**April 16, 2025**

# ADDENDUM NO. 4

RE: Renovations to Southern WV Community and Technical College
Logan Campus – Building A
100 College Drive
Logan, West Virginia 25601
Architect's Project No. 24011

TO: Prospective Bidders

FROM: ZMM, Inc. Architects and Engineers

This Addendum forms a part of the Contract Documents and modifies the original Bidding Documents.

**ATTACH THIS ADDENDUM TO THE FRONT COVER OF THE PROJECT MANUAL AND ACKNOWLEDGE RECEIPT OF THIS ADDENDUM IN THE SPACE PROVIDED ON THE BID FORM.**

PART 1 - CHANGES TO SPECIFICATIONS

A. Section 237416 "Water-Source Unitary Heat Pumps" Article 2.1 Paragraph E. Item #1, a DELETE "BAC-net or LonWorks". ADD "Factory Control Boards Thermostats shall be provided by Div.25".

B. REPLACE Section 250993 "Sequence of Operations for HVAC DDC" dated 10/30/24 with Section 250993 "Sequence of Operations for HVAC DDC" as attached to this Addendum..

END OF ADDENDUM

Attachments: Section 250993 "Sequence of Operations for HVAC DDC".....15 pages

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# SECTION 250993 - SEQUENCE OF OPERATIONS FOR HVAC DDC

## PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

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

### 1.2 SUMMARY

A. This section includes control sequences for HVAC systems, subsystems, and equipment.

B. Related Requirements:

1. Section 250923 "Direct Digital Control (DDC) System for HVAC" for control equipment.

### 1.3 DEFINITIONS

A. Analog Output: Proportional output signal (zero- to 10-V dc, 4 to 20 mA).

B. Binary Output: On/off output signal or contact closure.

C. DDC: Direct digital control.

D. Digital Output: Data output that must be interpreted digitally.

E. VAV: Variable air volume.

### 1.4 ACTION SUBMITTALS

A. Product Data:

1. An instrumentation list for each controlled system. Label each element of the controlled system in table format. Show, in the table element name, type of device, manufacturer, model number, and control device product data sheet number.
2. A complete description of the operation of the control system, including sequences of operation. Include and reference a schematic diagram of the controlled system.

B. Shop Drawings:

1. Riser diagrams showing control network layout, communication protocol, and wire types.
2. Schematic diagram of each controlled system. Include all control points labeled with point names shown or listed. Show the location of control elements in the system.

3. Wiring diagram for each controlled system. Show all control elements labels. Where a control element is the same as that shown on the control system schematic, label with the same name. Label all terminals.

1.5 DESCRIPTION OF WORK

A. Sequence of Operation is hereby defined as the manner and method by which controls function. Requirements for each type of control system operation are specified in this section.

B. The BAS Contractor (Division 25) is responsible for ensuring all mechanical equipment complies with the specified sequences. The Equipment Manufacturer (Division 23) is responsible for ensuring all equipment specified to be provided with a Manufacturer's standalone controller and an ASHRAE 135 (BACnet) communication interface must be programmed by the factory, or in the field, with the specified sequences. All programming modifications shall be done by a certified Manufacturer's Representative. The ASHRAE 135 (BACnet) communication interface shall be provided with enough readable and writable data points to allow for future modifications to the specified sequences by the BAS Contractor.

C. Operating equipment, devices and system components required for control systems are specified in other Division Controls Sections of these specifications.

D. For all graphics and sequences of operation, use final room names and number, which are not necessarily those shown on project drawings.

E. Include text of each Sequence of Operation as part of BAS graphics. The sequences shall include project set points.

F. Point List: Provide complete point list in spread sheet format for all input and output data points per apparatus, indicate alarm, time of day programs, graphic screen appearance, etc. Provide template for approval prior to producing. Provide alarms indicated and added during Shop Drawing Review.

G. Provide graphic screen showing the main building power and energy meter.

H. Provide graphic screen for each HVAC device showing temperatures, pressures, status, output, and adjustable set points.

