

Exhibit C: Sequence of Operations

Anchor Bay School District

Sequence of Operations (Typical)

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Controls Contractor to confirm all setpoints and schedules listed below with Anchor Bay School District's facilities/energy policy.

Standards of Comfort — Anchor Bay School District

Parameter	Occupied (School Hours)	Unoccupied (Nights/Weekends)	Setback (Extended Break/Summer)
Heating Setpoint	68–70°F	60–62°F(adj.)	55–60°F (adj.)
Cooling Setpoint	74–76°F(adj.)	80–85°F (or off if unconditioned) (adj.)	85°F (or system off) (adj.)
Relative Humidity	Not actively controlled	Not actively controlled	Not actively controlled
Gymnasiums	65–68°F (gym) (adj.)	Per building schedule	Reduced per break schedule
Kitchens/Cafeterias	68–72°F (supplemented by kitchen exhaust)	Setback	Setback
Server/IT Rooms	68–72°F, 24/7 (exempt from setback)	68–72°F	68–72°F

Typical Schedule of Operation

Building Type	Occupied Start	Occupied End	Weekend/Holiday Operation
Elementary Schools	6:00 AM (pre-warm/pre-cool)	4:30 PM	Setback, event-driven overrides
Middle/High Schools	5:30 AM (pre-warm/pre-cool)	6:00 PM (athletics/activities)	Setback, event-driven overrides
Administration Building	7:00 AM	5:00 PM	Setback

Building Type	Occupied Start	Occupied End	Weekend/Holiday Operation
Athletic Facilities (evening events)	Per event schedule	Per event schedule	Override as scheduled

Notes:

- BAS (Building Automation System) to have a **2°F deadband** between heating and cooling to prevent simultaneous operation.
- **Pre-occupancy warm-up/cool-down** periods (1–2 hrs before occupancy) bring rooms to setpoint before students/staff arrive.
- **Setback periods** engage automatically after the last scheduled occupancy each day, and during weekends, holidays, and summer recess, except in humidity- or freeze-sensitive spaces.
- Individual room overrides (via BAS scheduling) should be time-limited (e.g., 2–4 hours) for after-hours events to avoid full-building setback release.

VARIABLE AIR VOLUME AIR HANDLING UNITS:

A. Equipment served

1. AHU-XX
2. VFD-XX

B. Control programs

1. Morning warm up.
2. Optimal start.
3. Scheduled occupied/unoccupied.
4. Supply air reset.
5. Static pressure reset.
6. Enthalpy economizer.
7. Demand control ventilation.
8. Event mode.
9. Night set-back.
10. Night set-up.

C. Control Devices

1. Building Level System Controller.
2. Combination outside air damper and airflow measuring station and modulating damper actuator.
3. Return air damper and modulating damper actuator.
4. Two-way cooling coil valve and modulating actuator.
5. Three-way heating coil valve and modulating actuator.
6. Outputs for heating coil pump control.
7. Heating coil entering and leaving water temperature sensors.
8. Cooling coil entering and leaving water temperature sensors.
9. Outputs for fan motor speed control.
10. Unit discharge air, return air, and mixed air temperature sensors.
11. Cooling coil discharge air temperature sensor.
12. Return air humidity sensor.
13. CO2 sensor (return air)
14. CO2 sensor (outside air)
15. Duct mounted static pressure sensors (quantity as indicated).
16. High limit static pressure sensor.
17. Smoke detector (existing).
18. Filter air pressure drop differential sensor.
19. Fan status feedback.
20. Freeze protection thermostat.

D. Occupied Cycle

1. The unit fan motors shall start and the outside air and return air dampers shall slowly open to provide the minimum outside air airflow whenever the unit is scheduled to the occupied cycle.
2. The DDC control program shall, in sequence, modulate the cooling coil valve, economizer dampers, heating coil pump, and heating coil valve to maintain discharge air temperature setpoint as calculated by the supply air reset program.
3. The DDC control program shall modulate the unit fan speed to maintain duct static pressure setpoint as calculated by the static pressure reset program. Duct mounted static pressure sensors shall be located where indicated on the plans in the supply ductwork.

4. As the DDC control program modulates the fan speed, the outside air and return air dampers shall also modulate to maintain a constant minimum flow of outside air as indicated on the plans and as measured by the airflow measuring station.

E. Unoccupied Cycle

1. The fan motor shall cycle intermittently, at night set-back/set-up temperatures, with the outside air damper closed whenever any one of the room sensors calls for heating or cooling. VAV boxes shall be controlled by their respective DDC control program. When all zones have been satisfied the unit shall stop.

