ADDENDUM 3 TO ALL BIDDERS:

Reference: Invitation for Bids: IFB#214-06-Renovation Wheeler
Commodity: Renovation Wheeler Hall
Dated: May 19, 2006
For Delivery To: Wheeler Hall
Longwood University
201 High Street
Farmville, Virginia 23909

Bid Due: June 22, 2006 – 2:00 local time
Bid Open and Read aloud June 23, 2006 local time

REVISIONS TO SPECS:

08520, 2.1.A Revise the Basis-of-Design Product to EFCO Series 660.
08520, 2.5 Add “H. Exterior Panning and Interior Trim: Provide extruded aluminum exterior panning and interior trim as shown”.
15791 Replace Section in its entirety.
15855, 2.1, A Add Venmar CES as an acceptable manufacturer

REVISIONS TO DRAWINGS:

05/A8.3 Revise “New closet wall, door and frame (see plans and door schedule for details)” to read “Existing closet wall and frame to remain. New Door and track”.

PREBID QUESTIONS:

1. Reference Drawing A5.2: Aluminum window types A, B, C show muntin patterns. Are these muntins to be between the glass or applied? If applied, does a 1” I.G. still apply? If between the glass, what color and size are the muntins?
   Response: The muntins shall be applied and shall match the color of the window units. The glass will be ¾” I.G. Also, see revisions to section 08520 above.
2. Reference Spec section 04901: Repointing the masonry requires the contractor survey the precast and determine the work to be performed.
   Response: For bidding purposes, assume that all of the precast joints need to be repointed as per General Note 00-06 on drawing A2.1.
3. The legend on drawing E0.1 shows the telephone, data and TV boxes being 1 ½” deep. Spec Section 16780.2 specifies them to be 2 1/8” deep. Which is correct?
   Response: Boxes shall be 2 1/8” in new wall cavities. 1 ½” deep boxes are only intended for the furred out wainscoting on existing walls.
4. The feeders for existing panels to remain on drawing E5.2 are labeled with the note “Refer to Drawing E1.5”. Drawing E1.5 shows wire and conduit sizes to each. Drawing E1.1 shows existing conduit to remain. Are we pulling new feeders for these panels? Are the existing feeders to remain?
Response: Existing feeders and conduits to remain in service as indicated. Note T refers to the incoming entrance service conductors and conduit, which shall remain. Panels CW, CW1, CW2 and CW3 and their feeder to remain in service. On Drawing E1.5, all wire sizes are indicated for estimating purposes. Dashed-in feeders to be removed where indicated.

5. Drawing E3.1 shows the elevator disconnect as FSS/2/200/175 N3R. Drawing E4.3 and E5.2 show it as FSS/3/100/100 N3R. Which is correct?
   Response: FSS/3/100/100 NEMA-3R is correct for the elevator.

6. Note "B" on Drawing E5.3 describes a fused safety switch that does not seem to be shown on the drawing. Was this deleted or where would it be located?
   Response: Delete reference to note B.

7. When will this project be available on the website?
   Response: The Invitation for bid and addenda as well as the separate asbestos abatement project is currently available for viewing at [http://www2.longwood.edu/ifbrfp/reviewifb.asp](http://www2.longwood.edu/ifbrfp/reviewifb.asp). Drawings will not be posted.

8. Reference drawing A8.3. Detail 05 notes new closet wall, door and frame (see plans and door schedule for details). Demolition plans do not indicate closet walls being demolished. Door schedule does not appear to include closet doors, frames and hardware. Please clarify.
   Response: See note 01-03 on demolition plans and A5.2 for door and hardware information. Also, see revision to drawing 05/A8.3 above.

SECTION 15971 – AUTOMATIC TEMPERATURE CONTROLS

PART 1 – GENERAL

1.1 GENERAL REQUIREMENTS

A. The Bidding and Contract Requirements, Division 1 – General Requirements and Section 15050 – Mechanical General Requirements shall apply to this Section.

B. The major components of the automatic temperature control equipment shall be supplied by one of the acceptable manufacturers.

C. Single Source Responsibility: The control system shall be completely installed and placed in operating condition by those specializing in this type of work. The control system shall be provided by a manufacturer that shall have a single source responsibility for all system components, engineering services, maintenance and warranty.
   1. The Contractor shall be qualified and thoroughly experienced in providing single source responsibility for the Energy Management and Control System (EMCS).
   2. The Contractor shall be fully responsible for the complete design, installation and proper operation of the system.
   3. After the installation, the Contractor shall be responsible for the debugging and calibration of the system.

