

# SEQUENCE OF OPERATION

SEE POINTS LIST FOR ADDITIONAL REQUIREMENTS OF BUILDING AUTOMATION SYSTEM. SEQUENCE OF OPERATION IS NOTED BELOW.  
THE MECHANICAL CONTRACTOR SHALL PROVIDE A COMPLETE BUILDING DDC CONTROL SYSTEM TO COMPLY WITH THESE SEQUENCES OF OPERATION, AND THE POINTS LIST. (CONTROLS SHALL BE PROVIDED BY SIEMENS, TRANE, OR JCI)

## A. RTU VAV SYSTEM

THE BUILDING AUTOMATION SYSTEM (BAS) SHALL PERFORM THE FOLLOWING VAV AIR SYSTEM (VAS) CONTROL STRATEGIES, APPROPRIATE TO THE GIVEN OCCUPANCY MODE OF THE SYSTEM, AS DETERMINED BY THE USER-ADJUSTABLE TIME-OF-DAY SCHEDULE FOR THE SYSTEM. PROVIDE LOCAL HUMAN OPERATOR INTERFACE DISPLAY AT EACH RTU. VAS SHALL BE STOPPED/STARTED ON A PROGRAMMED BASIS THROUGH THE BAS. SUPPLY FAN SPEED SHALL BE CONTINUOUSLY ADJUSTED IN OCCUPIED MODE. SUPPLY FAN SPEED SHALL BE CONTROLLED BY A VARIABLE FREQUENCY DRIVE AND DUCT MOUNTED STATIC PRESSURE SENSOR. THE STATIC PRESSURE SENSOR SETPOINT SHALL BE RESET USING A TRM AND RESPOND ALGORITHM BASED ON ZONE AIRFLOW REQUIREMENTS FROM A LOW SETTING OF 0.75" (ADJ.) TO A HIGH SETTING OF 1.25" (ADJ.). ON A CALL FOR MORE AIRFLOW AT THE ZONE LEVEL, AND THE SPACES FOLLOWING SATISFACTION OF UNOCCUPIED SETPOINT AND SYSTEM SHUT DOWN.

### 1. OPTIMAL START MODE - COOLING MODE

THE BAS SHALL INITIATE THE OPTIMAL START MODE SUCH THAT THE VAV ROOFTOP UNIT IS STARTED AND VAV BOXES SERVING THE VAV ARE ENABLED PRIOR TO WHEN THE SPACE BEING SERVED BY THE VAV IS SCHEDULED TO BE OCCUPIED, TO ALLOW THE ZONE TEMPERATURE TO REACH THE PENDING OCCUPIED HEATING OR COOLING SETPOINT. THE SYSTEM SHALL WAIT AS LONG AS POSSIBLE BEFORE STARTING, SO THAT THE TEMPERATURE IN EACH ZONE REACHES THE OCCUPIED SETPOINT IN TIME FOR SCHEDULED OCCUPANCY. OUTSIDE AIR DAMPER SHALL REMAIN CLOSED DURING OPTIMAL START. THE BAS SHALL USE A SELF-ADJUSTING ALGORITHM TO CALCULATE THE ACTUAL TIME TO INITIATE OPTIMAL START FOR THE VAV AIR SYSTEM BASED ON THE OCCUPIED SETPOINT, AVERAGE SPACE COOLING CORNER SPACES, EACH FLOOR, HISTORICAL DATA AND OPTIMAL START PERFORMANCE DATA AND THE ASSOCIATED HEATING OR COOLING OPTIMAL START RATE. AN EARLY START LIMIT SHALL BE PROVIDED TO PREVENT THE VAV FROM STARTING PRIOR TO 120 MINUTES (ADJ.) BEFORE SCHEDULED OCCUPANCY. THE VAV SHALL TRANSITION FROM THE OPTIMAL START TO OCCUPIED MODE WHEN THE CURRENT TIME IS EQUAL TO THE SCHEDULED START TIME.