F. General

1. The outside air damper shall close whenever the unit fan motor is off.
2. The DDC control program shall cycle the heating coil pump and modulate the heating coil valve as required to maintain low limit mixed air temperature (65 deg. F.) (adj.) whenever the unit fan motor is off.
3. The auto reset freeze protection thermostat shall stop the unit fan motor, close the outside air damper, turn on the heating coil pump and open the heating coil valve whenever the coil discharge temperature drops below 35 deg. F. (adj.)
4. The smoke detector shall be located in the return air duct and shall stop the unit fan motor whenever smoke is present.
5. The high limit static pressure sensor shall be located in the supply ductwork near the fan discharge. Upon a rise in static pressure above setpoint (5" W.C.) (adj.) the DDC control program shall override the "occupied-unoccupied" schedule and stop the unit fan motors.

VARIABLE AIR VOLUME AIR HANDLING UNITS (w/ DX COOLING):

A. Equipment served

1. AHU-XX
2. VFD-XX
3. ACCU-XX

B. Control programs

1. Morning warm up.
2. Optimal start.
3. Scheduled occupied/unoccupied.
4. Supply air reset.
5. Static pressure reset.
6. Enthalpy economizer.
7. Night set-back.
8. Night set-up.

C. Control devices for each unit

1. Building Level System Controller.
2. Combination outside air damper and airflow measuring station and modulating damper Actuator.
3. Return air damper and modulating damper actuator.
4. Two-way heating coil valve and modulating actuator.
5. Outputs to modulate mechanical cooling.
6. Outputs for fan motor speed control.
7. Unit discharge air, return air, and mixed air temperature sensors.
8. Cooling coil discharge air temperature sensor.
9. Return air humidity sensor.
10. CO2 sensor (return air)
11. CO2 sensor (outside air)
12. Duct mounted static pressure sensors (quantity as indicated).
13. High limit static pressure sensor.
14. Smoke detector (existing).
15. Filter air pressure drop differential sensor.
16. Fan status feedback.
17. Freeze protection thermostat.

D. Occupied Cycle

1. The unit fan motors shall start and the outside air and return air dampers shall slowly open to provide the minimum outside air airflow whenever the unit is scheduled to the occupied cycle.
2. The DDC control program shall, in sequence, cycle stages of mechanical cooling and modulate the economizer dampers, and heating coil valve to maintain discharge air temperature setpoint as calculated by the supply air reset program.
3. There shall be an adjustable deadband or timed delay between stages of cooling to prevent short cycling of the refrigeration compressors.
4. The DDC control program shall modulate the fan speed to maintain duct static pressure Setpoint as calculated by the static pressure reset program. Duct mounted static pressure sensors shall be located where indicated on the plans in the supply ductwork. The minimum fan speed shall not be allowed to go below the minimum required air flow to prevent Dx coils from freezing.

5. As the DDC control program modulates the fan speed, the outside air and return air dampers shall also modulate to maintain a constant minimum flow of outside air based on the min outside air damper setpoint.

E. Unoccupied Cycle

1. The fan motors shall cycle intermittently, at night set-back/set-up temperatures, with the outside air damper closed whenever any one of the room sensors calls for heating or cooling. VAV boxes shall be controlled by their respective DDC control program. When all zones have been satisfied the unit shall stop.

F. General

1. The outside air damper shall close whenever the unit fan motors are off.
2. The DDC control program shall modulate the heating coil valve as required to maintain low limit mixed air temperature (65 deg. F.) (adj.) whenever the unit fan motors are off.
3. The auto reset freeze protection thermostat shall stop the unit fan motor, close the outside air damper, and open the heating coil valve whenever the coil discharge temperature drops below 35 deg. F. (adj.)
4. In cooling mode, the cooling shall cycle off whenever the discharge air temperature drops below 45 deg. F. (adj.) Cooling shall be allowed to cycle back on whenever there is enough of a call for cooling to ensure minimum system airflow across the cooling coil is satisfied, or VAV boxes are commanded open to a predetermined minimum airflow setting. Verify minimum system airflow requirements with the equipment manufacturer.
5. The outside air damper shall modulate toward the increased minimum position and the return air damper shall modulate toward the closed position whenever the CO2 concentration differential between the indoor sensor and the outside air exceeds setpoint (75 ppm). (adj.) When the CO2 level differential is reduced to 50 ppm(adj.), the outside air damper shall return to its reduced minimum position.
6. The smoke detector shall be located in the return air duct and shall stop the unit fan motors whenever smoke is present.
7. The high limit static pressure sensor shall be located in the supply ductwork near the fan discharge. Upon a rise in static pressure above setpoint (5" W.C.) (adj.) the DDC control program shall override the "occupied-unoccupied" schedule and stop the unit fan motors.