I. Show central plant flow totalization for the primary chilled water, terminal chilled water and heating hot water systems.

J. All variables listed in sequences to include time, temperature, pressures, flows are to be adjustable from operator control terminal.

K. BAS Contractor shall provide up to **15** custom graphic screens as required by Owner/Architect.

L. BAS Contractor shall provide up to an additional **25** Owner/Architect requested, customized graphic modifications with dynamic data point information. Coordinate specific points required with Owner or Architect prior to installation and closeout. These requested graphic modifications are in addition to the five custom graphic screens listed above.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 TIME SCHEDULES

A. All schedules shall be coordinated with and verified by Owner prior to final implementation.

B. All schedules shall be fully adjustable by the Owner at the user interface.

C. Owner shall have the ability to override all schedules, both globally and individually.

D. Each piece of equipment shall have its own adjustable schedule.

E. The Owner's designated staff shall be fully instructed on the operation of the system. When this instruction is complete and the system has been fully tested and is operational, the following schedules shall be implemented:

1. Auditorium Area: Occupied Mode 7:00am through 5:30pm Monday through Friday; Unoccupied Mode all other times.
2. Commons Dining and Main Lobby: Occupied Mode 7:00am through 3:30pm Monday through Friday; Unoccupied Mode all other times.
3. Kitchen Area: Occupied Mode 6:00am through 2:00pm Monday through Friday; Unoccupied Mode all other times.
4. Administration Areas: Occupied Mode 7:00am through 6:00pm Monday through Friday; Unoccupied Mode all other times.
5. Band, Choral and Music Areas: Occupied Mode 7:00am through 5:30pm Monday through Friday; Unoccupied Mode all other times.
6. Classroom Areas: Occupied Mode 7:00am through 3:30pm Monday through Friday; Unoccupied Mode all other times.
7. deadband from the screen.
8. Snow Day: Provide a snow day graphic button on home scree. When engaged the system shall be placed into unoccupied mode until 12:00 am. Then the system shall revert back to norm schedule.

3.2 WATER SOURCE COOLING/HEATING SYSTEMA

A. Heating Water Pump Control (HWP-1 and HWP-2):

1. Heating water pump shall be controlled both by pressure signal and flow meter input.
2. Once the isolation valve on the lead boiler has opened (end switch), start the lead heating water pump variable frequency drive for continuous operation at low speed and ramp up to required speed. Set to initial ramp speed of 10% per minute (Adj.). Pump VFD shall ramp up in response to satisfying differential pressure sensors.
3. Remote differential pressure sensors shall have an initial setpoint of 12 psig (Adjustable and set by TAB Contractor). With multiple end-of-line deferential pressure sensors, the system shall be controlled by the pressure sensor requiring the most demand to maintain

pressure at the sensor location. Pump VFD shall maintain minimum flow setpoint of 20 Hz (Adj.).

4. The BAS shall automatically rotate lead/lag pump selection every 750 hours, or as needed to equalize run time. Pump rotation shall occur during the unoccupied mode.
5. The controller shall monitor pump status. If one of the two operating pumps should fail the controller shall start the lag pump and send an alarm to the workstation.
6. A power monitor transmitter shall monitor the building input voltage. If the building power loses a phase or drops to a brown out condition, the controller shall stop the pumps and send an alarm to the workstation. When the voltage returns to normal the pump will re-start.

B. Communications:

1. Equipment Manufacturer (Division 23) shall provide factory-installed hardware and software to enable the DDC system for HVAC to monitor, control, and display unit status and alarms.

    a. ASHRAE 135 (BACnet) communication interface with the DDC system for HVAC shall enable the DDC system for HVAC operator to remotely control and monitor the unit from an operator workstation. Control features and monitoring points displayed locally at unit control panel shall be available through the DDC system for HVAC.
    b. Provide ASHRAE 135 (BACnet) interface at each Boiler and integrate the following data points to the BAS:

        1) Enable/disable
        2) Setpoint
        3) Supply temperature
        4) Return temperature
        5) Com status
        6) Annunciator first out / alarm
        7) Burner cycle count
        8) Burner run time
        9) Additional **10** points chosen by Engineer of Record

    c. Provide ASHRAE 135 (BACnet) interface at each VFD and integrate the following data points to the BAS:

        1) Start/stop
        2) Input/output
        3) Communication fault / alarm

            a) Last fault
            b) Previous fault 1
            c) Previous fault 2

        4) Feedback:

            a) Speed
            b) Frequency output
            c) Current

d) Torque
e) Power
f) Output voltage

5) Hand/Auto
6) Alarm status
7) Maintenance required
8) Additional **5** points chosen by Engineer of Record

2. BAS Contractor (Division 25) shall provide communications to the Boilers via BACnet interface for the following:

a. Enable/Disable
b. Hot water supply temperature setpoint.
c. Status (alarm)

3. BAS Contractor (Division 25) shall provide communications to the VFDs via BACnet interface for the following:

a. Enable/Disable
b. Output (position)
c. Status (alarm)
d. Input (position)

4. BACnet interface will be for monitoring, adjusting and communicating with the unit only. Operation of the specified sequences shall be conducted by unit manufacturer-provided controller and controls.

C. Alarms:

1. The microprocessor controller shall monitor the boiler and the heating pumps and send the following alarms to the front end workstation:

a. Heating Pump 1 Failure
b. Heating Pump 2 Failure
c. Boiler 1 Failure
d. Boiler 2 Failure
e. High Heating Water Supply Temperature, Setpoint 145 deg. F (adj.).
f. Low Heating Water Return Temperature, Setpoint 70 deg. F (adj.).

2. The alarms shall be displayed on the graphics screen and printed out.
3. All alarms shall be recorded to a hard drive file for future reference.

D. Graphics:

1. The front-end graphics shall include a graphic picture of the boiler/pump system.
2. The data shall be dynamic and include all water temperatures, pump status, and alarm indication. Include outside air indication on all heating water and pump graphic screens.
3. The graphic shall also include a control panel screen.
4. The operator shall adjust all set points as listed in the above sequence from this screen.

5. The graphic shall also include a control panel screen to adjust alternate hours for boiler Lead / Lag operation.
6. Each setpoint shall also have a deadband. The operator shall be able to adjust the deadband from the screen.

## 3.3 WATER SOURCE HEAT PUMP UNIT CONTROL

A. Unit shall be automatically switched to the Occupied or Unoccupied Cycle from the Front End Workstation via the occupancy schedule. Occupied or Unoccupied status shall have an override capability from the Front End Workstation. An occupied override button shall be provided at the wall-mounted thermostat and shall provide a 1-hour increment of occupied operation.

B. Units cooling shall be enabled/disabled as required to satisfy the space cooling setpoint

C. Unit heating shall be enabled/disabled as required to stratify the space heating set point.

D. Graphics:

1. The Front-End Workstation shall include a graphic picture of the above air handling unit. The data on this graphic shall be dynamic and include all Inputs and Outputs as on the drawings.
2. The graphic shall also include a control panel screen.
3. The operator shall adjust all set points as listed in the above sequence from this screen, including 5 degree Dead Band between Heating and Cooling Setpoints.
4. Fan run time shall also be included on the control panel screen.
5. Include outside air damper indication on all RTU graphic screens.

## 3.4 SINGLE ZONE CONSTANT VOLUME ROOFTOP AIR HANDLING UNITS

A. Unit shall be automatically switched to the Occupied or Unoccupied Cycle from the Front End Workstation via the occupancy schedule. Occupied or Unoccupied status shall have an override capability from the Front End Workstation. An occupied override button shall be provided at the wall mounted thermostat and shall provide a 1-hour increment of occupied operation.

