

SECTION 230993 – SEQUENCE OF OPERATIONS FOR HVAC CONTROLS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes control sequences for HVAC systems, subsystems, and equipment.
- B. This Section describes the minimum performance requirements for the systems and does not necessarily include all elements of control required for proper and safe operation of the systems. The Contractor shall provide all necessary safeties interlocks, high limits, low limits, time delays, and control logic for a complete and operable system.
- C. The Controls Contractor shall be a Certified Tridium Controls Contractor.
- D. For each system, provide the sequence of operation as currently exists as a minimum. The owner and engineer may make any changes to the existing sequence of operation, utilizing the current inputs and outputs. These changes and/or modifications to the existing sequence of operation shall be made at no additional cost to the owner. Owner or engineer can also make changes to system graphics also at no additional cost.
 - 1. BAS Contactor shall be responsible for all control wiring connections, auxiliary devices and control wiring diagrams to complete the control system and attain the described sequence of operation. All set-points of sensors, controllers and the like, that are not factory preset, shall be preset by the BAS Contractor before system startup.

1.3 DEFINITIONS

- A. DDC: Direct-digital controls.
- B. BAS: Building Automation System.

1.4 SNOWMELT SYSTEM

- A. Sequence of operation to be as it currently exists as a minimum.
- B. Pumps 4 and 5 are currently not running. These pumps do not need to be connected to new BAS. Existing controls shall be removed.
- C. Operator Station: Control and/or display the following:

1. System graphic.
2. Snowmelt status
3. Pumps 1 through 5 command and actual status
4. Outside air temperature
5. Schedule
6. Alarms
7. Trending for all readings

1.5 STEAM CONVERTER

- A. Sequence of operation to be as it currently exists as a minimum.
- B. Operator Station: Control and/or display the following:
 1. System graphic.
 2. Converter lock out temperature (adjustable)
 3. Converter water temperature (adjustable)
 4. Loop return water temperature
 5. Pump command and actual status
 6. Steam valve position
 7. Outside air temperature
 8. Alarms
 9. Trending for all readings

1.6 IN FLOOR RADIANT HEAT SYSTEM

- A. Sequence of operation to be as it currently exists as a minimum.
- B. Primary heat source for the building to be from in floor radiant heat system, not Rooftop units.
- C. There are six zones for the radiant floor heat system. Each of the following will apply to all six zones.
- D. Operator Station: Control and/or display the following:
 1. System graphic.
 2. Space temperature
 3. Space temperature set point
 4. Loop supply temperature
 5. Loop return temperature
 6. Loop temperature set point (adjustable)
 7. Loop pump command and actual status
 8. Loop valve position
 9. Schedule
 10. Alarms
 11. Trending for all readings.

1.7 ROOFTOP UNITS

- A. Sequence of operation to be as it currently exists as a minimum.
- B. Primary heat source for the building to be from in floor radiant heat system, not Rooftop units. Rooftop units will be second stage of heat.
- C. VAV rooftop units: For each rooftop unit add up each vav boxes airflow and display total rooftop units system air flow.
- D. Non VAV rooftop units: Install airflow monitoring station and display total rooftop units system air flow.
- E. Equipment controlled: RTU-1,2,3,4,5, and 6
- F. Operator Station: Control and/or display the following:
 - 1. System graphic.
 - 2. Space temperature
 - 3. Outside air temperature
 - 4. Outside air humidity
 - 5. Return air temperature
 - 6. Discharge air temperature
 - 7. Cooling set point (adjustable)
 - 8. Heating set point (adjustable)
 - 9. Occupied and unoccupied set points
 - 10. A/C compressor command and actual status 1st and 2nd stage.
 - 11. Burner command and actual status 1st and 2nd stage.
 - 12. Fan command and status
 - 13. Economizer enable set point (adjustable)
 - 14. Economizer status
 - 15. Outside air minimum position (adjustable)
 - 16. Duct static pressure
 - 17. Schedule (adjustable)
 - 18. Total system airflow
 - 19. Alarms
 - 20. Trending for all readings

