

## SEQUENCE OF OPERATION GUIDELINE

### **AIR TERMINAL UNITS – SINGLE DUCT VARIABLE AIR VOLUME with HOT WATER REHEAT or ELECTRIC HEAT**

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#### NOTES:

1. THIS SEQUENCE IS INTENDED TO PROVIDE THE DESIGN PROFESSIONAL WITH A BASIC GUIDELINE OF MINIMUM REQUIREMENTS FOR TYPICAL VAV AIR TERMINAL UNITS. THIS SEQUENCE SHALL BE CAREFULLY REVIEWED AND EDITED WITH RESPECT TO APPLICATION-SPECIFIC PROJECT REQUIREMENTS AND PROPOSED MODIFICATIONS SHALL BE REVIEWED WITH FSU STAFF.
2. THE INTENT IS FOR THIS SEQUENCE TO BE INCLUDED IN THE CONTRACT DRAWINGS.
3. USE ZONE OCCUPANCY SENSORS FOR “UNOCCUPIED” MODE WHENEVER POSSIBLE. COORDINATE WITH ELECTRICAL/LIGHTING DESIGN FOR DUAL USE.
4. REFERENCE STANDARD CONTROL DIAGRAMS IC-16.

#### VAV BOXES WITH HOT WATER REHEAT:

PROVIDE THE FOLLOWING FOR ALL AIR TERMINAL UNIT BOXES.

1. ROOM THERMOSTAT WITH INTEGRAL TEMPERATURE SENSOR, INTEGRAL DISPLAY, SLIDING SCALE SETPOINT ADJUSTMENT, AND REMOTE COMMUNICATION PORT.
2. PRESSURE INDEPENDENT VOLUME CONTROL WITH ADJUSTABLE MAXIMUM AND MINIMUM AIRFLOW SETTINGS.
3. CLOSE HOT WATER REHEAT AND RETURN THE VOLUME DAMPER TO A MINIMUM POSITION (25 %) WHEN ASSOCIATED AHU IS OFF.
4. PROVIDE A SUPPLY AIR SENSOR DOWNSTREAM OF THE HEATING COIL FOR USE IN MONITORING OVERALL VAV BOX PERFORMANCE.
5. OCCUPIED MODE SHALL BE DETERMINED BY [SCHEDULE OR LOCAL OCCUPANCY SENSOR].

#### OCCUPIED MODE

1. THE CONTROLLER SHALL CONTINUE TO MONITOR ROOM TEMPERATURE AND RESET THE CFM SETPOINT UP OR DOWN IN RESPONSE TO COOLING/HEATING DEMAND
2. ON A RISE IN ROOM TEMPERATURE, MODULATE THE AIR DAMPER TOWARDS ITS MAXIMUM CFM SETPOINT UNTIL OCCUPIED CLG SETPOINT HAS BEEN ACHIEVED.

3. WHEN THE ZONE TEMPERATURE IS BETWEEN THE COOLING SETPOINT AND THE HEATING SETPOINT, THE ZONE DAMPER SHALL CONTROL TO ITS MINIMUM OCCUPIED AIRFLOW (ADJ.). HOT WATER REHEAT REMAINS CLOSED.
4. ON A CONTINUED FALL IN ROOM TEMPERATURE, CONTINUE DELIVERING THE SCHEDULED MINIMUM AIR FLOW AND, INCREASE THE HOT WATER REHEAT OUTPUT PROPORTIONALLY UNTIL THE OCCUPIED HTG SETPOINT HAS BEEN ACHIEVED.

UNOCCUPIED MODE (BASED ON SCHEDULE OR LOCAL OCCUPANCY SENSOR)

ASSOCIATED AHU IS SCHEDULED OFF

1. THE AIR DAMPER SHALL REMAIN AT ITS MINIMUM 25% POSITION AND THE ELECTRIC HEAT SHALL REMAIN OFF.
2. IN THE EVENT THE AHU IS ENABLED DURING UNOCCUPIED HOURS (DUE TO A NIGHT SETBACK CALL FOR COOLING OR HEATING), THE BOX SHALL CONTROL ACCORDING TO THE OCCUPIED MODE DESCRIBED ABOVE USING THE OCCUPIED SETPOINTS.
3. THE BAS SHALL POLL THE VARIOUS ZONES AND, BASED ON A PRESET REQUEST QUANTITY TARGET (INITIALLY SET AT 2), ACTIVATE THE AHU WHEN THE ASSOCIATED QUANTITY TARGET HAS BEEN REACHED.
4. UPON ACTIVATION OF THE AHU BASED ON OCCUPANCY SENSORS, THE ASSOCIATED AHU SHALL BE TEMPORARILY ACTIVATED AND THE TERMINAL UNIT SHALL RESUME NORMAL OCCUPANCY MODE CONTROL. DEACTIVATION OF ALL LOCAL OCCUPANCY SENSORS SHALL RETURN THE TERMINAL UNIT TO ITS UNOCCUPIED STATE AND CAUSE THE ASSOCIATED AHU TO SHUT DOWN.
5. TERMINAL UNIT AND ASSOCIATED AHU SHALL REMAIN OCCUPIED AND ACTIVE FOR A MINIMUM OF 1 HR (ADJUSTABLE).