D. System must be capable of being tied in to a Tridium Architecture.

E. Where items under the Bidding and Contract Requirements, and Division 1 – General Requirements are repeated in this section, it is intended to call particular attention to or qualify the items. It is not intended that any other parts under the Bidding and Contract Requirements of Division 1 – General Requirements shall be assumed to be omitted if not repeated herein.

F. Documentation: All documentation required shall be considered as much a part of this contract as the system installation itself. Its accuracy and applicability shall be considered for
conformance to the specifications. Any system revisions and/or additions provided for or required under this contract shall be included in this documentation in the form of updated documents.

1.2 SCOPE

A. A complete automatic direct digital temperature control system utilizing a distributed processing configuration with microprocessor based controls and control panels capable of communication with all other control panels. Panels shall have stand-alone ability without input from other sources. System shall include automatic controls and system monitoring for hot water heating control, chilled water control, and air system control; monitoring and remote communications of equipment status, air, and water temperatures.

B. A complete Energy Management and Control System (EMCS) shall be furnished and installed in accordance with this Section and as shown on the Drawings. The EMCS shall monitor and control HVAC operations, index control modes, provide air handling/fan coil unit optimized start/stop operations, as well as providing reporting and trend logs. The EMCS must be capable of performing the functions, monitor and alarm selected conditions as well as initiate selected control sequences.

C. System Configuration: Furnish and install as hereinafter specified and shown on the drawings a complete system of automatic temperature controls.

D. System Components: The control system shall consist of all data processing components, instruments, thermostats, sensors, transmitters, controllers, relays, valves automatic dampers, valve and damper operators, switches, panels, instrument control cabinets, other accessory equipment, and a complete wiring system as required to fill the intent of the specifications and provide for a complete and operable system.

E. System Integration: Controls furnished as an integral part of items of equipment such as chillers, packaged pumping systems, air handling units and similar equipment shall be incorporated into the control system and all additional control components necessary to accomplish all phases of the control sequence shall be furnished and installed under this Section of the Specifications.

F. Electrical Work: Any necessary line voltage power wiring shall be furnished under Division 16 of the Specifications. All other electrical wiring, conduit and additional electrical components required to complete the automatic temperature control system including interlocking of motor controllers with all other control and building system components shall be provided and installed under this section of the specifications. Wiring shall comply with all requirements of Division 16 Specification and the National Electrical Code.

G. Other Work:

1. Temperature sensing equipment wells, actuators, and automatic dampers not supplied as an integral part of factory fabricated equipment shall be furnished under this Section of the Specifications and shall be installed under the respective piping and sheet metal Specification Sections.

2. Operators for dampers shall be electric type unless otherwise noted.

H. The work included under this Division shall include all drawings as specified, submittals, equipment, labor, materials, technical supervision, transportation, training services, documentation, warranty and other appurtenant work as required to furnish and install a fully operational system to monitor and control the facilities set forth, in strict accordance with these
specifications and subject to the terms and conditions of the Contract. Any apparatus, appliance, material or work not shown on the drawings but mentioned in the specifications, or vice versa, or any incidental accessories necessary to make with work complete in all respects and ready for operation, even if not particularly specified, shall be furnished, delivered and installed by the Contractor without additional expense to the Owner.

I. Items: The Contractor shall note that even if items of equipment are specified in the singular, the Contractor shall provide and install the number of items of equipment as indicated on the Drawings and as required for a complete system.

J. Completion: It is the intention of the Specifications and Drawings to call for finished work, tested, and ready for operation. Wherever the word "provide" is used, it shall mean "provide and install complete and ready for use."

K. Omissions: Minor details not usually shown or specified but necessary for proper installation and operation shall be included, the same as if herein specified or shown.

L. The Contractor shall be fully responsible for the complete design, installation, proper operation, and start-up of the system, including but not limited to, interfacing of equipment with existing central control system of all hardware, software, processors and mechanical equipment.

M. Standalone System: The EMCS shall be installed as a standalone system and shall not require a central computer unit for system operation. The EMCS shall be modular in nature to support expansion in capacity and function.