### 2. OPTIMAL START - HEATING MODE

THE BAS SHALL INITIATE THE OPTIMAL START - HEATING MODE, RTU (GAS HEAT), WHEN OPTIMAL START MODE HAS BEEN INITIATED AND THE TEMPERATURE OF THE MORNING WARM UP ZONE IS COOLER THAN ITS OCCUPIED HEATING SETPOINT. RTU GAS HEATING SHALL BE ENERGIZED AND SHALL MODULATE AS REQUIRED TO WARM SPACE. RTU FAN SHALL BE STARTED AT LOW SPEED AND UNIT HEATING CYCLE SHALL BE CONTROLLED TO SATISFY SPACE SETPOINTS. WHEN STARTED TO MEET UNOCCUPIED SETPOINT, THE RTU SHALL OPERATE FOR A MINIMUM OF 20 MINUTES (ADJ.) OR AS REQUIRED TO SATISFY UNOCCUPIED SETPOINT AND SHALL NOT BE ALLOWED TO RESTART FOR A MINIMUM OF 10 MINUTES (ADJ.) FOLLOWING SATISFACTION OF UNOCCUPIED SETPOINT AND SYSTEM SHUT DOWN. WHEN RETURN AIR TEMP RISES ABOVE 70°F (ADJ.), THE GAS HEATING SECTION SHALL BE DE-ENERGIZED AND RTU SUPPLY SHALL BE DEENERGIZED UNTIL TIME OF SCHEDULED OCCUPANCY. WHEN OUTSIDE AIR IS CLOSED WHILE OPERATING IN OPTIMAL START HEATING MODE, THE BAS SHALL DETERMINE THE LENGTH OF TIME REQUIRED TO RAISE THE SPACE TEMPERATURE TO THE OCCUPIED HEATING SETPOINT WHEN THE MODE OF THE VAV IS HEATING AND THE SPACE TEMPERATURE IS BELOW THE SETPOINT. EACH VAV BOX IN THE VAV AIR SYSTEM WILL CONTROL TO ITS OCCUPIED HEATING SETPOINT, AND SHALL MODULATE BOX AIRFLOW TO MAINTAIN THE SPACE TEMPERATURE SETPOINT FOR THE ZONE BEING SERVED BY THE VAV BOX. THE LOCAL FAN IN THE VAV BOX IS ENABLED AS THE SECOND STAGE OF WARM-UP HEATING. REHEAT IN THE VAV BOX IS ENABLED AS THE THIRD (EMERGENCY) WARM-UP HEATING. RTU OA DAMPER CLOSED DURING WARM UP MODE.

### 3. OCCUPIED COOLING MODE

WHEN THE ROOFTOP UNITS TRANSITION FROM THE OPTIMAL START TO THE OCCUPIED MODE, ALL ROOFTOP UNIT FUNCTIONS SHALL BE ENABLED. VARIABLE AIR VOLUME SHALL OPERATE IN SUPPLY AIR TEMPERATURE CONTROL MODE. THE ROOFTOP UNITS SHALL DEFAULT TO THIS MODE IN THE EVENT THAT COMMUNICATION WITH THE BAS ARE LOST. DURING THE OCCUPIED COOLING MODE OF OPERATION, THE ECONOMIZER AND EXHAUST COOLING ARE USED TO CONTROL THE SUPPLY AIR TEMPERATURE. IF THE TEMPERATURE OF THE OUTSIDE AIR IS APPROPRIATE TO USE FREE COOLING, THE ECONOMIZER SHALL BE USED TO SATISFY THE SUPPLY AIR SETPOINT. IF MORE COOLING IS REQUIRED, THEN MODULATE TO MAINTAIN MIXED AIR ENTHALPY SETPOINT (ADJ.). IF MORE COOLING IS THEN REQUIRED, COMPRESSORS SHALL BE ENERGIZED ON/OFF. A MINIMUM ON/OFF TIME OF THE COMPRESSORS SHALL PREVENT RAPID CYCLING. THE CONDITIONS ALLOW ENABLING OF ECONOMIZER COOLING AFTER COMPRESSOR IS ON. THE ECONOMIZER DAMPER IS FORCED TO 100% OPEN UNTIL ALL CONDITIONS ARE MET. WHEN OPERATING IN COOLING OR CHANGED TO DISABLE ECONOMIZER COOLING. THE ECONOMIZER DAMPER IS ACTIVATED PRIOR TO MECHANICAL COOLING. COMPRESSOR ACTIVATION IS PROHIBITED UNTIL ECONOMIZER DAMPER REACHES 100% OPEN. WHEN THE DAMPER IS 100% OPEN, THE ECONOMIZER DAMPER IS CHANGED TO CONTROL TO ITS LOCAL OCCUPIED SETPOINTS.