ASSOCIATED AHU RUNS CONTINUOUSLY

1. ON A RISE IN ROOM TEMPERATURE, MODULATE THE AIR DAMPER TOWARD ITS MAXIMUM CFM SETPOINT UNTIL THE UNOCCUPIED CLG SETPOINT HAS BEEN ACHIEVED.
2. ON A FALL IN ROOM TEMPERATURE MODULATE THE AIR TOWARDS ITS UNOCCUPIED MINIMUM CFM SETPOINT. ON A CONTINUED FALL IN ROOM TEMPERATURE, INCREASE THE HOT WATER REHEAT OUTPUT PROPORTIONALLY UNTIL THE UNOCCUPIED HTG SETPOINT HAS BEEN ACHIEVED.

OCCUPIED CLG SETPOINT 74 F (ADJUSTABLE)

OCCUPIED HTG SETPOINT 70 F (ADJUSTABLE)

UNOCCUPIED CLG SETPOINT 78 F (ADJUSTABLE)

UNOCCUPIED HTG SETPOINT 68 F (ADJUSTABLE)

VAV BOXES WITH ELECTRIC REHEAT:

PROVIDE THE FOLLOWING FOR ALL AIR TERMINAL UNIT BOXES.

1. ROOM THERMOSTAT WITH INTEGRAL TEMPERATURE SENSOR, INTEGRAL DISPLAY, SLIDING SCALE SETPOINT ADJUSTMENT, AND REMOTE COMMUNICATION PORT.

2. PRESSURE INDEPENDENT VOLUME CONTROL WITH ADJUSTABLE MAXIMUM AND MINIMUM AIRFLOW SETTINGS.
3. PROVIDE SCR VARIABLE CONTROL OF ELECTRIC HEAT STRIP.
4. DISABLE ELECTRIC HEAT AND RETURN THE VOLUME DAMPER TO A MINIMUM POSITION (25 %) WHEN ASSOCIATED AHU IS OFF.
5. PROVIDE A SUPPLY AIR SENSOR DOWNSTREAM OF THE HEATING COIL FOR USE IN MONITORING OVERALL VAV BOX PERFORMANCE.
6. OCCUPIED MODE SHALL BE DETERMINED BY **[SCHEDULE OR LOCAL OCCUPANCY SENSOR]**.

#### OCCUPIED MODE

1. THE CONTROLLER SHALL CONTINUE TO MONITOR ROOM TEMPERATURE AND RESET THE CFM SETPOINT UP OR DOWN IN RESPONSE TO COOLING/HEATING DEMAND
2. ON A RISE IN ROOM TEMPERATURE, MODULATE THE AIR DAMPER TOWARDS ITS MAXIMUM CFM SETPOINT UNTIL OCCUPIED CLG SETPOINT HAS BEEN ACHIEVED.
3. WHEN THE ZONE TEMPERATURE IS BETWEEN THE COOLING SETPOINT AND THE HEATING SETPOINT, THE ZONE DAMPER SHALL CONTROL TO ITS MINIMUM OCCUPIED AIRFLOW (ADJ.). ELECTRIC HEAT IS DISABLED.
4. ON A CONTINUED FALL IN ROOM TEMPERATURE, CONTINUE DELIVERING THE SCHEDULED MINIMUM AIR FLOW AND, INCREASE THE ELECTRIC HEATER OUTPUT PROPORTIONALLY UNTIL THE OCCUPIED HTG SETPOINT HAS BEEN ACHIEVED.