1.3 DESCRIPTION:

A. This section defines the Basic Materials and Methods used in the installation of LonMark or BACnet Control products to provide the functions necessary for control of the mechanical systems on this project.

B. The control system shall accommodate simultaneous multiple user operation. Access to the control system data should be limited only by operator password. Multiple users shall have access to all valid system data. An operator shall be able to log onto any workstation on the Control System and have access to all valid data.

C. The control system shall be designed such that each mechanical system will be able to operate under standalone control. As such, in the event of a network communication failure, or the loss of any other controller, the control system shall continue to independently operate under control.

D. Communication between the DDC LONWORK or BACnet control panels and workstations shall be over a high speed network (minimum type 1.78 Kbps). All modes on this network shall be peers. The operator shall not have to know the panel identifier or location to view or control an object. Application Specific Control Units shall be dynamically bound to update point information and alarm information. There shall be a maximum of 63 devices on a LONWORK trunk without a repeater and a maximum of 126 devices on a trunk. Communication for BACnet devices, if used, shall be over Ethernet (IEEE Standard 802.3) using 10 Base-T, UTP-8, Category 5 cable.

E. The documentation contained in this section and other contract documents pertaining to HVAC Controls is schematic in nature. The Contractor shall provide hardware and software necessary to implement the functions shown or as implied in the contract documents.

F. Control system shall include control of chilled water and hot water systems, fan coil units, heat recovery make-up air handling units, pump systems and unit heaters. Communication shall be
LONMARK/LONTALK or BACnet to an interface module, provided outside this work, which will interface to the Ethernet Enterprise LAN campus wide Graphical User Interface (GUI), also provided outside this work. Interface module shall be located in the Mechanical Room.

1.4 RELATED DOCUMENTS:

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division-1 Specifications, apply to work of this section.

1.5 SUMMARY OF WORK:

A. Provide LONMARK or BACnet compliant products that communicate on multiple channels to meet the functional specifications of Sequences of Operation in these specifications or as indicated on the Drawings and the dedicated product functional specifications and profiles specified in other Sections.

B. Provide LonTalk or BACnet routers and repeaters as required to combine different communication channels onto a central field bus or as required to segment groups of Intelligent Devices and/or Control Units.

C. Provide Intelligent Devices (ID's) and Control Units (CU’s) as herein specified and as indicated on the HVAC drawings.

D. Provide wire, raceway systems, back boxes, 24 DC and/or 24 AC power supplies and final connections to nodes provided by this contract and the following Control Units and Intelligent Devices provided by other Division 15 Contractors.

1. Intelligent Air Terminal Device Control Units.
2. Intelligent Occupancy Sensors.
3. Intelligent Damper Operators.
4. Intelligent Valve Operators.
5. Packaged Air Handling Control Units.
6. Packaged Unitary Air Conditioning Control Units, (i.e., Condensing Units, etc.).
7. Other Packaged HVAC Equipment Control Units (Chillers, Pumping Systems, etc.).

E. Provide Supervisory Control Unit(s) (SCU’s) that functions as a LONWORKS or BACnet Network Services Server (NSS) for network management, LonTalk or BACnet to Ethernet gateway, and User Interface utilizing a graphical, object oriented software application program(s).

F. Provide LonTalk or BACnet gateways to the following systems installed by other trade contractors:

1. Existing HVAC Controls installed in the Project.
2. Packaged HVAC Equipment.

G. Provide (one) Portable Operators Terminal to permit remote Operator Interface to facilitate network management, node commissioning, diagnostics and general operator interface with the installed LONWORKS or BACnet Control System as a LONWORKS or BACnet Network Services Interface (NSI) tool.

1.6 DEFINITIONS
A. Algorithm: A logical procedure for solving a recurrent mathematical problem.

B. Analog: A continuously varying signal value (temperature current, velocity, etc.).

C. Binary: A two-state system where an "on" condition is represented by a high signal level and an "off" condition is represented by a low signal level.

D. Bridge: A device that routes messages or isolates message traffic to a particular segment sub-net or domain of the same physical communication media.

E. Distributed Control: A system whereby all control processing is decentralized and independent of a central computer.

F. Diagnostic Program: Machine-executable instructions used to detect and isolate system and component malfunctions.

G. Gateway: A device that contains an I/O software driver to translate data from a standard format to that conforming to LonWorks or BACnet standard. LonTalk or BACnet protocol is inserted on outbound LONWORKS or BACnet message and stripped on all incoming messages.