### 4. SUPPLY AIR TEMPERATURE RESET

ABOVE 70°F COOLING TEMPERATURE, VAV SUPPLY AIR TEMPERATURE SHALL BE 55°F (ADJ.). BELOW 65°F COOLING TEMPERATURE, VAV SUPPLY AIR TEMPERATURE SHALL BE 65°F (ADJ.). SUPPLY AIR TEMPERATURE SHALL VARY LINEARLY BETWEEN THE HIGH AND LOW TEMPERATURES.

### 5. STATIC PRESSURE OPTIMIZATION

THE BUILDING AUTOMATION SYSTEM (BAS) SHALL CONTINUOUSLY MONITOR THE DAMPER POSITION OF ALL VAV TERMINAL UNITS. THE DISCHARGE DUCT STATIC PRESSURE SHALL BE SENSED DIRECTLY AT THE DISCHARGE OF EACH ROOFTOP UNIT. THE SENSOR MUST BE MOUNTED IN A NON-TURBULENT LOCATION. THE BAS SHALL ALSO READ THE STATUS ON THE SUPPLY AIR SENSOR AND DISPLAY THE PRESSURE READING ON THE STATUS SCREEN. THE BUILDING AUTOMATION SYSTEM SHALL MONITOR THE DAMPER POSITION OF ALL VAV TERMINAL UNITS AND DETERMINE EACH VAV RTU'S CRITICAL ZONE VAV TERMINAL (CZ), WHICH IS THE VAV TERMINAL UNIT THAT IS THE MOST OPEN. WHEN ANY VAV DAMPER IS MORE THAN 85% (ADJ.) OPEN, THE SUPPLY FAN DISCHARGE DUCT STATIC PRESSURE SETPOINT SHALL BE RESET UPWARD BY 0.1 IN W.C. (ADJ.), AT A FREQUENCY OF 15 MINUTES (ADJ.). UNTIL NO DAMPER IS MORE THAN 85% OPEN OR THE STATIC PRESSURE SETPOINT HAS RESET UPWARD TO THE SYSTEM MAXIMUM DUCT STATIC PRESSURE SETPOINT OR THE RTU VARIABLE-FREQUENCY DRIVE IS AT THE MAXIMUM SPEED SETTING. WHEN ALL VAV DAMPERS ARE LESS THAN 65% (ADJ.) OPEN, THE SUPPLY FAN DISCHARGE DUCT STATIC PRESSURE SETPOINT SHALL BE RESET DOWNWARD BY 0.1 IN W.C. (ADJ.), AT A FREQUENCY OF 15 MINUTES (ADJ.), UNTIL AT LEAST ONE DAMPER IS MORE THAN 65% OPEN OR THE STATIC PRESSURE SETPOINT HAS RESET DOWNWARD TO THE SYSTEM MINIMUM DUCT STATIC PRESSURE SETPOINT OR THE RTU VARIABLE-FREQUENCY DRIVE IS AT THE MINIMUM SPEED SETTING. THE BAS SHALL HAVE THE CAPABILITY TO ALLOW THE OPERATOR TO EXCLUDE "PROBLEM" ZONES THAT SHOULD NOT BE CONSIDERED WHEN DETERMINING THE OPTIMIZED SETPOINT. THE BAS SHALL HAVE THE ABILITY TO IDENTIFY, AND DISPLAY TO THE USER, THE VAV BOX THAT SERVES THE CRITICAL ZONE (THAT IS, THE ZONE WITH THE MOST WIDE-OPEN VAV DAMPER). THIS INFORMATION SHALL UPDATE DYNAMICALLY AS THE LOCATION OF THE CRITICAL ZONE CHANGES BASED ON BUILDING LOAD, AND DUCT STATIC PRESSURE SETPOINT OPTIMIZATION CONTROL. VAV BOXES IN CALIBRATION OR AUTO COMMISSIONING MODE SHALL NOT IMPACT THE CRITICAL ZONE CALCULATION. THE CONTROL BANDS, SETPOINT INCREMENT VALUES, SETPOINT DECREMENT VALUES AND ADJUSTMENT FREQUENCIES SHALL BE ADJUSTED TO MAINTAIN MAXIMUM STATIC PRESSURE OPTIMIZATION WITH STABLE SYSTEM CONTROL AND MAXIMUM COMFORT CONTROL.

