the value is $0.00) to be responsive.

2) BID ALTERNATES *(Specify whether additive or deductive)*

~~(1) BLDG 1: CONTROLS PER SECTION 25 50 01~~ ALT BID NO.1 IS NOT USED

(2) BLDG 20B: CONTROLS PER SECTION 25 50 01 ADDITIVE $_____

Do not include Washington State Sales Tax **in alternate amounts**.

The Owner reserves the right to accept or reject any or all bid prices within sixty (60) days of the bid date.

TIME FOR COMPLETION

Contract Time - The undersigned hereby agrees to Substantially Complete all the work under the Base Bid (and accepted Alternates) within 90 calendar days after the date of Notice to Proceed.

Final Completion – All the Work shall be fully and finally completed in accordance with the contract documents within 30 calendar days after the date of Substantial Completion.

Project Name: Washington Military Department – Building 1 & Building 20B HVAC Replacement

Project No.: 2020-608 G (1-1)

Contractor Name: _____

FEDERAL AND STATE REQUIREMENTS

The undersigned agrees to perform the requirements set out and incorporated by reference in attached "DIVISION 00 SPECIAL CONDITIONS" section in the specifications, if applicable.

LIQUIDATED DAMAGES

The undersigned agrees to pay the Owner as liquidated damages the sum of $250 for each consecutive calendar day that is in default after the Contract Time. Liquidated damages shall be deducted from the contract invoice after taxes and retainage.

RECEIPT OF ADDENDA

Receipt of the following addenda is acknowledged:

Addendum No. _____	Addendum No. _____
Addendum No. _____	Addendum No. _____
Addendum No. _____	Addendum No. _____

Name of Firm _____

NOTE: *If Bidder is a corporation, write State of Incorporation; if a partnership, give full names and addresses of all parties below.*

Signed by _____ Official Capacity _____

Print Name _____

Address _____

City _____ State _____ Zip Code _____

Date _____ Telephone _____ FAX _____

State of Washington Contractor's License No. _____

Federal Tax ID # _____ E-mail address: _____

Employment Security Department No. _____

CONTRACTOR CERTIFICATION
WAGE THEFT PREVENTION – RESPONSIBLE BIDDER CRITERIA
WASHINGTON STATE PUBLIC WORKS CONTRACTS

Return this signed "Contractor Certification" with your signed Bid Form or within two (2) business days of request by Owner.

Prior to awarding a public works contract, the Washington State Department of Enterprise Services is required to determine that a bidder meets the responsibility criteria to be considered a 'responsible bidder' and is qualified to be awarded a public works project. See RCW 39.04.350(1)(g) & (2). Pursuant to legislative enactment in 2017, the responsibility criteria include a contractor certification that the contractor has not willfully violated Washington's wage laws. See Chap. 258, 2017 Laws (enacting SSB 5301).

Project No.: 2020-608 G (1-1)

Project Name: Washington Military Department
Building 1 & Building 20B HVAC Replacement

Procurement Solicitation Date: August 18, 2020

I hereby certify, on behalf of the firm identified below, as follows (check one):

☐ **NO WAGE VIOLATIONS**. This firm has NOT been determined by a final and binding citation and notice of assessment issued by the Washington Department of Labor and Industries or through a civil judgment entered by a court of limited or general jurisdiction to have willfully violated, as defined in RCW 49.48.082, any provision of RCW chapters 49.46, 49.48, or 49.52 within three (3) years prior to the date of the above-referenced procurement solicitation date.

OR

☐ **VIOLATIONS OF WAGE LAWS**. This firm has been determined by a final and binding citation and notice of assessment issued by the Washington Department of Labor and Industries or through a civil judgment entered by a court of limited or general jurisdiction to have willfully violated, as defined in RCW 49.48.082, a provision of RCW chapters 49.46, 49.48, or 49.52 within three (3) years prior to the date of the above-referenced procurement solicitation date.

I hereby certify, under penalty of perjury under the laws of the State of Washington, that the certifications herein are true and correct and that I am authorized to make these certifications on behalf of the firm listed herein.

FIRM NAME: _____
Name of Contractor/Bidder – Print full legal entity name of firm

By: _____ _____
Signature of authorized person | Print Name of person making certifications for firm

Title: _____ Place: _____
Title of person signing certificate | Print city and state where signed

Date: _____

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 00 and Division 01 Specification Sections, apply to this Section.

B. Requirements of Section 20 05 00 apply to this Section.

1.02 SECTION INCLUDES

A. Control System Design.

B. Complete Mechanical System Controls.

C. Control Devices, Components, and Wiring.

D. Control System Commissioning.

1.03 BIDDING

A. Building 1:

1. Base Bid: Controls as specified in 25 50 00.

B. Building 20B:

1. Base Bid: Controls as specified in 23 09 33.

2. Alt Bid 2: Controls as specified in 25 50 01.

1.04 SUBMITTALS

A. General: Comply with Section 20 05 00.

B. Product Data: Submit manufacturer's product data for all items to be used. Provide a complete materials list, labeled to match labeling used on shop drawing, with manufacturer and model number. Clearly indicate specific each item’s control features (e.g. range of operation, accuracy, electrical characteristics, material of construction, etc.). Provide a schedule listing all control valves, control dampers, sizes, flow rates, pressure drops, Cv's, and related data to clearly identify application.