H. Intelligent Devices: A LONMARK or BACnet product that is configured to provide control over a single control loop or to monitor a single or multiple control variable(s).

I. LONWORKS: General purpose direct digital control and LONTALK Communication protocol IC developed by the Echelon Corporation. The technology employs routers, gateways, bridges multimedia transceivers to permit topology and media independent control solutions.

J. LONMARK Interoperability Association: Standards committee consisting of numerous independent product developers and systems integrators dedicated to determine and maintain the interoperability guidelines for the LONWORKS industry.

K. Man-machine Interface (MMI): A graphical, object oriented, method by which an operator is capable of communicating with the control system. Man-machine interfacing allows the operator to manage, command, monitor, and program the system.

L. Network: A system of distributed control units that are linked together on a communication bus. A network allows sharing of point information between all control units. Additionally, a network provides central monitoring and control of the entire system from any distributed control unit location.

M. Operating System (OS): Software which control the execution of computer programs and which provides scheduling, debugging, input/output controls, accounting, compilation, storage assignment, data management, and related services.

N. Peripheral. Input/Output equipment used to communicate to and from the computer and make hard copies of system outputs and magnetic files. Peripherals include CRT, printer, hard drives, disk drives, modems, etc.

O. Deadband: A temperature range over which no heating or cooling energy is supplied, such as 72-78 Deg. F., i.e. as opposed to single point changeover or overlap.

P. Control Wiring: Includes conduit, wire and wiring devices to install complete HVAC Control Systems including motor control circuits, interlocks, thermostats, switches and like devices. Includes all wiring from CU to CU and CU's to all sensors and point defined in the input/output summary shown on drawings or specified herein and required to execute the sequence of operation.
Q. HVAC Control Systems: The complete DDC Building Automation Control System comprising User Interface and routers, gateways, repeaters, Control Units (CU’s), the Supervisory Control Unit(s), software, portable operators terminals, network communications wiring and raceways, and required field hardware, etc.

R. Control Unit (CU): A general purpose, programmable DDC controller dedicated to a single or multiple mechanical systems with the required processing capabilities and universal input/output configuration to satisfy the specified sequence of operation.

S. Supervisory Control Unit (SCU): The User Interface command terminal over the HVAC Control System. The SCU consists of a high level processing personal computer with varying devices of quality and capability based on the application specific and Facility Management requirements.

T. Router: A device which routes messages destined for a node on another segment sub-net or domain of the control network. The device controls message traffic based on a node address and priority. Routers shall also serve as communications links between powerline, twisted pair and RF medias.

1.7 QUALITY ASSURANCE

A. General: The HVAC Control System shall be furnished, engineered, and installed by a LONWORKS HVAC Controls Contractor and Licensed Trade Technicians (i.e. electricians, pipe fitters, etc.). The project shall be supervised by a controls specialist who has completed a LONMARK Network Design, Installation and Maintenance Training Program. The Contractor shall employ technicians to provide instruction, routine maintenance, and emergency service within 24 hours upon receipt of request.

B. Contractor: Contractor shall have a local service facility within a 50-mile radius of the job site, staffed with qualified service personnel, fully capable of providing instructions and routine emergency maintenance service.

C. Experience Record:

1. Provide a list of no less than ten similar projects which have building controls systems as specified. These projects must be online and functional such that the Owner/Users representative can observe a direct digital control system in full operation. At least two (2) projects shall be using LONMARK or BACnet control products and approved network management tools.

2. Submit resumes with the bid proposal indicating the LONWORKS BACnet System integrator training and prior instrument and Controls experience.

D. Reference Standards

1. Control system components shall be new and in conformance with the following applicable standards for products specified;

   a. American Society for Testing and Materials ASTM
   b. Institute of Electrical and Electronic Engineers IEEE
   c. National Electrical Manufacturers Association NEMA
   d. Underwriters Laboratory, UL (UL 916).
   e. FCC Regulation, Part 15, Section 156.
   f. National Fire Protection Association NFPA
E. Products

1. The Building Management System (BMS) shall use an open architecture and fully support a multi-vendor environment. To accomplish this effectively, the BMS shall support open communication protocol standards and integrate a wide variety of third-party devices and applications. The system shall be designed for use on the Internet, or intranets using off the shelf, industry standard technology compatible with other owner provided networks.