SINGLE ZONE VARIABLE AIR VOLUME AIR HANDLING UNITS

A. Equipment served

1. AHU-XX
2. VFD-XX

B. Control programs

1. Morning warm up.
2. Optimal start.
3. Scheduled occupied/unoccupied.
4. Dead band.
5. Enthalpy economizer.
6. Night set-back.
7. Night set-up.

C. Control devices for each unit

1. Building Level System Controller.
2. Combination outside air damper and airflow measuring station and modulating damper actuator.
3. Return air damper and modulating damper actuator.
4. Two way heating coil valve and modulating actuator.
5. Two way cooling coil valve and modulating actuator.
6. Outputs for fan motor speed control.
7. Unit discharge air temperature sensor.
8. Return air temperature sensor.
9. Mixed air temperature sensor.
10. Cooling coil leaving air temperature sensor.
11. Room temperature sensor – Plain cover type.
12. Return air humidity sensor.
13. CO2 sensor (return air).
14. CO2 sensor (outside air).
15. Duct mounted static pressure sensor.
16. Smoke detector (existing).
17. Filter air pressure drop differential sensor.
18. Fan status feedback.
19. Freeze protection thermostat.

D. Occupied Cycle

1. The unit fan motors shall start and the outside air and return air dampers shall slowly open to provide the minimum outside air airflow whenever the unit is scheduled to the occupied cycle.
2. Heating Mode:
 - a. When the system is in the heating mode, the DDC control program shall modulate the heating coil valve and fan speed as follows: on a call for heat, the heating coil valve shall modulate as required to maintain heating discharge air temperature setpoint while the fan speed is slowly increased as needed to reach room temperature setpoint. When room temperature setpoint is satisfied, the fan speed shall reduce back to minimum air flow. On a further reduction in the call for heat, the heating discharge air temperature setpoint shall reset from max heating to room air temperature.
3. Cooling Mode:
 - a. When the system is in the cooling mode, the DDC control program shall modulate the economizer dampers, cooling coil valve and fan speed as follows: on a call for cooling, the economizer dampers and cooling coil valve shall modulate as required to maintain

cooling discharge air temperature setpoint while the fan speed is slowly increased to reach room temperature setpoint. When room temperature setpoint is satisfied, the fan speed shall reduce back to minimum air flow. On a further reduction in the call for cooling, the cooling discharge air temperature setpoint shall reset from max cooling to room air temperature.

4. As the DDC control program modulates the fan speed, the outside air and return air dampers shall also modulate to maintain a constant minimum flow of outside air as indicated on the plans and as measured by the airflow measuring station.

E. Unoccupied Cycle

1. The fan motors shall cycle intermittently, at night set-back/set-up temperatures, with the outside air damper closed whenever the room sensor calls for heating or cooling. When the night set-back/set-up room temperature has been satisfied the unit shall stop.

F. General

1. The outside air damper shall close whenever the unit fan motors are off.

2. The DDC control program shall modulate the heating coil valve as required to maintain low limit mixed air temperature (65 deg. F.) (adj.) whenever the unit fan motors are off in the unoccupied mode.

3. The outside air damper shall modulate toward the increased minimum position and the return air damper shall modulate toward the closed position whenever the CO2 concentration differential exceeds setpoint (75 ppm) (adj.) or the unit is scheduled for "Event" mode. When the CO2 level differential is reduced to 50 ppm(adj.), the outside air damper shall return to its reduced minimum position.

4. The auto reset freeze protection thermostat shall stop the unit fan motor, close the outside air damper, and open the heating coil valve whenever the coil discharge temperature drops below 35 deg. F. (adj.)

5. The smoke detector shall be located in the return air duct and shall stop the unit fan motors whenever smoke is present.

SINGLE ZONE CONSTANT VOLUME AIR HANDLING UNIT:

A. Equipment served

1. AHU-XX

B. Control programs

1. Morning warm up.
2. Optimal start.
3. Scheduled occupied/unoccupied.
4. Dead band.
5. Enthalpy economizer.
6. Night set-back.
7. Night set-up.

C. Control devices for each unit

1. Building Level System Controller.
2. Combination outside air damper and airflow measuring station and modulating damper actuator.
3. Return air damper and modulating damper actuator.
4. Two way heating coil valve and modulating actuator.
5. Two way cooling coil valve and modulating actuator.
6. Outputs for fan motor control.
7. Unit discharge air, return air, and mixed air temperature sensors.
8. Cooling coil discharge air temperature sensor.
9. Room temperature sensor – Stainless steel flush plate type.
10. Return air humidity sensor.
11. CO2 sensor (return air).
12. CO2 sensor (outside air).
13. Smoke detector (existing).
14. Filter air pressure drop differential sensor.
15. Fan status feedback.
16. Freeze protection thermostat.