B. Fan Control:

1. Occupied: During the Occupied Cycle the microprocessor controller shall send a signal to start the supply fan for continuous fan operation. After a time delay (Adj.) the controller shall open the outside air damper to its design position as listed on schedule. The supply fan status shall be monitored through the ECM controller. If the supply fan stops during normal operation, then a fan failure alarm shall be sent to the workstation.
2. Unoccupied: During the Unoccupied Cycle, the supply fan shall remain off. If the space temperature falls below the night heating set point 55 (Adj.) or above the night cooling set point 85 (Adj.), then the controller shall cycle the supply fan to maintain night temperatures. The outside air damper shall remain closed.
3. Morning Warm-Up: When Morning Warm-Up Cycle begins, the supply fan shall start. The outside air damper shall remain closed. The gas-fired heater shall be engaged until the return air temperature rises above 70 deg.F (Adj.) and the Morning Warm-Up Cycle shall end. The unit shall resume normal operation when the Occupied Cycle begins.

4. Morning Cool-Down: When the Morning Cool-Down Cycle begins, the supply fan shall start. The outside air damper shall remain closed. DX cooling shall be energized to maintain 55 deg.F. supply air set point during Cool-Down Cycle. When the return air temperature drops to 75 deg.F. (Adj.) the Cool-Down Cycle shall end. The unit shall resume normal operation when the Occupied Cycle begins. Use Economizer sequence when available (Outside Air Temperature Permitting).
5. Optimization: The Morning Warm-Up and Cool Down Cycles shall be capable of optimizing start-up and cycle duration times.
6. Phase Protection: A Power Monitor Transmitter shall monitor the building input voltage. If the Building Power loses a phase or drops to a brown out condition, then the controller shall stop the unit fan and send an alarm to the workstation. When the voltage returns to normal, all equipment will re-start on a staggered schedule.
7. Shelter-In-Place: During the Shelter-in-Place Mode the supply fan shall remain off and outside air damper closed. When Shelter-In-Place has been cleared, the RTU's shall re-start on a staggered schedule.

C. Outdoor Air Introduction and Ventilation Control:

1. The Design Outside Air value shall be balanced while the Supply Fan is operating at its Design speed to provide a constant Supply Air and Outside Air flow rate during the occupied mode.
2. The outside air damper shall close if the supply fan stops.

D. System and Space Static Pressure:

1. The barometric damper shall be set to maintain a space static pressure set point of 0.05 inches (Adj.).

E. DX Cooling/Outside Air Dampers:

1. A Space Temperature Sensor shall send a signal to the Microprocessor Controller.
2. When the Supply Fan is running, the controller shall energize DX Cooling to maintain the Space Temperature Set Point of 75 deg F.(Adj.).
3. When the Outside Air Temperature falls below the Cooling lockout Set Point, the DX Cooling shall remain Off.
4. When the Outside Air Temperature and Humidity fall below the Economizer Set Point (Adj.), the Microprocessor Controller shall modulate the Outside Air Damper and the Return Air Damper, to maintain the Space Temperature Set Point. Excess air shall be relieved through the unit barometric relief damper.
5. The Microprocessor Controller shall receive a signal from a Mixed Air Temperature Sensor.
6. During the Economizer Cycle the Controller shall override and modulate close the Outside Air Damper and modulate open the Return Air Damper to maintain a Mixed Air Low Limit Set Point of 45 deg. F (Adj.). Outside Air and Return Air Damper shall not modulate below CFM setpoint positions during the occupied mode.
7. If the Mixed Air Temperature falls below the Mixed Air Set Point Alarm (Mixed Air Set Point –5) a Low Mixed Temperature Alarm shall be sent to the Workstation.
8. If the Supply Fan stops, the Outside Air Damper shall close and the Return Air Damper shall open.

9. When the Outside Temperature and Humidity rises above the Economizer Set Point, Outside Air Damper and Relief Air Damper shall modulate to CFM setpoint positions during the occupied mode.
10. Outside Air Damper shall close and the Return Air Damper shall open during unoccupied mode.
11. If the Space Temperature rises above the Space Temperature Cool Set Point Alarm (Cool Set Point + 10) a High Cooling Temperature Alarm shall be sent to the Workstation.