2. Utilize standard PC components for all assemblies. Custom hardware, operating system, and utility software are not acceptable.

3. The system shall be modular in nature, and shall permit expansion of both capacity and functionality through the addition of sensors, actuators, controllers and operator devices, while re-using existing controls equipment.

4. Utilize Standard Configuration Parameter Types (SCPT's) for all product configuration parameters. Do not use network variable for this purpose.

F. Acceptable Manufacturers:

1. Honeywell
2. Invensys
3. Johnson Controls

1.8 SUBMITTALS

A. General: Provide eight (8) copies of submittals. Submit the following according to conditions of Contract and Division 1 Specification sections. In addition, provide the following:

1. Product data on all components used to meet the requirements of the specifications such as enclosures, network transceivers, XIF documentation, configuration parameter options, mounting details, power supplies, etc.

2. Software documentation regarding the proposed PC operating system, third party utilities and application programs, and the proposed custom application programs for the Supervisory Control Units.

3. Logical and physical diagrams for each channel indicating each node (CU's and ID's), node address (domain, subnet and group), channel type and router specifications. Submit Perf calculations for each channel.

4. Electrical low voltage power wiring schematic indicating voltage drop calculations, wire size, node power consumption, maximum full load circuit amperage.

5. Submit functional temperature control diagrams for each mechanical system served by the HVAC Control System. Indicate and Tag each input/output served by each Control Unit or Intelligent Device.

1.9 SEQUENCES OF OPERATION
A. Make-Up Air Unit (MUA-1):

1. The EMCS shall start and stop the unit supply fan according to a pre-determined occupied/unoccupied schedule. During the unoccupied mode, unit fan shall remain off and outside air damper shall remain closed. During the occupied mode, the EMCS shall open the outside air damper. A damper end switch shall confirm full open damper position and allow the unit fan to start for continuous operation.

2. Preheat water coil: In the occupied mode, the hot water control valve shall modulate as required to maintain a unit discharge air setpoint (adjustable). In the unoccupied mode, the control valve shall be positioned to 10% open any time the outdoor air temperature falls below 36 Deg. F. for coil freeze protection.

3. Chilled water coil: In the occupied mode, the chilled water control valve shall modulate as required to maintain unit discharge temperature (adjustable). The heat exchanger shall provide pre-cooling.

4. A freezestat located downstream of the heating water coil shall sense the discharge air temperature of the heating water coil. If the discharge air temperature falls below 36 Deg. F., the unit fan shall stop, outside air damper shall close and an alarm shall be sent to the EMCS.

5. A differential pressure sensor across the filter shall alarm the system when the differential pressure indicates that the filter has reached its "dirty filter" point.

6. Supply fan operating status shall be derived from the current relay.

B. Make-Up Air Units (MUA-2 and MUA-3):

1. The EMCS shall start and stop the unit supply air fan and exhaust air fan according to a pre-determined occupied/unoccupied schedule. During the unoccupied mode, unit fans shall remain off and outside air and exhaust air dampers shall remain closed. During the occupied mode, the EMCS shall open the outside air and exhaust air dampers. Damper end switches shall confirm full open damper position for the outdoor air and exhaust air dampers and allow the supply air and exhaust air fans to start for continuous operation.

2. Reheat water coil: In the occupied mode, the hot water control valve shall modulate as required to maintain a discharge air setpoint (adjustable). In the occupied mode, the control valve shall be positioned 10% open any time the outdoor air temperature falls below 36 Deg. F. for coil freeze protection.

3. Chilled water coil: In the occupied mode, the chilled water control valve shall modulate as required to maintain discharge temperature (adjustable).

4. A freezestat, located between the heat pipe and the chilled water coil shall sense the temperature of the air entering the chilled water coil. If the air temperature falls below 36 Deg. F., the supply air fan shall stop, outside air damper shall close and an alarm shall be sent to the EMCS.

5. Differential pressure sensors across the outdoor air and exhaust air filters shall alarm the system when the differential pressure indicates that the filter has reached its "dirty filter" point.

6. Supply fan and exhaust fan operating status shall be derived from differential pressure sensors.
C. Air-Cooled Chiller: The EMCS shall start and stop the chiller. Upon a call for cooling in the system (unless cooling is locked out) and confirmation of proper chilled water flow (confirmed by water flow switch), the chiller shall be energized. The chiller controls shall operate the compressors and condenser fans to maintain the desired leaving chilled water temperature. Unit controls shall include all necessary unit protections including loss of flow, freeze protection and pump down cycle. Coordinate packaged chiller controls with the EMCS.