C. Shop Drawings: Submit shop drawings of complete control system, including the following information: interconnect drawings showing all wiring and control connections, all control device locations, sequence of operation for all controlled systems, building floor plans with all proposed thermostat and other control device locations shown.

D. Labeling: Submit list of proposed component labeling.

E. Qualifications: Submit the following information:

1. Background and history of company that will be contracted with to do the work of Division 25. Indicate staff size, shop UL listing capability, years of experience

with control system to be installed on this project, etc. Indicate specific people that will be assigned to this project.

2. List any of the sub-contractors to be used, and information on working relationship: i.e. projects done together, history, etc.

3. List of similar projects completed by the Company, with information on each project, i.e. when completed, description, size, dollar value, when completed, project references (Owner or Architect), and any other pertinent projects.

4. Submittal of system communication architecture, general layout, and programming protocol.

5. Submittal of major products to be used, including but not limited to:

   a. Network Controller.

   b. Heat Pump Unit Controllers.

   c. Thermostats.

   d. Actuators.

6. Company's service and maintenance capabilities.

7. Lead Programmer resume.

8. Project Managers (or Project Superintendant) resume.

9. Other pertinent data to allow the Owner and Engineer to evaluate qualifications.

F. Commissioning Reports: Submit documentation showing commissioning work and results.

G. Approved Systems/Contractors: Work of this section shall be:

Delta Controls, as installed by Delta Connects.

1.05 QUALITY ASSURANCE

A. Listing: All network controllers, central system controllers and local user displays shall be UL Listed under Standard UL 916, category PAZX.

B. Electrical Interference: All electronic equipment shall conform to the requirements of FCC 15, governing radio frequency electromagnetic interference and be so labeled.

C. Skilled Workers: The entire control system shall be installed by skilled electricians, technicians, and programmers, all of whom are experienced, properly trained and qualified for the work they perform. Contractor shall submit evidence of workers' experience and training upon request of the Engineer.

D. Provide documentation to indicate controller compliance with Federal Risk Management Framework (RMF), as manufactured.

E. Provide testing in the field after the system is installed to demonstrate system compliance with Federal Risk Management Framework (RMF), see System Conformance Paragraph 1.07 D. The first portion of testing will be to demonstrate that the control system works properly while connected to only the local building control network. After that portion is demonstrated, the Government will provide an IP address for the controller and in the field testing will be done to demonstrate system compliance with Federal Risk Management Framework (RMF).

1.06 GENERAL REQUIREMENTS

A. Single Contractor: One single Company shall be responsible to design, furnish and install the complete Division 25 control system. Any subcontracted installation work shall be done by firms experienced and qualified in the work they perform, and subject to approval by the Engineer.

B. Local Contractor: System shall be designed, programmed, and commissioned by local office personnel, with their office facilities, located within 100 miles of the project location.

C. Qualifications: Firms performing the Division 25 work shall meet the qualifications listed below. Firms listed below have been pre-qualified as a convenience to bidders.

1. Have installed control systems of the type required for this project in at least 6 projects of similar or greater complexity in the last 2 years. These similar or more complex projects shall involve integrating controls of another contractor.

2. Be qualified by the manufacturer of the system being installed to install the type of controls and of the magnitude required for this project. Such pre-qualifications shall include titles as "Authorized Control Integrator", "Independent Field Office", "Authorized Factory Representative" or similar.

3. Have installed control systems similar to the type for this project in at least 6 projects in a campus setting where the work could affect the control systems in multiple buildings.

4. Pre-qualified firms: Sound Energy, ATS Automation, Delta Controls, local branch office of listed control system manufacturers (see Paragraph 2.01 this Section).

D. Licensing: Provide licensing which allows the Owner to make modifications, additions, expansion, and interconnections to all aspects of the system without limitation. Manufacturer’s software licensing agreements shall be configured to allow the system to be “open” and non-proprietary. The Owner shall have full ownership for the system and access.

E. Payments: The Contractor is advised that in addition to payments held out for retainage and project final completion (i.e. punchlist work) as specified elsewhere, the work of this specification Section may be limited to a maximum payment of 90% of the scheduled value of the work until all system are proven operational and have been properly checked out by the installing Contractor.

F. Service Allowance: Include 24 hours of control labor for special work (i.e. software changes, system consultation, relocation of control devices and other services) during construction as required by the Owner or Engineer. The Engineer and Contractor will jointly track the amount of time used. Only time directly authorized and agreed to by the Engineer may be tracked as part of this allowance. This allowance is for work outside of

other required project work, and is for specific tasks assigned to the Contractor by the Owner or Engineer.

G. Programming Point Names: Custom point naming is required to match the Owner's standard point naming scheme. Coordinate with Owner to confirm standards.

H. Existing Systems:

1. Existing Controls: Existing controls at the buildings are stand-alone, 7-day programmable thermostat type; and shall be removed completely. New controls shall be the DDC type complying with these specifications.