D. Occupied Cycle

1. The unit fan motors shall start and the outside air and return air dampers shall slowly open to provide the minimum outside air airflow whenever the unit is scheduled to the occupied cycle.
2. The DDC control program shall, in sequence, modulate the cooling coil valve, economizer dampers, and heating coil valve to maintain room air temperature setpoint.

E. Unoccupied Cycle

1. The fan motors shall cycle intermittently, at night set-back/set-up temperatures, with the outside air damper closed whenever the room sensor calls for heating or cooling. When the night set-back/set-up room temperature has been satisfied the unit shall stop.

F. General

1. The outside air damper shall close whenever the unit fan motors are off.
2. The DDC control program shall modulate the heating coil valve as required to maintain low limit mixed air temperature (65 deg. F.) (adj.) whenever the unit fan motor is off.
3. The outside air damper shall modulate toward the increased minimum position and the return air damper shall modulate toward the closed position whenever the CO2 concentration differential exceeds setpoint (75 ppm) (adj.) or the unit is scheduled for "Event" mode. When the CO2 level differential is reduced to 50 ppm(adj.), the outside air damper shall return to its reduced minimum position.

4. The mixed air sensor shall be located in the mixed air duct and the DDC control program shall modulate the outside air damper closed and the return air damper open whenever the mixed air temperature drops below 40 deg. F. (adj.)
5. The auto reset freeze protection thermostat shall stop the unit fan motor, close the outside air damper, and open the heating coil valve whenever the coil discharge temperature drops below 35 deg. F. (adj.)
6. The smoke detector shall be located in the return air duct and shall stop the unit fan motors whenever smoke is present.

VARIABLE AIR VOLUME ROOF MOUNTED AIR HANDLING UNITS:

A. Equipment served

1. RTU-XX
2. VFD-XX

B. Control programs

1. Morning warm up.
2. Optimal start.
3. Scheduled occupied/unoccupied.
4. Supply air reset.
5. Static pressure reset.
6. Enthalpy economizer.
7. Night set-back.
8. Night set-up.

C. Control Devices

1. Building Level System Controller.
2. Outside air combination damper/airflow measuring station and modulating damper actuator. (for field installation)
3. Return air damper and modulating damper actuator. (for field installation)
4. Two way heating coil valve and modulating actuator.
5. Two way cooling coil valve and modulating actuator.
6. Outputs for fan motor speed control.
7. Unit discharge air, return air, and mixed air temperature sensors.
8. Cooling coil discharge air temperature sensor.
9. Return air humidity sensor.
10. CO2 sensor (return air)
11. CO2 sensor (outside air)
12. Duct mounted static pressure sensors (quantity as indicated).
13. High limit static pressure sensor.
14. Smoke detector.
15. Filter air pressure drop differential sensor.
17. Fan status feedback.
18. Freeze protection thermostat.

D. Occupied Cycle

1. The unit fan motors shall start and the outside air and return air dampers shall slowly open to provide the minimum outside air airflow whenever the unit is scheduled to the occupied cycle.
2. The DDC control program shall, in sequence, modulate the cooling coil valve, economizer dampers, and heating coil valve to maintain discharge air temperature setpoint as calculated by the supply air reset program.
3. The DDC control program shall modulate the fan speed to maintain duct static pressure setpoint as calculated by the static pressure reset program. Duct mounted static pressure sensors shall be located where indicated on the plans in the supply ductwork.
4. As the DDC control program modulates the fan speed, the outside air and return air dampers shall also modulate to maintain a constant minimum flow of outside air as indicated on the plans and as measured by the airflow measuring station.

E. Unoccupied Cycle

1. The fan motors shall cycle intermittently, at night set-back/set-up temperatures, with the outside air damper closed whenever any one of the room sensors calls for heating or cooling.

VAV boxes shall be controlled by their respective DDC control program. When all zones have been satisfied the unit shall stop.

F. General

1. The outside air damper shall close whenever the unit fan motors are off.
2. The DDC control program shall modulate the heating coil valve as required to maintain low limit mixed air temperature (65 deg. F.) (adj.) whenever the unit fan motors are off.
3. The auto reset freeze protection thermostat shall stop the unit fan motor, close the outside air damper, and open the heating coil valve whenever the coil discharge temperature drops below 35 deg. F.
4. The outside air damper shall modulate toward the increased minimum position and the return air damper shall modulate toward the closed position whenever the CO2 concentration differential between the indoor sensor and the outside air exceeds setpoint (75 ppm). (adj.) When the CO2 level differential is reduced to 50 ppm(adj.), the outside air damper shall return to its reduced minimum position.
5. The smoke detector shall be located in the return air duct and shall stop the unit fan motors whenever smoke is present.
6. The high limit static pressure sensor shall be located in the supply ductwork near the fan discharge. Upon a rise in static pressure above setpoint (5" W.C.) (adj.) the DDC control program shall override the "occupied-unoccupied" schedule and stop the unit fan motor.