F. Gas Heat (RTU'S)

1. A Space Temperature Sensor shall send a signal to the Microprocessor Controller
2. When the Supply Fan is running and on a call for Heat, the Controller shall modulate the gas valve to maintain the supply air Set Point 75°F(Adj.).
3. If the Space Temperature falls below the Space Temperature Heat Set Point Alarm (Heat Set Point-10) a Low Heating Temperature Alarm shall be sent to the Workstation.

G. Dehumidification Cycle:

1. When the space humidity rises above the humidity set point of 60% RH (Adj.) a high humidity alarm shall be sent to the workstation and the dehumidification cycle shall be initiated.
2. The Controller shall energize all stages of DX Cooling.
3. The controller shall energize the Hot Gas Reheat Valve (RTU'S) or heating Hot Water Valve (AHU's).
4. When the space humidity falls below the humidity set point, a humidity return to normal alarm shall sound at the workstation.
5. The controller shall disable the dehumidification cycle.
6. The unit shall return to normal operation.

H. Alarms:

1. The microprocessor controller shall monitor the rooftop air handling unit and send the following alarms to the Front-End Workstation:

    a. Supply Fan Failure
    b. DX Cooling Failure
    c. Gas Heating Failure.
    d. Low Mixed Air Temp Alarm
    e. High and Low Discharge Air Temperature.
    f. High and Low Space Temperature.

2. The alarms shall be displayed on the graphic screen and printed out.
3. All alarms shall be recorded to a hard drive file for future reference.

I. Graphics:

1. The Front-End Workstation shall include a graphic picture of the above Rooftop DX air handling unit. The data on this graphic shall be dynamic and include all Inputs and Outputs as on the drawings.
2. The graphic shall also include a control panel screen.

3. The operator shall adjust all set points as listed in the above sequence from this screen, including 5 degree Dead Band between Heating and Cooling Setpoints.
4. Fan run time shall also be included on the control panel screen.
5. Include outside air damper indication on all RTU graphic screens.

## 3.5 SINGLE-ZONE VARIABLE VOLUME ROOFTOP AIR HANDLING UNITS

A. Each unit shall be automatically switched to the Occupied or Unoccupied Cycle from the Front-End Workstation via the occupancy schedule. Occupied or Unoccupied status shall have an override capability from the Front-End Workstation. An occupied override button shall be provided at the wall mounted thermostat and shall provide a 1-hour increment of occupied operation. During the unoccupied cycle, a high CO2 reading will force the RTU into the occupied mode until the CO2 sensor is satisfied.

B. Fan Control:

1. Occupied: During the Occupied Cycle the microprocessor controller shall send a signal to start the supply fan at 50% speed (adj.) for continuous fan operation. After a time delay (Adj.) the controller shall open the outside air damper to its minimum position as listed on schedule. The supply fan status shall be monitored with adjustable current sensor. The supply fan shall never drop below a 50% operating speed. Supply fan speed shall increase as needed to maintain space temperature setpoint. If the supply fan stops during normal operation, then a fan failure alarm shall be sent to the workstation.
2. Unoccupied: During the Unoccupied Cycle, the supply fan shall remain off. If the space temperature falls below the night heating set point 55 (Adj.) or above the night cooling set point 85 (Adj.), then the controller shall cycle the supply fan to maintain night temperatures. The outside air damper shall remain closed.
3. Morning Warm-Up: When Morning Warm-Up Cycle begins, the supply fan shall start. The outside air damper shall remain closed. The gas heater shall energize stages to maintain a 90 deg.F. supply air set point during Morning Warm-Up. When the return air temperature rises above 70 deg.F (Adj.) the Morning Warm-Up Cycle shall end. The unit shall resume normal operation when the Occupied Cycle begins.
4. Morning Cool-Down: When the Morning Cool-Down Cycle begins, the supply fan shall start. The outside air damper shall remain closed. Stages of DX Cooling shall energize to maintain 55 deg.F. supply air set point during Cool-Down Cycle. When the return air temperature drops to 75 deg.F. (Adj.) the Cool-Down Cycle shall end. The unit shall resume normal operation when the Occupied Cycle begins. Use Economizer sequence when available (Outside Air Temperature Permitting).
5. Optimization: The Morning Warm-Up and Cool Down Cycles shall be capable of optimizing start-up and cycle duration times.
6. Phase Protection: A Power Monitor Transmitter shall monitor the building input voltage. If the Building Power loses a phase or drops to a brown out condition, then the controller shall stop the unit fan and send an alarm to the workstation. When the voltage returns to normal, all equipment will re-start on a staggered schedule.
7. Shelter-In-Place: During the Shelter-in-Place Mode the supply fan shall remain off and outside air damper closed. When Shelter-In-Place has been cleared, the RTU's shall re-start on a staggered schedule.