I. Spare Parts: Contractor shall furnish the Owner with minimum of the following spare parts, of same type as used in this project:

1. One spare Unitary terminal control unit.

2. Two room temperature sensors/thermostats with occupancy override.

3. One current sensing relay as used on fans.

J. Warranty:

1. Basic: System shall be warranted to provide the sequence of operation and basic features specified, with the accuracy and flexibility specified. The system shall be repaired or replaced, including materials and labor, if in Owner's reasonable opinion, system is other than as warranted.

2. Emergency Service: During the warranty period maintain a 24 hour emergency phone service and be able to respond by a trained and qualified Controls Engineer familiar with the installed system. The Contractor shall be able to communicate with the system for purposes such as program algorithm alterations, operational evaluations, trouble-shooting, etc.; said response shall be within six hours, with site visits (as necessary) in no less than two weekdays.

3. Warranty Service Allowance: Include 16 hours of control technician/programmer’s time for special service (i.e. software changes, system consultation, setting up additional trends, etc.) and other services during the warranty period as required by the Owner or Engineer. The Owner and Contractor will jointly track the amount of time used. Only time directly authorized and agreed to by the Owner may be tracked as part of this allowance. This allowance is for work outside of other required project work, and is for specific tasks assigned to the Contractor by the Owner or Engineer.

4. End of Warranty Service: At the end of the warranty period, the Contractor shall provide a re-check of the entire system operation, including calibration testing of a sample number of components and providing any necessary control adjustments for proper system operation. Such work shall be for a minimum of 8 hours on site.

1.07 REFERENCES

A. UL 916: Energy Management Equipment.

B. FCC 15: Code of Federal Regulations, Title 47, Part 15, Federal Communications Commission Regulations.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. General: Products shall comply with Section 20 05 00. See Section 20 05 00, paragraph 2.01 for Acceptable Manufacturer requirements.

B. Control System Manufacturer: Delta Controls as installed by the local office of Delta Connects; contact Eric Shimmin, (425) 877-6762.

C. Actuators: Belimo.

D. Other Control Components and Accessories: Idec, Hoffman, McDonnell, Tridelta, Veris, Kele, Edwards, Mamac, APC, Barksdale, Mark-Time, Functional Devices, and manufacturers listed for microprocessor based products.

2.02 BASIC SYSTEM

A. General: The system shall be a distributed processing type direct digital control (DDC) system. System shall provide complete stand-alone temperature control/monitoring and energy management for this project, using a network of various independent controllers, sensors and associated devices interconnected in a communicating network.

B. System Protocol: System shall utilize an open (i.e. non-proprietary) communications protocol which allows the use of control components by different manufacturers to be installed as part of the system with automatic adaption and incorporation into the system with minimal programming. System shall be a BACnet compliant type with all component communication using the protocols and standards as defined by ANSI/ASHRAE 135. LAN type shall be Contractor selected (complying with Contract Document requirements).

C. Version: System shall be latest version of the manufacturer’s standard commercial building DDC system.

D. Expansion: System shall have a fully modular architecture, allowing expansion through the addition of controllers, and control devices. System shall have capability to increase capacity by 100% (i.e. as many points as system currently has) without requiring software upgrades or revised licensing.

E. Network: All controllers shall be interconnected in a communicating network to provide facility wide access to work stations and sharing of information. A Local Area Network (LAN) shall be provided to interconnect controllers for high speed data transmission. Failure of a single or multiple controllers shall not cause loss of communication between other LAN-connected controllers still active. The control system LAN shall be separate and independent from other building LAN’s (except for a single data terminal connection at a single system workstation).

F. Full DDC: All items to be controlled/monitored shall be by DDC. No line voltage thermostats, line voltage switches, etc. that provide direct system control are allowed, unless specifically noted otherwise.

G. System Performance:

1. Graphics: System shall display a graphic with at least 20 dynamic points with all current data within 10 seconds of being initially displayed. System shall refresh a graphic with at least 20 dynamic points with all current data within 8 seconds.

2. Object Command: Commands of a binary object entered at local workstations shall be executed at the commanded device within 2 seconds of being entered; analog objects shall start to adjust within 2 seconds.

3. Current Data: Any data used or displayed at a controller or local workstation shall be current within the previous 6 seconds.

4. Alarm Response: Maximum time between an alarm event at it being annunciated shall be 45 seconds.

5. Program Execution Frequency: Applications shall be capable of running as often as every 5 seconds; select execution times that are consistent with the process under control and provide optimum comfort and control of setpoints without excess deviation. Controllers shall be able to execute PI and PID control loops at a selectable frequency of at least once per second; with the process value and algorithm output updated at this same frequency.

6. Reporting Accuracy: Control system reporting end-to-end accuracy shall be no less than the following:

a. Space, Duct, Water Temperatures: Plus/minus 1 deg F.

b. Outside Air Temperatures: Plus/minus 2 deg F.

c. Airflow at VAV Terminal: Plus/minus 10% of full scale.

d. Airflow at Measuring Stations: Plus/minus 5% full scale.

e. Water Flow: Plus/minus 5% full scale.

f. Air Pressure in Spaces: Plus/minus 0.01-inches wg.

g. Air Pressure in Ducts: Plus/minus 0.1-inches wg.

h. Water Pressure: Plus/minus 2% of full scale.