CONSTANT VOLUME PACKAGED ROOFTOP UNITS:

A. Equipment served

1. RTU-XX

B. Control programs

1. Morning warm up.
2. Optimal start.
3. Dead band.
4. Scheduled occupied/unoccupied.
5. Enthalpy economizer.
6. Supply air reset.
7. Demand control ventilation.
8. Night set-back.
9. Night set-up.

C. Control devices for each unit (by BAS Contractor except as noted)

1. Building Level System Controller.
2. Outside air and return air dampers and modulating damper actuators (furnished with the unit)
3. Outputs for the airflow measuring station in the unit.
4. Outputs for supply and relief fan motor VFD control.
5. Outputs to modulate the gas heating section.
6. Two way cooling coil valve and modulating actuator.
7. Cooling coil entering and leaving water temperature sensors.
8. Return air humidity sensor.
9. Unit discharge air, return air and mixed air temperature sensors.
10. Cooling coil discharge air temperature sensor.
11. CO2 sensor (return air).
12. CO2 sensor (outside air).
13. Building static pressure sensor
14. Smoke detector (existing).
15. Filter air pressure drop differential sensor.
16. Fan status feedback.
17. Freeze protection thermostat.

D. Occupied Cycle

1. The digital control program shall enable the unit.
2. The unit supply fan motors shall start and the outside air and return air dampers shall slowly open to their minimum position whenever the unit is scheduled to the occupied cycle.
3. The control program shall, in sequence, modulate the cooling coil valve, modulate the economizer dampers, and sequence the stages of gas heat to maintain discharge air temperature setpoint as calculated by the supply air reset program.
4. The outside air damper shall modulate to maintain a constant minimum flow of outside air as indicated on the plans and by the airflow measuring station.
5. There shall be an adjustable deadband or timed delay between stages of cooling to prevent short cycling of the refrigeration compressors.

E. Unoccupied Cycle

1. The fan motors shall cycle intermittently, at night set-back/set-up temperatures, with the outside air damper closed whenever any one of the room sensors calls for heating or cooling. When the night set-back/set-up room temperature has been satisfied the unit shall stop.

F. General

1. The outside air damper shall close whenever the unit fan motors are off.

2. The control program shall modulate the heating section and cycle the supply fan with the outside air damper closed as required to maintain low limit mixed air temperature (50 deg. F.) (adj.) whenever the unit fan motor is off.
3. The auto reset freeze protection thermostat shall stop the unit fan motors, and close the outside air damper whenever the unit discharge temperature drops below 35 deg. F.
4. The control shall function so that the relief fan motor starts at minimum speed whenever the building static pressure rises above setpoint. The control shall modulate the relief fan as required to maintain building static pressure setpoint (+0.03" w.c., adj.) (adj.) On a drop in building static pressure below setpoint (+0.01" w.c., adj.) (adj.), the fan shall stop. Provide a deadband to prevent frequent cycling of the fan.
5. Where multiple units pull return air from a common plenum space, relief fans shall be brought on sequentially at minimum speed with a timed delay to prevent sudden negative pressurization of the spaces served.
6. The relief shall be off whenever the unit fan motor is off.
7. The smoke detector shall be located in the return air duct and shall stop the unit fan motors whenever smoke is present.

FAN COIL UNIT:**A. Control programs**

1. Morning warm up.
2. Optimal start.
3. Dead band.
4. Scheduled occupied/unoccupied.
5. Enthalpy economizer.
6. Night set-back.
7. Night set-up.

B. Control devices for each unit

1. Advanced Application Controller.
2. Outside air damper and two-position damper actuator as indicated.
3. Two-way heating coil valve and modulating actuator.
4. Two-way cooling coil valve and modulating actuator. (if applicable)
5. Output(s) for full fan motor speed modulation.
6. Room temperature sensor – Plain cover type.
7. Return air humidity sensor.
8. Interlock with room occupancy sensor (if applicable)
9. Unit discharge air temperature sensor.
10. Condensate overflow switch.
11. Fan status feedback.
12. Filter air pressure drop differential sensor.
13. Freeze protection thermostat.