### 6. TIMED OVERRIDE MODE

TIME OVERRIDE FROM SPACE SENSOR IS ENABLED OR DISABLE BY THE BAS END USER OPERATOR. IF ENABLED, UPON THE RECEIPT OF A TIMED OVERRIDE REQUEST FROM A ZONE SENSOR, THE BAS SHALL INITIATE THE NORMAL START MODE FOR THE VAV AIR SYSTEM. THE VAS SHALL REMAIN OCCUPIED UNTIL THE TIMED OVERRIDE PERIOD HAS EXPIRED, 120 MINUTES (ADJ.), OR WHEN A CANCEL COMMAND HAS BEEN RECEIVED FROM A ZONE SENSOR. THE VAS SHALL ENABLE VENTILATION FUNCTIONS FOR THE ASSOCIATED RTU AND VAV BOXES. UPON TRANSITION OUT OF TIMED OVERRIDE MODE, THE BAS SHALL RELINQUISH THE OVERRIDE ON THE VAV AIR SYSTEM AND ITS INDIVIDUAL COMPONENTS.

### 7. OFF/STANDBY MODE

THE BAS SHALL PLACE THE MEMBERS OF THE VAV AIR SYSTEM INTO OFF/STANDBY MODE AS DETERMINED BY THE USER-ADJUSTABLE TIME-OF-DAY SCHEDULE FOR THE SYSTEM. THE VAV BOXES SHALL CONTROL TO THEIR INDIVIDUAL UNOCCUPIED TEMPERATURE SETPOINTS, AND ALL VENTILATION FUNCTIONS SHALL BE DISABLED. VAV BOX LOCAL REHEAT IS DISABLED WHILE THE VAV IS IN UNOCCUPIED MODE. AFTER THE VAV BOXES HAVE BEEN COMMANDED TO UNOCCUPIED, THE VAV SHALL COMMAND THE ASSOCIATED RTU TO UNOCCUPIED MODE. SUPPLY FAN SHALL BE SHUT DOWN, HEATING AND COOLING SHALL BE DISABLED. OUTDOOR AIR DAMPER SHALL BE CLOSED, AND ALL VENTILATION FUNCTIONS SHALL BE DISABLED.

### 8. NIGHT HEAT/COOL MODE

DURING SCHEDULED UNOCCUPIED HOURS, THE VAV AIR SYSTEM SHALL BE CONTROLLED BY THE BAS TO MAINTAIN THE UNOCCUPIED HEATING AND COOLING SETPOINTS, AS APPROPRIATE. VENTILATION FUNCTIONS ARE DISABLED. THE OUTDOOR AIR DAMPER SHALL REMAIN CLOSED, UNLESS OUTDOOR AIR IS USED FOR ECONOMIZING DURING UNOCCUPIED MODE. CYCLING ON ONLY WHEN HEATING OR COOLING IS NEEDED.