D. Chilled Water Pumping System

1. The system shall be enabled from the EMCS or by the local enable switch on the packaged pumping system panel.

2. After enable, the lead pump shall start. If the lead pump fails, by not meeting the minimum differential pressure setpoint after a time-delay or through a VFD fault, the second pump shall automatically start. This pump shall be the lead pump and the other pump shall fault and require a manual reset. Fault alarms shall illuminate on the panel and shall send signals to the EMCS.

3. Pump speed shall be maintained through PID loop control. The remote differential pressure sensors shall send 4-20mA feedback signals back to the system controller which is directly proportional to the measured differential pressure. If the remote sensors have failed, the system shall operate at a manually adjustable constant speed.

4. The Packaged Pump Logic Controller shall utilize flow, system KW, system differential pressure and remote differential pressure as PLC inputs necessary to monitor and sequence the pumps within their best efficiency range. When demand increases in the system, as monitored by flow and/or differential pressure, the standby pump shall be brought online after a time delay to maintain the pumps within the best-efficiency range. As demand in the system decreases, pumps shall stop in reverse order until only the lead pump is in operation. The lead pump will continue to operate until it is shut down either manually or by remote signal.

5. The lead pump shall be alternated automatically by disabling the system or by toggling the system enable on a scheduled basis.

6. The equipment shall have adjustable minimum-run timers to prevent unnecessary starting and stopping of equipment.

7. The variable speed chilled water pumps shall maintain a minimum flow through the chiller by maintaining the required DP as sensed at the remote location. If this does not meet the minimum flow requirements for the operational chillers, as sensed by the chiller DP sensor, the bypass valve shall modulate open. As the flow increases past the minimum requirements, the bypass shall be modulated closed.

E. Heating Water Pumping System (including Steam-to-Water Heat Exchanger)

1. The system shall be enabled from the EMCS or by the local enable switch on the packaged pumping system panel.

2. After enable, the lead pump shall start. If the lead pump fails, by not meeting the minimum differential pressure setpoint after a time-delay or through a VFD fault, the second pump shall automatically start. This pump shall be the lead pump and the other pump shall fault and require a manual reset. Fault alarms shall illuminate on the panel and shall send signals to the EMCS.
3. Pump speed shall be maintained through PID loop control. The remote differential pressure sensors shall send 4-20mA feedback signals back to the system controller which is directly proportional to the measured differential pressure. If the remote sensors have failed, the system shall operate at a manually adjustable constant speed.

4. The Packaged Pump Logic Controller shall utilize flow, system KW, system differential pressure and remote differential pressure as PLC inputs necessary to monitor and sequence the pumps within their best efficiency range. When demand increases in the system, as monitored by flow and/or differential pressure, the standby pump shall be brought online after a time delay to maintain the pumps within the best-efficiency range. As demand in the system decreases, pumps shall stop in reverse order until only the lead pump is in operation. The lead pump will continue to operate until it is shut down either manually or by remote signal.

5. The lead pump shall be alternated automatically by disabling the system or by toggling the system enable on a scheduled basis.

6. The equipment shall have adjustable minimum-run timers to prevent unnecessary starting and stopping of equipment.

7. The controller shall modulate the steam valves (1/3 and 2/3 capacity) to maintain leaving water temperature from the heat exchanger. As the leaving water temperature increases above 180 Deg. F., the valves shall modulate closed. As the leaving water temperature decreases below 180 Deg. F., the valves shall modulate open (1/3 capacity control valve first). When the system is off or no pump is running, the valves shall be closed.

F. Ductless Split Air Conditioning Unit (AC-1):

1. Unit shall be controlled by a wall-mounted thermostat with programmable setpoints as provided with the unit. The supply fan shall operate continuously. On a call for cooling, the controls shall stage on the DX cooling to maintain setpoint.

2. Safeties: An alarm shall announce the EMCS whenever the condensate pump malfunctions. The EMCS shall monitor unit status and room temperature.

G. Horizontal and Console Fan Coil Units:

1. General: Each fan coil unit shall have a microprocessor based terminal unit controller (TUC) which shall monitor and control the fan coil unit in a stand-alone mode or as directed by the EMCS.