7. Stability: System shall provide stable and accurate control operation without excessive variation of controlled variables; variation shall in no case be more than 1.5 the reporting accuracy for temperatures, and the same as the reporting accuracy for other variables. System shall operate without invalid alarms or with excessive alarms.

2.03 SYSTEM FEATURES

A. General: Controllers, operator workstation, control components, and accessories shall all be combined to form a complete system providing the sequences of operation/functions specified and having the features specified. System shall monitor and control all functions relating to building environment, utilities, energy usage, and mechanical

systems operation. The point monitoring and controlling functions to be performed by the system shall include but not limited to the following capabilities:

1. Digital inputs (e.g. a contact closure of a control device).

2. Analog inputs (varying electrical signal from a control device to a controller).

3. Digital output (e.g. a contact closure by a controller).

4. Analog outputs (varying electrical signal from a controller to a control device).

5. PWM (pulse width modulation) with feedback position indication.

B. Controllers: The system controllers shall directly control all fans, HVAC equipment, dampers, coils, system equipment, and similar devices. All control software shall be implemented in the controllers.

C. Controller Failure: Upon failure of any controller system shall display off-line occurrence for each individual affected point. Provide communication verification to each NAC for each I/O channel. If communication is disrupted, show error count for each attempt to communicate for each registered point per NAC. Operator shall be able to update count and reset to zero.

D. Zone Control: Provide zone-by-zone control of space temperature, usage scheduling, equipment status reporting, and override timers for off-hours usage.

E. Setpoints: Zone temperature setpoints, equipment setpoints, pressure setpoints and all other controlled parameters shall be able to be set by an operator (except where indicated otherwise). System shall have global command ability to override all settings of the same type to the same value. All setpoints shall be operator adjustable (via common English language commands).

F. Password and Security: Access to system shall be by priority password security system to prevent unauthorized use. Minimum of five levels, each assignable to dedicated functions. Operator may select individual security level assignments for each operation and menu selection available.

G. Time Control: System shall have capability for each equipment to have its own independent time schedule; including occupied/unoccupied modes and optimum start cycles. In addition, system shall have capability for each equipment that could be operated on a seasonal basis (e.g. boiler in heating season, chiller in cooling season, associated pumps, de-stratification fans, baseboard heaters, AC units, etc.) to have independent time of year seasonal schedules.

H. Time Schedule Override: Bypass devices shall send signal to control system indicating requirement for time schedule override operation. The operator shall program the time of override operation at the keyboard from 1 to 15 hours; set initially for 2 hours. Override time remaining to be displayed as part of system graphics; and operator shall be able to alter override time or turn area back to automatic.

I. Run Time: Equipment run time totalization and start/stop totalization of all equipment connected to system; may be trended totalization information, with no required auxiliary equipment.

J. Menu Modification: Operator shall have complete capability to modify displays, menus and menu format headings, data base information, with no required auxiliary equipment.

K. Clock: Real-time clock shall be self-contained and accurately controlled by a quartz crystal. A battery standby power supply shall be used to maintain clock operation when primary power fails. When primary power returns, the system shall automatically restart to the appropriate schedules with accurate clock time and require no action from personnel to re-initialize.

L. Alarms:

1. For each analog input point allow operator assignable high and low alarm limits; for each digital input point allow operator assignable alarm.

2. For each analog input alarm and each digital input alarm, allow the following assignable alarm responses:

a. Provide system output to sound horn or flash remote light as directed on alarm occurrence.

b. Display English-language description of alarm on system graphics.

c. Print out alarm description and operator-created alarm message.

d. Require acknowledgment by operator and print occurrence if directed by owner.

e. Store previous 300 alarms, with description, time of occurrence, time of acknowledgment, and time of return to normal. Provide for review of alarm history on display and printer.

f. Provide 100 programmable alarm messages, up to 256 characters each.

3. Operational Alarms:

a. Provide for 200 operational (non-maintenance type) alarms which indicate a safety device alarm or equipment failure alarm (related to an operational issue).

b. Failed Function Alarm: Provide alarm for each equipment that controls heating or cooling: if unit calls for heating (or cooling) but the temperature of the media (i.e. air or water) leaving the equipment does not vary appropriately from the entering temperature of the media; indicating equipment failure. Provide similar alarms for pumps and fans (using proof of flow device pressure) and water heaters.

4. Maintenance Alarms: Provide for 100 maintenance alarms of at least 256 characters. These alarms shall occur to indicate normal maintenance requirements; i.e. upon the arrival of a predetermined calendar date, upon the passage of a specified equipment run time or upon passage of a specified number of equipment start/stops.

5. Train the Owner in the development of all alarms and program the first 25.

M. Logs:

1. Trend Log: Provide trends for all input and output data and the ability to log the data. For each trend log, operator may assign multiple points and an interval sampling rate of 1 minute to 96 hours. Store time segments. Provide for review of data on graphic display and printer. Each trend log shall be able to be assigned individual start/stop times/dates in advance. System shall automatically begin entry into each log as scheduled. Each point in the log shall have 360 entries, all data stored for future retrieval. Trends shall be formatted for ease of reading.

2. Current Alarm Log: An alarm log shall track and display all points currently in alarm.

3. Alarm History Log: Log last 100 alarms as to time of occurrence, time of acknowledgment and time of return to normal. Maintenance alarms shall be separate from operational type alarms.