C. Occupied Cycle

1. The control shall function so that the unit fan motor starts whenever DDC control program is indexed to the "occupied" cycle.
2. The outside air and return air dampers shall open to their minimum position.
3. The unit fan motors shall start and the outside air and return air dampers shall slowly open to provide the minimum outside air airflow whenever the unit is scheduled to the occupied cycle.
4. Heating Mode:
 - a. When the system is in the heating mode, the DDC control program shall modulate the heating coil valve and fan speed as follows: on a call for heat, the heating coil valve shall modulate as required to maintain heating discharge air temperature setpoint (90 deg. F, adj.) (adj.) while the fan speed is slowly increased as needed to reach room temperature setpoint. When room temperature setpoint is satisfied, the fan speed shall reduce back to minimum air flow. On a further reduction in the call for heat, the heating discharge air temperature setpoint shall reset from max heating to room air temperature.
5. Cooling Mode:
 - a. When the system is in the cooling mode, the DDC control program shall modulate the economizer dampers, cooling coil valve and fan speed as follows: on a call for cooling, the economizer dampers and cooling coil valve shall modulate as required to maintain cooling discharge air temperature setpoint (55 deg. F, adj.) (adj.) while the fan speed is slowly increased to reach room temperature setpoint. When room temperature setpoint is satisfied, the fan speed shall reduce back to minimum air flow. On a further reduction in the call for cooling, the cooling discharge air temperature setpoint shall reset from max cooling to room air temperature.
6. As the DDC control program modulates the fan speed, the outside air and return air dampers shall also modulate to maintain a constant minimum flow of outside air as indicated on the plans.

D. Unoccupied Cycle

1. The fan motor shall cycle intermittently with the outside air damper closed whenever the room sensor calls for heat.

E. Occupancy Stand-by Cycle:

1. Minimum ventilation settings shall be disabled, and the fresh air damper shall close. The fan motor shall modulate intermittently, at occupied temperature setpoints, whenever the room sensor calls for heating or cooling.
2. Note: Room temperature setpoint shall not be set back or set up in the occupancy stand-by cycle.

F. General

1. The outside air damper shall close whenever the unit fan motor is off.
2. The auto reset freeze protection thermostat shall stop the unit fan motor, close the outside air damper, and open the heating coil valve whenever the coil discharge temperature drops below 35 deg. F. (adj.)
3. The condensate overflow switch shall shut down the unit fan motor whenever high condensate level is detected.

SINGLE ZONE VARIABLE AIR VOLUME BLOWER COIL UNITS:

A. Equipment served

1. BCU-XX

B. Control programs

1. Morning warm up.
2. Optimal start.
3. Scheduled occupied/unoccupied.
4. Dead band.
5. Enthalpy economizer.
6. Night set-back.
7. Night set-up.

C. Control devices for each unit

1. Building Level System Controller.
2. Combination outside air damper and airflow measuring station and modulating damper actuator.
3. Return air damper and modulating damper actuator.
4. Two way heating coil valve and modulating actuator.
5. Two way cooling coil valve and modulating actuator. (if applicable)
6. Output(s) for full fan speed modulation.
7. Unit discharge air, return air and mixed air temperature sensors.
8. Cooling coil discharge air temperature sensor.
9. Room temperature sensor – Plain cover type.
10. Return air humidity sensor.
11. Duct mounted static pressure sensor.
12. Condensate overflow switch.
13. Interlock with room occupancy sensor (if applicable)
14. Filter air pressure drop differential sensor.
15. Fan status feedback.
16. Freeze protection thermostat.

D. Occupied Cycle

1. The unit fan motors shall start and the outside air and return air dampers shall slowly open to provide the minimum outside air airflow whenever the unit is scheduled to the occupied cycle.
2. Heating Mode:
 - a. When the system is in the heating mode, the DDC control program shall modulate the heating coil valve and fan speed as follows: on a call for heat, the heating coil valve shall modulate as required to maintain heating discharge air temperature setpoint while the fan speed is modulated to maintain room temperature setpoint. When room temperature setpoint is satisfied, the fan shall modulate from full air flow to minimum air flow. On a further reduction in the call for heat, the heating discharge air temperature setpoint shall reset from max heating to room air temperature.
3. Cooling Mode:
 - a. When the system is in the cooling mode, the DDC control program shall modulate the economizer dampers, cooling coil valve and fan speed as follows: on a call for cooling, the economizer dampers and cooling coil valve shall modulate as required to maintain cooling discharge air temperature setpoint while the fan speed is modulated to maintain room temperature setpoint. When room temperature setpoint is satisfied, the fan shall modulate from full air flow to minimum air flow. On a further reduction in the call for cooling, the cooling discharge air temperature setpoint shall reset from max cooling to room air temperature.