C. Demand Control Ventilation:

1. During the Occupied Cycle, outside air shall be continually introduced into the system to maintain indoor air contaminants at acceptable levels. The current guidelines of ASHRAE 62 – Indoor Air Quality Standards shall be used to determine the outside air flow rates. Refer to the Air Handling Unit Schedule for Minimum and Design Outside Air values.
2. During the occupied mode, provide the Minimum Outdoor Air as indicated in the equipment schedule, at all times. The Minimum Outdoor Air damper position shall be set when the Supply Fan is operating at 50% speed.
3. During the occupied mode, the outside air damper shall modulate above Minimum setpoint based on readings from the space CO2 sensor to maintain Outside ambient CO2+650 ppm (adj.).

D. System and Space Static Pressure:

1. The barometric damper shall be set to maintain a space static pressure set point of 0.05 inches (Adj.).

E. DX Cooling/Outside Air Dampers:

1. A Space Temperature Sensor shall send a signal to the Microprocessor Controller.
2. When the Supply Fan is running, the controller shall energize stages of DX Cooling to maintain the Space Temperature Set Point of 75 deg F.(Adj.).
3. When the Outside Air Temperature falls below the Cooling lockout Set Point, the DX Cooling shall remain Off.
4. When the Outside Air Temperature and Humidity fall below the Economizer Set Point (Adj.), the Microprocessor Controller shall modulate the Outside Air Damper and the Return Air Damper, to maintain the Space Temperature Set Point. Excess air shall be relieved through the unit barometric relief damper.
5. The Microprocessor Controller shall receive a signal from a Mixed Air Temperature Sensor.
6. During the Economizer Cycle the Controller shall override and modulate close the Outside Air Damper and modulate open the Return Air Damper to maintain a Mixed Air Low Limit Set Point of 45 deg. F (Adj.). Outside Air and Return Air Damper shall not modulate below CFM setpoint positions during the occupied mode.
7. If the Mixed Air Temperature falls below the Mixed Air Set Point Alarm (Mixed Air Set Point –5) a Low Mixed Temperature Alarm shall be sent to the Workstation.
8. If the Supply Fan stops, the Outside Air Damper shall close and the Return Air Damper shall open.
9. When the Outside Temperature and Humidity rises above the Economizer Set Point, Outside Air Damper and Relief Air Damper shall modulate to CFM setpoint positions during the occupied mode.
10. Outside Air Damper shall close and the Return Air Damper shall open during unoccupied mode.
11. If the Space Temperature rises above the Space Temperature Cool Set Point Alarm (Cool Set Point + 10) a High Cooling Temperature Alarm shall be sent to the Workstation.

F. Gas Heat (RTU'S)

1. A Space Temperature Sensor shall send a signal to the Microprocessor Controller

2. When the Supply Fan is running and on a call for Heat, the Controller shall modulate the gas valve to maintain the supply air Set Point 75°F(Adj.).
3. If the Space Temperature falls below the Space Temperature Heat Set Point Alarm (Heat Set Point-10) a Low Heating Temperature Alarm shall be sent to the Workstation.