N. Scheduling:

1. Time Schedules: The Control System shall provide time clock schedule with at least 100 time schedules. Each schedule to be 8-day type, 6 entries per day. All entries to be in 12 hour AM/PM format. The complete schedule shall be displayed at one time on the operator workstation for easy editing. Each time program shall be able to include on/off, high/low speed or duty cycle commands, or Analog Control Values as applicable for the application. Equipment may be assigned to named schedules, with master revisions to the schedule revising all assigned equipment.

2. Holiday Schedules: A minimum of 24 holiday time schedules shall be available and shall be assigned to any number of available points.

3. Holiday schedule shall display entire year and shall also allow for an interval holiday time, program showing holiday start date to end date (example: December 24 to January 2).

4. Schedules shall provide control of all equipment as indicated in the sequence of operation. Coordinate with Owner for final project schedules.

O. Demand Limiting: Provide a demand limiting program with a hierarchy of equipment loads to be shed. System shall support at least 100 loads and three demand meters.

P. Warm-up Mode: Control System shall have warm-up mode prior to occupied mode on heating to pre-warm building prior to occupancy. Time of beginning warm-up cycle shall be determined by an optimum start/stop program.

Q. Optimum Start/Stop: Control System shall have optimum start/stop program to reduce run time of HVAC equipment. Optimum start/stop program shall consider building mass, building temperatures, outdoor air temperatures, and other system factors in determining time of system start-up or shut-down. Program shall record previous warm-up times versus actual warm-up times and shall adjust the program algorithm so that program calculated warm-up time corresponds to actual.

R. System Graphics:

1. Graphics: Provide complete system color graphics with displays of all controlled systems. Graphics shall allow operator capability of constructing additional floor plan drawings, mechanical equipment diagrams, piping diagrams, and similar systems drawings at will, while system is on line. Graphics to be color dynamic, displaying current monitored system values. Graphics shall be menu driven from keyboard keys and from mouse. System shall use English language and acronyms selected to allow operators to use the system without extensive training or without programming backgrounds. Software shall use command strings in a request-response sequence in which the machine prompts the operator for all required information; operator response required shall be the appropriate parameter input data. Software shall contain edit functions and escape modes to eliminate continuous logic loops requiring system reboot to escape. Coordinate with Owners staff to develop all operational data to satisfaction of Owner.

2. Building Plans: Graphics shall include building plans showing locations of all controlled or monitored equipment, areas served, thermostat locations, and significant major control device locations (e.g. CO2 sensors, outside air sensors, etc.).

3. Equipment Summary: Display shall include a summary display of all system measured variables (i.e. all control devices) for equipment, and include (but not be limited to):

    a. Summary status of all controlled or monitored equipment.

    b. Equipment ID number and zone (or area) served.

    c. Zone temperature.

    d. Zone heating and cooling setpoints (adjustable).

    e. Zone mode (heating, cooling, float).

    f. Discharge temperature of HVAC units.

    g. Fan status and commanded value.

    h. Outside air damper position (percentage open).

    i. Alarm status of equipment (contrasting colors).

    j. Economizer disable setpoint (adjustable).

    k. All safety control devices.

4. Detailed status of mechanical equipment:

    a. Equipment identification, location, area served, and description of unit and system.

    b. Provide all information required to be sent to GUI for each equipment and any other control loop data indicative of unit operation.

c. Schematic of system with appropriate temperatures, flows, etc. interposed on schematic. Provide schematic for each hydronic system, fan system, steam system, domestic HW, and other systems where extensive measurements are made.

d. Alarm conditions as listed for each equipment under Sequence of Operation portion of specifications. Alarm condition shall be indicated in a contrasting color from normal operation.

e. Unit Run Times:

1) Annual run time.

2) Total life run time.

3) Number of starts/stops.

4) Run time shall be reset by operator (provide operator confirmation that change is desired before making change).

f. Unit and zone time schedules.

5. Time schedules (daily and annual).

6. Operational Alarms.

7. Time and date of last update of listed information.

8. Record of daily outside air temperatures.

9. Record of annual daily building temperatures (selectable from any zone or combination of zones).

10. Trend Logs.

11. Run times of all equipment in one display.

12. All measured control signals (i.e. all points) transmitted to system controllers shall be available for display. Provide organized format and menu for ease of operator display of this information.

13. Building Floor plans indicating location of each thermostat and temperature of space served by that thermostat.

14. Summary of all space temperatures on a single graphic display.

15. AHU Summary: Provide screens with summary listing of all AHU's. List to include unit no., area served (room no. and name), space temp, SA temp, OA damper position, alarm indication, and 2 other variables as selected by Owner.

S. All percentage values on actuators shall indicate percentage open.

T. Provide adjustable date and time stamp on main graphics page.

2.04 CONTROLLERS

A. General: Shall be manufacturer's standard controllers used for commercial DDC systems complying with the system communication protocol specified and allowing the system to provide the specified features and sequence of operation. Controllers shall be listed, certified, or in some definitive way deemed compliant by an appropriate independent agency that they comply with the system communication protocol being utilized.

B. Types: Type, capacities, arrangement and features shall be Contractor selected to provide an overall system complying with Contract Document requirements.