2. The fan coil air conditioner shall consist of:
   a. Chilled water coil with a control valve.
   b. Air supply fan.
   c. Hot water auxiliary coil with a control valve.

3. The EMCS shall perform the following fan coil control strategies, provide the points listed on the list and provide the specified monitoring and diagnostics.
   a. Fan Operation: The supply fan shall operate automatically at various speeds in the Occupied Mode. The fan shall also be manually adjusted to different speeds through a unit-mounted fan speed switch. Units shall be equipped with the Fan Status option and shall indicate an alarm at the EMCS if the supply air fan output and the status do not match after an adjustable verification delay.
b. Heating/Cooling Setpoint and Mode:  The space temperature cooling setpoint shall be determined either by a local setpoint adjustment knob, the TUC default setpoint or the EMCS downloaded values.  The local setpoint adjustment knob shall determine the setpoint if the TUC is in Local Mode.  If the TUC is in the Remote Mode or if the knob fails, the TUC shall use the EMCS downloaded setpoint.  If the EMCS is not communicating, the TUC shall use its own default setpoint.  The cooling setpoint shall be limited by adjustable parameters in the TUC to prevent it from being set too high or low.  The heating setpoint shall be a TUC-calculated value less than or equal to the cooling setpoint.  The TUC shall be set to a cooling mode when the space temperature rises one degree F above the cooling setpoint.  In the Unoccupied Mode, the setpoints shall be widened to accommodate night setback and shall be adjustable.

c. Four Pipe Valve Control:  In heating mode, the heating valve shall be modulated to maintain the heating setpoint temperature and the cooling valve shall be fully closed.  In the cooling mode, the cooling valve shall be modulated to maintain the cooling setpoint and the heating valve shall be fully closed.  In either mode, the discharge air temperature setpoint shall be limited to an adjustable low (usually 50 Deg. F.) and high (usually 90 Deg. F.) to prevent extremely cold or hot air from blowing into the space.

d. Unoccupied Operation:  In the Unoccupied Mode, the heating and cooling operation shall be the same as Occupied Mode, except that the adjustable setpoints shall have a wider range of values to accommodate night setback.  The TUC shall change to Unoccupied operation when commanded.

e. Morning Warm-Up/Cool Down:  When a warm up or cool down is initiated, the fan shall turn at high speed and the heating or cooling valve shall control to setpoint.  When the space temperature reaches setpoint, the TUC shall operate in Occupied Mode.

f. Fan Status:  A motor current sensor shall be used to sense the fan status.

g. Each zone shall use a thermistor element to measure the actual zone temperature.  The setpoint shall be determined by the EMCS setup.

h. The Timed Override (TOV) On and Cancel commands shall be issued by the zone sensor when the corresponding buttons are pressed.  When the On button is pressed, the TUC shall activate the Timed Override Signal for two minutes, clear the TOV Cancel Signal (if it was set) and start the two hour adjustable, timed override timer.  When the TOV Cancel button is pressed for at least one second, the TUC shall activate the TOV Cancel signal, clear the TOV signal and set the timed override timer to zero.  Pressing either button shall not affect the zone temperature reported by the TUC.

H. Horizontal and Cabinet Unit Heaters:  Unit shall be controlled by a wall-mounted 2-stage thermostat.  The thermostat shall cycle the unit fan and open-close the heating water control valve to maintain the thermostat setpoint.  An aquastat shall be provided to stop the fan if the heating water temperature falls below 80 Deg. F.

I. Vertical Fan Coil Units:

1. General: Each fan coil unit shall be controlled and monitored as directed by the EMCS.

2. The vertical fan coil unit shall consist of:
a. Chilled water coil with a 2-way modulating control valve.
b. Air supply fan (3-speed).
c. Hot water coil with a 2-way modulating control valve.