G. Dehumidification Cycle:

1. When the space humidity rises above the humidity set point of 60% RH (Adj.) a high humidity alarm shall be sent to the workstation and the dehumidification cycle shall be initiated.
2. The Controller shall energize all stages of DX Cooling.
3. The controller shall energize the Hot Gas Reheat Valve.
4. When the space humidity falls below the humidity set point, a humidity return to normal alarm shall sound at the workstation.
5. The controller shall disable the dehumidification cycle.
6. The unit shall return to normal operation.

H. Alarms:

1. The microprocessor controller shall monitor the rooftop air handling unit and send the following alarms to the Front-End Workstation:

   a. Supply Fan Failure
   b. DX Cooling Failure
   c. Gas Heating failure.
   d. Low Mixed Air Temp Alarm
   e. High and Low Discharge Air Temperature.
   f. High and Low Space Temperature.
   g. High $CO_2$ Level
   h. High Space Humidity Alarm

2. The alarms shall be displayed on the graphic screen and printed out.
3. All alarms shall be recorded to a hard drive file for future reference.

I. Graphics:

1. The Front-End Workstation shall include a graphic picture of the above Rooftop DX air handling unit. The data on this graphic shall be dynamic and include all Inputs and Outputs as on the drawings.
2. The graphic shall also include a control panel screen.
3. The operator shall adjust all set points as listed in the above sequence from this screen, including 5 degree Dead Band between Heating and Cooling Setpoints.
4. Fan run time shall also be included on the control panel screen.
5. Include outside air damper indication on all RTU graphic screens.

## 3.6 PTAC UNITS

A. This unit shall be operated by manufacturer provided controls.

B. Unit shall automatically switch from heating to cooling to maintain the space set point of 70 deg F (Adj.) year round

C. Provide temperature sensor to monitor space temperature through the EMS and provide an alarm if space temperature exceeds 80°F (adj.).

D. Alarms:

1. The microprocessor controller shall monitor the unit and send the following alarms to the front-end workstation.

    a. Supply Fan Failure Alarm
    b. Condensing Unit Failure Alarm
    c. Low Room Temperature
    d. High Room Temperature

2. The alarms shall be displayed on the graphics screen and printed out.
3. All alarms shall be recorded to a hard drive file for future reference.

E. Graphics:

1. The front-end graphics workstation shall include a graphic picture of the unit.
2. The data on this graphic shall be dynamic and include all inputs and outputs. The graphic shall also include a control panel screen.
3. The operator shall adjust all set points as listed in the above sequence from this screen.
4. Fan run time shall also be included on the control panel screen.

## 3.7 BUILDING MODE – PARTIAL OCCUPATION (RTU)

**A. <u>Partial occupation should only be used AS NEEDED.</u>**

B. If non-standard occupation (see 3.1 Time Schedules – Adj.) is restricted to only a few hours, it is recommended to utilize the override function at the space thermostat (RTU).

C. Areas to be occupied outside of normal operating hours (see 3.1 Time Schedules – Adj.) must be scheduled at the front-end workstation as occupied in order to be enabled to operate in the occupied mode as previously described. If spaces are not scheduled for partial occupancy, the default is unoccupied.

D. Cooling:

1. During periods of time when building is partially occupied, such as evening classes, special events, or summer classes, the system shall be in partial occupied mode.
2. Areas occupied shall be enabled to operate in occupied mode as previously described.
3. Other areas of the building shall be in unoccupied mode as previously described.

E. Heating:

1. During periods of time when building is partially occupied, such as evening classes and special events, the system shall be in partial occupied mode.
2. Areas occupied shall be enabled to operate in occupied mode as previously described.

3. Other areas of the building shall be in unoccupied mode previously described.

F. Alarms:

1. High Temperature
2. Low Temperature
3. The alarms shall be displayed on the graphics screen and printed out.
4. All alarms shall be recorded to a hard drive file for future reference.

G. Graphics:

1. The Front-End Workstation shall include a graphic picture of the overall building with each unit indicated and its mode of operation (occupied or unoccupied) shown.