1.8 EXISTING VARIABLE AIR VOLUME BOXES

- A. Sequence of operation to be as it currently exists as a minimum.
- B. Install air flow monitoring stations to monitor air flow for each VAV box.
- C. Operator Station: Control and/or display the following:
 - 1. System graphic.
 - 2. Space temperature
 - 3. Discharge air temperature
 - 4. Cooling set point (adjustable)

5. Heating set point (adjustable)
6. Damper position
7. Airflow (cfm)
8. Schedule (adjustable)
9. Alarms
10. Trending for all readings

1.9 NEW VAV BOX SEQUENCE

- A. Equipment controlled: New variable air volume box VAV-1
- B. VAV box is provided with actuator and flow sensing ring. BAS monitors space temperature and modulate box damper from minimum to maximum setting as required to maintain space setpoint based on if rooftop unit is in heat or cooling mode. If rooftop unit is in heating mode and the room is calling for cooling, the box shall modulate to minimum position as required to satisfy space temperature. If room temperature cannot be achieved in five minutes and box is at minimum position with the rtu in heating mode and future split system is installed cycle split system on and off as required to maintain space temperature. If rooftop unit is in cooling mode and the room is calling for heating, the box shall modulate to minimum position as required to satisfy space temperature. Reset damper position as required to maintain required airflow under varying supply pressure.
 1. Morning Warm-Up: Open box to maximum during morning warm-up until space temperature reaches setpoint. Close damper if space temperature reaches 5 deg F above setpoint and cooling is unavailable.
 2. Overcooling Control: During occupied status, reset box minimum to zero if space temperature falls more than 5 deg F below setpoint.
- C. Operator Station: Control and/or display the following:
 1. System graphic.
 2. Space temperature
 3. Discharge air temperature
 4. Cooling set point (adjustable)
 5. Heating set point (adjustable)
 6. Damper position
 7. Airflow (cfm)
 8. Schedule (adjustable)
 9. Alarms
 10. Trending for all readings

1.10 FUTURE SPLIT SYSTEM (INSTALLED BY OWNER IN THE FUTURE)

- A. Sequence of operation: See new vav box sequence above.
- B. Operator Station: Control and/or display the following:
 1. System graphic.
 2. Space temperature

3. Discharge air temperature
4. Fan command and status
5. Compressor command and status
6. Cooling set point (adjustable)
7. Occupied and unoccupied set points
8. Schedule (adjustable)
9. Alarms
10. Trending for all readings

1.11 EXHAUST FANS

- A. Sequence of operation to be as it currently exists as a minimum.
- B. Operator Station: Control and/or display the following:
 1. System graphic.
 2. Command and actual status
 3. Schedule (adjustable)
 4. Alarms
 5. Trending for all readings

1.12 INFORMATION BOOTH HEAT PUMP

- A. Sequence of operation to be as it currently exists as a minimum.
- B. Operator Station: Control and/or display the following:
 1. System graphic.
 2. Space temperature
 3. Discharge air temperature
 4. Fan command and status
 5. Compressor command and status
 6. Mode of unit (heat or cool)
 7. Cooling set point (adjustable)
 8. Heating set point (adjustable)
 9. Occupied and unoccupied set points
 10. Schedule (adjustable)
 11. Alarms
 12. Trending for all readings

1.13 COMPUTER ROOM

- A. Sequence of operation to be as it currently exists as a minimum. Add to existing sequence of operations to send alarm to BAS when space temperature reaches 85 degrees (adjustable).
- B. Operator Station: Control and/or display the following:
 1. System graphic.

2. Space temperature
3. Alarms
4. Trending for all readings

1.14 RELIEF HOOD DAMPERS

- A. Modulate dampers open and closed as required to maintain a 0.1” (adjustable) positive building pressure.
- B. Operator Station: Control and/or display the following:
 1. System graphic.
 2. Space pressure
 3. Space pressure setpoint
 4. Damper position
 5. Damper alarm

1.15 MECHANICAL ROOM

- A. Sequence of operation to be as it currently exists as a minimum.
- B. Operator Station: Control and/or display the following:
 1. System graphic.
 2. Space temperature
 3. Space temperature set point
 4. Unit heater command and status
 5. Alarms
 6. Trending for all readings

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 230993