C. Operating Conditions: Controllers shall be capable of operation over a temperature range of 32 deg F to 130 deg F and a humidity range of 5% to 95% (non-condensing).

D. Network Area Controller (NAC): Shall be modular, multi-tasking, microprocessor based direct digital controller, capable of forming a complete interconnected/communications. Shall provide the interface between the LAN and the field control devices, and provide global supervisory control functions over the control devices connected to the NAC. Shall be Risk Management Framework (RMF) compliant, per NIST 800-37; Wireless communication shall be disables from the factory. It shall be capable of executing application control programs to provide:

1. Calendar functions.

2. Scheduling.

3. Trending.

4. Alarm monitoring and routing.

5. Time synchronization.

6. Network management functions for control devices.

7. The NAC must provide all hardware features and accessories as necessary, including ethernet port and battery backup, to provide a complete and operational control system.

8. Provide with flash memory for long term data backup (if battery backup or flash memory is not supplied, the controller must contain a hard disk with at least 1 gigabyte storage capacity).

9. The NAC shall support a standard Web browser access via the Intranet/Internet and provide multiple user access.

10. Controller mounted display with LCD screen with user friendly menu for system access.

E. Terminal Unit Controllers (TUC's): Controller specifically designed for control of individual air handling units, fans, VAV terminal units, and similar type units; controllers shall be microprocessor based and shall contain a non-volatile resident program to allow for proper sequencing of controlled equipment. TUC shall interface to the building control system a multi-drop communications network. Each terminal controller shall be

accessible for purposes of control and monitoring from a central or remote operator's terminal as specified herein.

F. Graphic User Interface (GUI): Shall consist of a personal computer, and include a keyboard, modem, printers, monitor, and interface devices for communication to system NAC's and to the system. The system shall allow full interface to entire system for monitoring, equipment control, database management, system performance analysis, trending, programming, management reports, and all other functions necessary to operate and manage the control system. The GUI shall communicate with the system controllers and with other GUI's. There shall be no limit on the number of simultaneous users accessing the system via their GUI and the internet.

2.05 ACTUATORS

A. General: Actuators shall use a brushless DC motor controlled by a microprocessor with protection from overload at all angles of rotation. Run time shall be constant, independent of torque. Actuator shall have manual positioning mechanism and direction of rotation control switch and visual position indicator. Housing shall be NEMA rated to suit the conditions at the actuator location.

B. Type: Proportional or two position or floating point type, as required for application. Proportional type shall modulate in response to a 2-10 VDC, or 4 to 20mA control input. Provide with auxiliary switches as required for sequence of operation and to allow for safe operation of items served (and interlocked items), switches shall meet requirements for "double insulation" so an electrical ground is not required.

C. Automatic Closure: Actuator shall spring return upon power interruption, spring return position shall be fail-safe as dictated by freeze, fire or temperature protection requirements; except that actuators required to be the fast operating type may utilize a capacitor discharge for fail-safe closure in lieu of spring (subject to Engineer's approval). Spring return is not required for air terminal units or zone damper.

D. Performance: Actuator power and torque shall be sufficient to match dampers or valves being controlled and allow proper damper and valve operation against system pressures liable to be encountered. Actuator shall be capable of driving control devices from full closed to full open in less than 90 seconds (unless indicated otherwise) and where fast operating type are required (i.e. where interlocked with equipment operation). Where actuators serve valves or dampers directly serving equipment (e.g. boiler water flow control valves) or are interlocked with equipment operation (e.g. make-up air equipment dampers) verify required operating time of actuator with equipment manufacturers and timing of other system components to allow for proper system operation without nuisance shutdowns of equipment or creating undesirable effects due to improper actuator response time.

E. Accessories: Units shall be complete with all brackets, and hardware required for mounting and to allow for the proper control of the regulated damper or valve.

2.06 TEMPERATURE SENSORS

A. Room Temperature Sensors: Solid state electronic type, employing a resistance type output. Factory calibrated to an accuracy of plus/minus 0.5 deg F with a temperature range of 32 to 130 deg F in normally occupied areas and -40 to 140 deg F in other areas, with the following features:

1. Space temperature display.

2. Momentary push button for placing room's system into occupied mode when pressed.

3. Means for adjusting temperature setpoint up or down with setpoint display.

4. System heating or cooling mode indication.

5. For heat pump systems, indications of supplemental heat activation.

B. Duct Temperature Sensor: Shall be solid state electronic type, employing a resistance type output. Factory calibrated accuracy of plus/minus 0.5 deg F with a temperature range shall be -40 to 160 deg F. The sensor shall include a utility box and gasket to prevent air leakage and vibration noise. For all mixed air and preheat air applications, install bendable averaging duct sensors with a minimum 5 foot long sensor element installed so as to sense a representative sample of the medium being controlled.

C. Liquid Immersion Temperature Sensor: Shall be solid state electronic type, employing a resistance type output. Factory calibrated accuracy of plus/minus 1 deg F with a temperature range 0 to 250 deg F. Provide brass thermowells and install sensor probe with heat conductive grease. Probe and sensor head shall be removable without breaking fluid seal. Install sensors in top of pipe for horizontal runs and at a positive slope on vertical runs to prevent condensation from flowing to sensor head.