#### UNOCCUPIED MODE (BASED ON SCHEDULE OR LOCAL OCCUPANCY SENSOR)

##### ASSOCIATED AHU IS SCHEDULED OFF

1. THE AIR DAMPER SHALL REMAIN AT ITS MINIMUM 25% POSITION AND THE ELECTRIC HEAT SHALL REMAIN OFF.
2. IN THE EVENT THE AHU IS ENABLED DURING UNOCCUPIED HOURS (DUE TO A NIGHT SETBACK CALL FOR COOLING OR HEATING), THE BOX SHALL CONTROL ACCORDING TO THE OCCUPIED MODE DESCRIBED ABOVE USING THE OCCUPIED SETPOINTS.
3. THE BAS SHALL POLL THE VARIOUS ZONES AND, BASED ON A PRESET REQUEST QUANTITY TARGET (INITIALLY SET AT 2), ACTIVATE THE AHU WHEN THE ASSOCIATED QUANTITY TARGET HAS BEEN REACHED.
4. UPON ACTIVATION OF THE AHU BASED ON OCCUPANCY SENSORS, THE ASSOCIATED AHU SHALL BE TEMPORARILY ACTIVATED AND THE TERMINAL UNIT SHALL RESUME NORMAL OCCUPANCY MODE CONTROL. DEACTIVATION OF ALL LOCAL OCCUPANCY SENSORS SHALL RETURN THE TERMINAL UNIT TO ITS UNOCCUPIED STATE AND CAUSE THE ASSOCIATED AHU TO SHUT DOWN.
5. TERMINAL UNIT AND ASSOCIATED AHU SHALL REMAIN OCCUPIED AND ACTIVE FOR A MINIMUM OF 1 HR (ADJUSTABLE).

##### ASSOCIATED AHU RUNS CONTINUOUSLY

1. ON A RISE IN ROOM TEMPERATURE, MODULATE THE AIR DAMPER TOWARD ITS MAXIMUM CFM SETPOINT UNTIL THE UNOCCUPIED CLG SETPOINT HAS BEEN ACHIEVED.

2. ON A FALL IN ROOM TEMPERATURE MODULATE THE AIR TOWARDS ITS UNOCCUPIED MINIMUM CFM SETPOINT. ON A CONTINUED FALL IN ROOM TEMPERATURE, ENERGIZE THE ELECTRIC HEATER IN STAGES UNTIL THE UNOCCUPIED HTG SETPOINT HAS BEEN ACHIEVED.

OCCUPIED CLG SETPOINT 74 F (ADJUSTABLE)  
OCCUPIED HTG SETPOINT 70 F (ADJUSTABLE)  
UNOCCUPIED CLG SETPOINT 78 F (ADJUSTABLE)  
UNOCCUPIED HTG SETPOINT 68 F (ADJUSTABLE)

| VAV #                      |                              | UNITS     | POINT TYPE |         | ALARM       |            |           | INTEGRATED POINT | NOTES |
|----------------------------|------------------------------|-----------|------------|---------|-------------|------------|-----------|------------------|-------|
| TYPE: IC-16                |                              |           | ANALOG     | DIGITAL | CONDITION   |            |           |                  |       |
| SHORT NAME                 | POINT DESCRIPTION            |           |            |         | EQUIP ALARM | HIGH LIMIT | LOW LIMIT |                  |       |
| bbb_RMxxxx_AHxxx_BOxxx_FLW | SUPPLY AIR FLOW              | CFM       | X          |         |             | X          | X         |                  |       |
| bbb_RMxxxx_AHxxx_BOxxx_DMP | SUPPLY AIR DAMPER            | %OPEN     |            | X       |             |            |           |                  |       |
| bbb_RMxxxx_AHxxx_BOxxx_RHV | REHEAT VALVE OUTPUT          | %OPEN     | X          |         |             |            |           |                  |       |
| bbb_RMxxxx_AHxxx_BOxxx_SA  | SUPPLY AIR TEMPERATURE       | DEG F     | X          |         |             | X          | X         |                  |       |
| bbb_RMxxxx_AHxxx_BOxxx_OS  | OCCUPANCY STATUS             | OCC/UNOCC |            | X       |             |            |           |                  |       |
| bbb_RMxxxx_AHxxx_BOxxx_ZT  | ZONE TEMPERATURE             | DEG F     | X          |         |             | X          | X         |                  |       |
| bbb_RMxxxx_AHxxx_BOxxx_SP  | ZONE TEMPERATURE SETPOINT    | DEG F     | X          |         |             |            |           |                  |       |
| bbb_RMxxxx_AHxxx_BOxxx_OR  | TEMPORARY OCCUPANCY OVERRIDE | OCC/UNOCC |            | X       |             |            |           |                  |       |