4. As the DDC control program modulates the fan speed, the outside air and return air dampers shall also modulate to maintain a constant minimum flow of outside air as indicated on the plans and as measured by the airflow measuring station.

E. Unoccupied Cycle

1. The fan motors shall cycle intermittently, at night set-back/set-up temperatures, with the outside air damper closed whenever the room sensor calls for heating or cooling. When the night set-back/set-up room temperature has been satisfied the unit shall stop.

F. Occupancy Stand-by Cycle:

1. Minimum ventilation settings shall be disabled, and the fresh air damper shall close. The fan motor shall modulate intermittently, at occupied temperature setpoints, whenever the room sensor calls for heating or cooling.

2. Note: Room temperature setpoint shall not be set back or set up in the occupancy stand-by cycle.

G. General

1. The outside air damper shall close whenever the unit fan motors are off.

2. The DDC control program shall modulate the heating coil valve as required to maintain low limit mixed air temperature (65 deg. F.) (adj.) whenever the unit fan motors are off in the unoccupied mode.

3. The auto reset freeze protection thermostat shall stop the unit fan motor, close the outside air damper, and open the heating coil valve whenever the coil discharge temperature drops below 35 deg. F. (adj.)

4. The smoke detector shall be located in the return air duct and shall stop the unit fan motors whenever smoke is present.

5. The condensate overflow switch shall shut down the unit fan motor whenever high condensate level is detected.

BOOSTER COIL:

- A. Control programs
 - 1. Supply air reset.
 - 2. Night set-back.
- B. Control devices for each unit.
 - 1. Application Specific Controller.
 - 2. Room temperature sensor – Plain cover type.
 - 3. Two way heating coil valve and modulating actuator.
 - 4. Discharge air temperature sensor.
- C. Control Sequence
 - 1. The DDC control program shall modulate the valve to maintain room temperature setpoint.
 - 2. Whenever the discharge air temperature drops below 40 degrees F, the heating coil valve shall fully open, and the BAS shall shut down the respective air handling system.

UNIT HEATERS:

- A. Control programs
 - 1. Scheduled occupied/unoccupied.
 - 2. Dead band.
 - 3. Night set-back.
- B. Control devices for each unit.
 - 1. Application Specific Controller.
 - 2. Room temperature sensor – Stainless steel flush plate type.
 - 3. Two-way heating coil valve and modulating actuator.
 - 4. Outputs for fan motor control.
- C. Control Sequence
 - 1. The DDC control program shall cycle the unit fan motor and modulate the heating coil valve to maintain room temperature setpoint.

CABINET HEATER:

- A. Control programs
 - 1. Scheduled occupied/unoccupied.
 - 2. Dead band.
 - 3. Night set-back.
- B. Control devices for each unit.
 - 1. Application Specific Controller.
 - 2. Room temperature sensor – Stainless steel flush plate type.
 - 3. Two-way heating coil valve and modulating actuator.
 - 4. Outputs for fan motor control.
- C. Control Sequence
 - 1. The DDC control program shall cycle the unit fan motor and modulate the heating coil valve to maintain room temperature setpoint.

CONVECTOR:

- A. Control programs
 - 1. Scheduled occupied/unoccupied.

2. Dead band.
3. Night set-back.
- B. Control devices for each unit.
 1. Application Specific Controller.
 2. Room temperature sensor – Stainless steel flush plate type.
 3. Two-way heating coil valve and modulating actuator.
- C. Control Sequence
 1. The DDC control program shall modulate the heating coil valve to maintain room temperature setpoint.

PANEL RADIATION:

- A. Control programs
 1. Scheduled occupied/unoccupied.
 2. Dead band.
 3. Night set-back.
- B. Control devices for each section of panel radiation.
 1. Application Specific Controller.
 2. Room temperature sensor – Stainless steel flush plate type.
 3. Two-way heating coil valve and modulating actuator.
- C. Control Sequence
 1. The DDC control program shall modulate the valve to maintain room temperature setpoint.
 2. Where panel radiation serves a room or space with another heating source, the same room temperature sensor shall serve both. The panel radiation valve shall open first and close last (heating mode only). Where panel radiation serves a room or space that is served by a VAV box or booster coil that serves multiple rooms, the panel radiation shall be served by a separate room temperature sensor.
 3. When the system is indexed to cooling mode, the panel radiation valve shall remain closed and the terminal unit coil shall operate as the only source of heat or reheat.