D. Outside Air Temperature Sensor: Solid state electronic type device, for outdoor installation, factory calibrated accuracy of plus/minus 0.5 deg F, with a temperature range of -20 to 180 degrees F. Provide a sun shield and weatherproof assembly.

2.07 ACCESSORIES

A. Wiring and Conduit:

1. Basic Materials: As specified in Division 26.

2. Power Wiring: 18 AWG minimum and rated for 300 VAC service. Wiring for circuits greater than 24 V shall be as specified in Division 26.

3. Analog Signal Wiring: Field-installed analog signal wiring shall be 18 AWG single or multiple twisted pair. Each cable shall be 100 percent shielded and have a 20 AWG drain wire. Each wire shall have insulation rated for 300 VAC service. Cables shall have an overall aluminum-polyester or tinned-copper cable-shield tape.

4. Life Safety Applications: Wiring that performs code required life safety control (e.g. shutdown of equipment), control of engineered smoke systems, fire alarm interface and similar functions shall comply with code and NFPA standards for fire alarm system wiring and the specific application.

B. Labels:

1. General: Shall comply with Section 20 05 00.

2. Control Devices: Labels on control devices shall use the same designation that appears on the control shop drawings and an indication as to purpose; except

that devices in finished rooms shall be labeled as to the generic item controlled for better user understanding (i.e. 'Room Exhaust Fan", "Hood Fan").

3. Wiring: Wiring labels shall be the self-laminating or heat shrink type with numbering, lettering, or an alpha-numeric identifier indicating the wire signal/power purpose and matching the designation that is used on the control drawings

C. Control Cabinets: Wall mounted, NEMA rated construction, type and rating to suit location environment, UL listed, minimum 14 gauge sheet metal, hinged front door with latch. Size as required to house controls. Controls/devices shall be logically assembled in cabinet, with all devices and cabinet labeled.

D. Relays/Contactors: Shall be the single coil electrically operated, mechanically held type. Positive locking shall be obtained without the use of hooks, latches, or semi-permanent magnets. Contacts shall be doubled break silver to silver type protected by arching contact where necessary. Number of contacts and rating shall be selected for the application intended. Operating and release times shall be 100 milliseconds or less. Contactors shall be equipped with coil transient suppression devices to limit transients to 150% of rated coil voltage. Relays shall have mechanical switching to allow manual operation of relay and LED light to indicate the energized state.

E. Miscellaneous Sensors/Transmitters/Switches/Transformers: Shall be manufacturer's standard, designed for application in commercial building HVAC control systems, compatible with other components so as to provide sequence of operation specified.

PART 3 - EXECUTION

3.01 INSTALLATION

A. General: Provide all computer software and hardware, operator input/output devices, sensors, relays, switches, dampers, actuators, conduit, tubing, wiring, motor starters, transformers, control cabinets, power panel circuit breakers, system design, and all other components required to provide a complete control system with the system features and sequence of operation specified. Select control components with proper characteristics to suit the application, meet specified system performance, provide specified system features, and provide the specified sequence of operation.

B. Electrical Power and Wiring:

1. General: All work shall comply with code and Division 26 requirements. Run conduit and wiring in neat lines, parallel with building construction and coordinated with other trades. Use wire type and size as required by code and recommended by component manufacturers and to suit the application conditions.

2. Conduit: All wiring shall be installed in conduit and in accordance with Division 26 section of these specifications, except that low voltage wiring within ceiling plenum spaces and in mechanical mezzanine areas may be ran without conduit provided that plenum rated cable is used. Install all conduit and wiring parallel to building lines.

3. Electrical Power:

a. Scope: It is the responsibility of the Division 25 Contractor to provide power for all control devices requiring electrical power. Coordinate with the Division 26 Contractor to confirm which panels and circuits are to be utilized. Provide all electrical wiring, conduit, junction boxes, circuit breakers, grounding, panel circuit breakers (of proper size/type), transformers, enclosures and all other components as needed to power all control devices.in accordance with code and Division 26 requirements.

b. Sources: Power for control devices shall be obtained from electrical panels and not from power serving the equipment (unless noted otherwise or the Engineer gives approval). Utilize panels located closest to the items served to the greatest extent possible. Where the building has a generator, equipment served by the generator shall also have their control power (i.e. power to control devices which allow the item to be controlled and monitored) shall also be served by the generator.

4. Service Loop: Provide minimum of 6" extra wiring at all wiring terminations for ease of future maintenance/servicing. Such extra wiring shall be neatly coiled/bundled to allow for uncoiling when the connected equipment is serviced.

5. Miscellaneous Control Wiring: Provide all necessary control wiring between equipment to allow for proper operation. This includes AC units, chillers, boilers, kitchen hoods, and items furnished by others or under other Sections of the specifications.

C. Labeling: All control components, except regular room thermostats, shall be labeled. All control wiring shall be labeled except where color coded wiring is used and the control shop drawings clearly identifier wiring for each color and it is fully consistent through-out the entire project. Submit list of proposed labeling prior to installing.