## 3.8 SPECIAL EVENT MODE

A. When a special event is scheduled and additional cooling is required, occupied cooling setpoint shall be reduced during the unoccupied mode so that the space will be "pre-cooled" to accommodate additional load.

B. As a minimum, the units serving the Gymnasium, Auxiliary Gymnasium, and the Commons Dining shall be provided with this mode of programming. Additional spaces requiring this programming shall be coordinated with the owner.

C. Graphics: Include a graphic picture of each unit entitled "Special Event", with setpoint adjustment and duration of event that the sequence will serve.

## 3.9 BUILDING STATIC PRESSURE

A. During the Occupied Mode, the BAS shall monitor the Building Static and Outdoor Air Static Pressure sensors and calculate the Differential Static Pressure in the building.

1. Provide a High Building Static Pressure when the reading is greater than 0.1" w.c.
2. Provide a Low Building Static Pressure when the reading is lower than 0.02" w.c.

## 3.10 OUTSIDE AIR TEMPERATURE AND HUMIDITY

A. Monitor OA temperature and humidity.

B. Use in comparative enthalpy calculation with RA temperature and humidity for economizer operation.

## 3.11 RELATIVE HUMIDITY AND DEW POINT TEMPERATURE

A. Monitor space relative humidity and temperature in locations indicated on the drawings:

1. Each RTU

B. Monitor each sensible cooling terminal unit space relative humidity sensor. Disregard the highest and lowest value, then use remaining relative humidity values to calculate the Average Zone Relative Humidity for all spaces served by each DOAS unit. Display the Average Zone Relative Humidity for each DOAS unit on its graphic screen.

C. Monitor each sensible cooling terminal unit space relative humidity sensor and temperature sensor to calculate the dew point temperature. Disregard the highest and lowest value, then use remaining dew point temperature values to calculate the Average Zone Dew Point Temperature for all spaces served by each DOAS unit. Display the Average Zone Dew Point Temperature for each DOAS unit on its graphic screen.

D. Monitor ALL relative humidity readings within the building. Disregard the highest and lowest value, then use remaining relative humidity values to calculate the Average Building Relative Humidity. Display the Average Building Relative Humidity on each DOAS and RTU screen.

E. Use the Average Zone Relative Humidity, the Average Zone Dew Point Temperature and Average Building Relative Humidity values for specific DOAS and Sensible Cooling VAV box sequences. See sequences for additional information.

## 3.12 SHELTER-IN-PLACE

A. A two-position selector switch shall be located in the Principal's Office and in the Mechanical Room. The selector shall be labeled "NORMAL – SIP" and be monitored by the DDC system.

B. In the NORMAL position, equipment shall operate under standard sequences as described in this section.

C. In the SIP position, all air intakes, relief vents, air conditioning units, exhaust fans, central boiler and chiller plants, and air handling units shall be shut down. All outdoor air dampers shall be closed, including combustion air dampers. Pumps that were operating immediately before the SIP alarm shall continue to run.

D. An alarm shall be initiated through the DDC system.

E. Graphics: The Front-End Workstation shall include a graphic picture verifying that all requirements of the SIP event have been met.

## 3.13 CARBON MONOXIDE DETECTORS

A. The following spaces, as a minimum, shall have carbon monoxide (CO) levels monitored by the Building Automation System:

1. Kitchen
2. Mechanical Room

B. A High CO Level Alarm shall be sent to the BAS when a CO level of 30 ppm (Adj.) or higher is detected.

## 3.14 COOLER AND FREEZER TEMPERATURE

A. Cooler and Freezer temperatures shall be monitored by room temperature sensors.

B. Alarms:

1. High Temperature
2. Low Temperature

C. Graphics:

1. The Front-End Workstation shall include a graphic picture of the cooler and freezer with dynamic graphic of each space temperature.

## 3.15 HYDRONIC VALVE AND ACTUATOR EXERCISE

A. During unoccupied mode all actuators and controls valves shall be exercised 2 full strokes every 7 days. Stager exercise so that only 20% of the valve and actuators are exercising at once.

END OF SECTION