A. NIGHT SETUP COOLING MODE: THE BAS SHALL INITIATE THE NIGHT COOLING MODE WHEN THE SPACE TEMPERATURE FOR THE SPACE BEING SERVED BY THE VAV EXCEEDS 85 DEG F (ADJ.). NIGHT COOLING WILL TERMINATE WHEN THE SPACE TEMPERATURE FALLS BELOW THE UNOCCUPIED COOLING SETPOINT MINUS THE UNOCCUPIED COOLING DIFFERENTIAL (4 DEG F, ADJ.). EACH VAV BOX THAT IS ASSOCIATED WITH THE VAV SHALL CONTROL TO ITS OCCUPIED COOLING SETPOINT, AND SHALL MODULATE BOX AIRFLOW TO MEET THE AIRFLOW REQUIREMENTS TO COOL THE SPACE TO THE UNOCCUPIED COOLING SETPOINT MINUS THE UNOCCUPIED COOLING DIFFERENTIAL. THE ROOFTOP UNIT SHALL MODULATE ITS AIRFLOW TO MAINTAIN THE DUCT STATIC PRESSURE SETPOINT.

B. NIGHT SETBACK HEATING MODE: VAV BOX FAN AND LOCAL REHEAT SHALL BE ENERGIZED WHERE THE SPACE TEMPERATURE FOR THE SPACE BEING SERVED BY THE VAV IS LESS THAN 60 DEG F. (ADJ.). NIGHT HEATING WILL TERMINATE WHEN THE SPACE TEMPERATURE RISES ABOVE THE UNOCCUPIED HEATING SETPOINT PLUS THE UNOCCUPIED HEATING DIFFERENTIAL (4 DEG F, ADJ.).

### 9. SPACE PRESSURE CONTROL OF INTERNAL RELIEF FAN

RELIEF FAN SHALL BE INTERLOCKED TO RUN WITH SUPPLY FAN AND SHALL MODULATE THE EXHAUST DAMPERS TO MAINTAIN A SLIGHTLY POSITIVE ROOM STATIC PRESSURE. SPACE PRESSURE SENSOR SHALL MONITOR TO THE RTU AND SHALL MODULATE RELIEF FAN VFD AND EXHAUST DAMPER TO MAINTAIN .05 IN OF H2O (ADJ.) REFERENCE POINT OF SPACE TEMPERATURE. RELIEF FAN SHALL NOT BE ALLOWED TO OPERATE WHEN EXHAUST DAMPER AND SUPPLY DUCT PRESSURE. SETPOINT SHALL BE ADJUSTABLE. BUILDING SPACE PRESSURE CONTROL SHALL BE DISABLED DURING UNOCCUPIED AND MORNING WARM UP PERIOD. A SPACE PRESSURE SENSOR SHALL BE PROVIDED FOR EACH RTU (TYPICAL OF 3) AND SHALL MODULATE TO MAINTAIN A MINIMUM ROOM STATIC PRESSURE (ADJ.) RELATIVE TO AMBIENT. THE BAS SHALL MONITOR EACH VAV PRESSURIZATION CONTROL OF ITS ASSOCIATED RETURN AIR FAN AND SHALL OVER-RIDE AN INDIVIDUAL RELIEF FAN OPERATION. 10. VAV STATUS REPORT RTU

THE BAS SHALL PROVIDE AN OPERATING STATUS SUMMARY OF THE FOLLOWING INFORMATION TO PROVIDE THE OPERATOR WITH CRITICAL ROOFTOP OPERATING DATA.

1. UNIT MAKE AND SIZE
2. OPERATING MODE
3. ACTIVE ROOM DIAGNOSTICS
4. ACTIVE COOLING MODE
5. ACTIVE COOLING/SUPPLY AIR SETPOINT
6. SUPPLY AIR TEMPERATURE
7. SUPPLY AIR PRESSURE
8. SUPPLY FAN STATUS
9. SUPPLY FAN PERCENT MODULATION
10. EXHAUST FAN STATUS
11. EXHAUST FAN PERCENT MODULATION
12. ACTIVE SPACE PRESSURE
13. ACTIVE SUPPLY AIR PRESSURE
14. COMPRESSOR ON/OFF STATUS
15. ECONOMIZER STATUS
16. ECONOMIZER POSITION - PERCENT
17. CO2 MONITORING (INDOOR VS. OUTDOOR)