3. The EMCS shall perform the following fan coil control strategies, provide the points listed on the list and provide the specified monitoring and diagnostics.

a. Fan Operation: The supply fan shall operate automatically at various speeds in the Occupied Mode. Units shall be equipped with a current sensing relay to indicate an alarm at the EMCS if the supply air fan motor fails.

b. Heating/Cooling Setpoint and Mode: The space temperature heating/cooling setpoints shall be determined by the EMCS. In the Unoccupied Mode, the setpoints shall be adjusted as directed by the Owner.

c. Four Pipe Valve Control: In heating mode, the heating valve shall be modulated to maintain the heating setpoint temperature and the cooling valve shall be fully closed. In the cooling mode, the cooling valve shall be modulated to maintain the cooling setpoint and the heating valve shall be fully closed. In either mode, the discharge air temperature setpoint shall be limited to an adjustable low (usually 50 Deg. F.) and high (usually 90 Deg. F.) to prevent extremely cold or hot air from blowing into the space.

d. Unoccupied Operation: In the Unoccupied Mode, the heating and cooling operation shall be the same as Occupied Mode, except that the adjustable setpoints shall be adjusted as directed by the Owner.

e. Warm-Up/Cool Down: When a warm up or cool down is initiated, the fan shall turn at high speed and the heating or cooling valve shall control to setpoint. When the space temperature reaches setpoint, the unit shall operate in Occupied Mode.

f. Fan Status: A motor current sensor shall be used to sense the fan status.

g. Each zone shall use a thermistor element to measure the actual zone temperature. The setpoint shall be determined by the EMCS setup.

J. Exhaust Fans:

1. Exhaust Fans EF-1, EF-4, EF-5, EF-6, EF-7, EF-8, EF-9 and EF-10 shall be controlled through the EMCS according to an "Interlock Schedule" with the make-up air units. When MUA-1, MUA-2 or MUA-3 is energized, the appropriate exhaust fans indicated in the "Interlock Schedule" (shown on the drawings) shall be energized. When the fan is energized, the exhaust air motorized damper shall open.

2. Exhaust Fans EF-2 and EF-3 shall be controlled by a wall-mounted single-stage cooling thermostat. When the thermostat calls for cooling, the exhaust air discharge motorized damper shall fully open, the fan shall energize and the outdoor air intake motorized damper shall fully open.

K. Steam Condensate Pump (CP-1): The steam condensate pump is controlled by a float switch located inside the pump receiver. When the level of steam condensate return in the pump rises above the float switch setting, the pump allows high pressure steam to push the steam condensate return out of the pump to the pumped steam condensate return main and to the central heating plant.
L. Glycol Feed System: Each of the two (2) glycol feed pumps shall be controlled by a Hand-Off-Auto selector switch. In the auto mode, each pump shall be controlled by the pressure switch mounted in the closed chilled water piping loop served by the pump. The pressure switch shall have adjustable low and high setpoints. When the pressure in the piping loop reaches the low setpoint, the pump begins to feed glycol/water solution into the system until the high pressure setpoint is achieved and shall stop the pump. Controls shall include pump "on" indicator lights, "low" tank level indicator light and audible alarm and push button silence. When the pumps are positioned to "Auto," the EMCS determines lead-lag operation for the pumps or energizes the lag pump upon failure of the lead pump as indicated by a motor current sensor.

M. Domestic Hot Water System Control:

1. Pump Control: The EMCS shall start and stop the circulator pump according to the operator entered occupancy schedule. In the occupied mode, the pump shall run continuously. In the unoccupied mode, the pump shall be off. If pump does not operate when selected to run, an alarm shall be sent to the operator through a motor current sensor.

2. Freeze Protection: When outside air temperature drops to 38 Deg. F. or below, circulator pump shall be started.

3. Monitor the hot water supply temperature.

1.10 POINT LISTS

A. The following point lists are provided as a minimum basis for control. Other points shall be provided as required to accomplish the Sequence of Control and to provide a complete control system for automatic and safe control of the HVAC equipment.

B. See attached pages 15971-13 through 15971-19.

NOTE: A signed acknowledgment of this addendum must be received at the location indicated on the IFB either prior to the proposal due date and hour or attached to your proposal. Signature on this addendum does not substitute for your signature on the original proposal document. The original proposal document must be signed.

Very truly yours,

James E. Simpson, CPPB, VCO
Director Materiel Management

Name of Firm _____________________________________________
Signature/Title ____________________________________________
Date: ___________________________________________________
## SYSTEM POINT LIST

<table>
<thead>
<tr>
<th>SYSTEM POINT DESCRIPTION</th>
<th>ANALOG</th>
<th>BINARY</th>
<th>SYSTEM FEATURES</th>
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<td>OUTPUT</td>
<td>ALARMS</td>
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**GENERAL NOTES:** PROVIDE ONE COLOR GRAPHIC WITH ALL DYNAMIC DATA SHOWN.