VARIABLE AIR VOLUME BOXES:

- A. Control programs
 1. Occupancy Stand-by.
 2. Scheduled occupied/unoccupied.
 3. Dead band.
 4. Night set-back.
 5. Night set-up.
- B. Control devices for each unit.
 1. Application Specific Controller.
 2. Modulating damper actuator for VAV damper in the unit.
 3. Room temperature sensor – Plain cover type.
 4. Discharge air temperature sensor.
 5. Two-way heating coil valve and modulating actuator.
 6. Interlock with room occupancy sensor (if applicable)
- C. Control Sequence
 1. The DDC control program shall modulate the VAV box actuator and heating coil valve in sequence as required to maintain room temperature setpoint.

2. On a drop in room temperature below setpoint, the air flow shall modulate from maximum to minimum air flow. On a further drop in room temperature, the heating coil valve shall modulate as required to maintain room temperature setpoint but shall not exceed the scheduled leaving air temperature. On a further call for heat, the air flow shall modulate from minimum to maximum air flow, maintaining the scheduled leaving air temperature as required to maintain room temperature setpoint. On a rise in room temperature above setpoint, the reverse shall occur.
3. Whenever the respective system is in cooling mode or economizer, the VAV box shall not be allowed to increase air flow above 30% of maximum when reheating to control space temperature or prevent overcooling.
4. Coordinate minimum and maximum air flow settings with the air balancing contractor.
5. Whenever the discharge air temperature drops below 40 degrees F(adj.), the heating coil valve shall fully open, and the BAS shall shut down the respective air handling system.
6. Occupancy Stand-by Cycle:
 - a. Minimum ventilation settings shall be disabled and the VAV box shall be allowed to modulate to the fully closed position.
 - b. Note: Room temperature setpoint shall not be set back or set up in the occupancy stand-by cycle.
 - c. The occupancy stand-by control shall not be implemented on VAV boxes that serve multiple rooms with multiple occupancy sensors.
7. Direct expansion cooling systems:
 - a. Coordinate system minimum airflow requirements with the equipment manufacturer to determine total VAV box minimum airflow settings required to prevent coil frosting and/or low limit discharge air shutdown.

VERTICAL UNIT VENTILATORS:

A. Control programs

1. Morning warm up.
2. Optimal start.
3. Dead band.
5. Occupancy Stand-by.
6. Enthalpy economizer.
7. Night set-back.
8. Night set-up.

B. Control devices for each unit (by BAS except as indicated):

1. Building Level System Controller
2. Unit discharge air, return air and mixed air temperature sensors.
3. Cooling coil discharge air temperature sensor.
4. Outside air modulating damper actuator for damper in the unit.
5. Return air modulating damper actuator for damper in the unit.
6. Two way heating coil valve and modulating actuator.
7. Two way cooling coil valve and modulating actuator. (if applicable)
8. Return air humidity sensor.
9. Room temperature sensor – Plain cover type.
10. Interlock with room occupancy sensor (if applicable)
11. Fan status feedback.
12. Output(s) for fan full fan motor speed modulation (supply and exhaust).
13. Filter air pressure drop differential sensor.
14. Freeze protection thermostat.

C. Occupied Cycle

1. The unit control program shall enable the unit.
2. The unit fan motors shall start and the outside and return air dampers shall slowly open to their minimum position whenever the unit is scheduled to the occupied cycle.
3. The DDC control program shall, in sequence, modulate the fan speed, cooling coil valve, economizer dampers, and heating coil valve to maintain setpoint of the room sensor.

D. Occupancy Stand-by Cycle

1. Minimum ventilation settings shall be disabled, and the outside air damper shall close. The fan supply motor shall modulate intermittently at occupied temperature setpoints, whenever the room sensor calls for heating or cooling.

E. Unoccupied Cycle

1. The supply fan motor shall cycle intermittently with the exhaust fan off, at night set-back/set-up temperatures, with the outside air damper closed whenever the room sensor calls for heating or cooling.

F. General

1. The outside air damper shall close whenever the unit fan motors are off.
2. The freeze protection thermostat shall stop the unit fan motors whenever the unit discharge temperature drops below 35 deg. F. (adj.)
3. The DDC control program shall modulate the heating coil valve as required to maintain low limit mixed air temperature (65 deg. F.) (adj.) whenever the unit fan motors are off.
4. The DDC control program shall modulate the outside air damper closed and the return air damper open whenever the mixed air temperature drops below 45 deg. F. (adj.)
5. The DDC control program shall modulate the cooling coil closed whenever the discharge air temperature drops below 55 deg. F. (adj.)
6. The DDC control program shall modulate the supply and exhaust fans as required to maintain design airflows to offset increased pressure drop across the filters.

7. Where room occupancy sensors are utilized, during the “occupancy stand-by” periods of the occupied cycle, the outside air damper shall close and the exhaust fan shall be off, but the unit supply fan shall continue to run and maintain the occupied room temperature