D. Complete Functions: Provide complete system totally programmed to provide all specified functions, including but not limited to:

1. Time and Holiday Schedules.

2. Alarm Limits.

3. Optimum Start of Each Zone.

4. Dynamic Graphic of Each Distinct Floor Area; include graphic key to allow changes in graphic display.

5. Dynamic Graphic of Each Mechanical System; include graphic key to allow changes in graphic display.

6. Summary of All Zone Temperatures.

7. Summary of Data for Each Zone.

8. All Displays Specified in Sequence of Operation.

9. Master Menu and Graphics as requested by the Owner.

10. All Controller Setpoints and Operational Values Required.

11. Demand Limiting.

12. Optimum Start/Stop and Warm-up.

E. Electrical Phase Loss: Provide all necessary wiring, components, software, and accessories to monitor building electrical power quality and 3-phase power; initiate shutdown of 3-phase powered mechanical equipment on loss of a phase.

F. On/Off Status Indication: All devices which indicate on/off status to GUI, shall have this on/off status manually or automatically controlled from GUI, and shall have positive proof of on or off by differential pressure switch or other applicable device.

G. TUC: To simplify controls and mechanical service and trouble-shooting, the TUC shall be mounted inside a waterproof cabinet on the side of rooftop units. This shall allow all controls maintenance and trouble-shooting to be made while at the unit location.

H. Programming: Provide complete system totally programmed to provide all specified sequences, monitoring data, communications and features.

3.02 MONITORING DATA

A. General: Monitoring information shall be provided at graphic user interface. Provide all necessary controls/devices to provide the data indicated. Monitoring data listed is not a “points list” but is a list of items that shall be monitored and is in addition to data (or “points”) required by the sequence of operation and other specification requirements. A complete “points list” shall be compiled by the Division 25 Contractor based on all system requirements and sequence.

B. Exhaust Fans:

1. Fan on/off status.

2. Fan commanded status (on/off).

3. Fan failure alarm; (i.e. not "proven" on when commanded on).

C. Air Handling Units (all units with fans and ability to heat or coil environmental air):

1. Zone temperature.

2. Zone temperature setpoint.

3. Unit commanded mode (heating/cooling).

4. Supply air temperature off unit.

5. Mixed air temperature at unit.

6. Percent commanded heating or cooling.

7. Override status.

8. Outside air and return damper positions (% commanded open).

9. Fan on/off.

10. Fan commanded position (on/off).

11. Alarm/trouble conditions, shall include as a minimum: freezestat alarm; fan not "proven" on when should be on; heat failure alarm - SA temp not warmer than ma and unit is in heating; cooling failure alarm - SA not cooler than ma and unit is in cooling; "false" cooling or heating call - i.e. Unit calls for heating when OA temperature is above 70 deg F, unit calls for cooling and OA temperature is below 30 deg F).

12. Carbon dioxide levels (as noted on AHU schedule).

13. Heat pump supplemental heat status.

D. Water Heater:

1. Leaving HW temperature.

2. HWC temperature (at HWC pump).

3. High tank temperature alarm (10 degrees above scheduled tank temperature).

E. Circulating Pumps:

1. On/Off status (by differential pressure device or flow switch).

2. Failure alarm (i.e. not "proven" on when commanded on).

F. Miscellaneous:

1. Outside Air Temperature (two locations).

2. MDF/Telecom/Elevator Equipment Room Temperature. Indicate alarm if above setpoint.

3. Fire Alarm Status.

3.03 START-UP

A. Calibration and Commissioning: As each part of the systems become operational, this Contractor shall calibrate all sensing and readout devices and shall test and observe the operation of each and every air moving and/or heating unit and shall adjust all controls so that the items function according to the intent of the specifications. The control contractor shall commission all controls prior to the work of Section 20 08 00 being done. This commissioning work shall include a point-to-point check of all devices, check of sequences, check of proper wiring, and documentation substantiating the work.

B. Report/Statement: After making all necessary system testing and adjusting, the Contractor shall submit a report to the Engineer indicating all testing/adjustment work done and comment on how system is operating. Such report shall be signed by the individual directly responsible for supervision of the installation of the control system.

When the Contractor feels that the system is complete and ready for review by the Engineer, Contractor shall submit a written statement (signed by same individuals as for report) stating that the system is in compliance with the project requirements and ready for review.

C. Owner Instruction: Shall include training in separate sessions. Each session shall include training on both system programming and manipulation, as well as hands-on work with the building system. See Section 20 05 00 for complete requirements.

D. Start-up Trend Logs: The Contractor shall submit to and review with the Engineer daily for a period of four weeks after substantial completion a hard copy log of the following:

1. Five Owner selected room temperature values at 15 minute intervals.

2. Outside air temperature values at 15 minute intervals.

E. Documentation: Contractor shall provide a hard copy documentation of the software application program for each digital controller (TUC, NAC). Documentation provided shall include block software flow chart showing the interconnection between each of the control algorithms and sequences for systems utilizing program listings. A program listing shall be printed onto the same blueprint, along with the program flow chart, and description of the sequence of operation. A hard copy of this document shall be stored and maintained in each stand-alone digital controller panel. System acceptance shall not be completed until this documentation is provided and located in each panel.

3.04 COMMISSIONING

A. The Products referenced in this section are to be commissioned per Section 20 08 00. The Contractor has specific responsibilities for scheduling, coordination, startup, test, development, testing and documentation.

END OF SECTION