### 11. DIAGNOSTICS UNIT STATUS REPORT RTU

THE BAS SYSTEM SHALL BE ABLE TO ALARM FROM ALL SENSED POINTS FROM THE ROOFTOP UNITS AND DIAGNOSTIC ALARMS SENSED BY THE UNIT CONTROLLER. ALARM LIMITS SHALL BE DESIGNATED FOR ALL SENSED POINTS.

#### 1. INDIVIDUAL ROOFTOP DIAGNOSTIC AND ALARM STATUSES SHALL INCLUDE THE FOLLOWING LATCHING ITEMS FOR EACH ROOFTOP UNIT:

- A. SUPPLY FAN FAILURE
- B. EXHAUST FAN FAILURE
- C. COMPRESSOR TRIP (EACH CIRCUIT)
- D. COMPRESSOR CONTACTOR FAIL (EACH CIRCUIT)

#### 2. INDIVIDUAL ROOFTOP DIAGNOSTIC AND ALARM STATUSES SHALL INCLUDE THE FOLLOWING NON-LATCHING ITEMS FOR EACH ROOFTOP UNIT:

- A. ZONE TEMPERATURE SENSOR FAILURE
- B. SUPPLY AIR TEMPERATURE SENSOR FAILURE
- C. DISCHARGE TEMPERATURE SENSOR FAILURE
- D. OUTDOOR AIR TEMPERATURE SENSOR FAILURE
- E. OCCUPIED ZONE COOL/HEAT SETPOINT FAILURE
- F. SUPPLY AIR PRESSURE SENSOR FAILURE
- G. OUTDOOR AIR HUMIDITY SENSOR FAILURE
- H. EVAPORATOR TEMPERATURE SENSOR FAILURE (EACH CIRCUIT)
- I. CONDENSER TEMPERATURE SENSOR FAILURE (EACH CIRCUIT)
- J. MORNING WARM-UP ZONE SENSOR FAIL
- K. UNOCCUPIED ZONE COOL/HEAT SETPOINT FAILURE
- L. SUPPLY AIR PRESSURE SETPOINT FAILURE
- M. SPACE STATIC PRESSURE SETPOINT FAILURE
- N. SPACE PRESSURE SENSOR FAILURE
- O. AUTO SUPPLY AIR STATIC PRESSURE LIMIT
- P. UNIT COMMUNICATIONS LOSS
- Q. NIGHT SETBACK PANEL COMMUNICATIONS FAILURE
- R. SUPPLY AIR TEMPERATURE COOL/HEAT SETPOINT FAIL
- S. NIGHT SETBACK ZONE TEMPERATURE SENSOR FAIL

### 12. HUMIDITY CONTROL (ALL RTU'S)

RTU AND VAV SHALL PROVIDE HUMIDITY CONTROL WHILE IN THE OCCUPIED OR UNOCCUPIED MODE. HUMIDITY SENSOR (SEE FLOOR PLANS FOR LOCATIONS) SHALL PLACE RTU IN THE DEHUMIDIFICATION MODE WHEN THE SPACE RH RISES ABOVE 60% IN EITHER THE OCCUPIED OR UNOCCUPIED MODE. HUMIDITY CONTROL SEQUENCE SHALL BE ENERGIZED THROUGH THE BAS. ALL REFRIGERATION CIRCUITS SHALL PROVIDE 100% COOLING AT MINIMUM AIRFLOW. WHEN SPACE HUMIDITY DROPS BELOW 55% F (ADJ.), BAS SHALL DEACTIVATE HUMIDITY CONTROL SEQUENCE. CONTROL OF RTU SHALL REVERT TO NORMAL OPERATION. IF SPACE HUMIDITY REACHES 65% RELATIVE HUMIDITY (ADJ.), AN ALARM SHALL BE SENT TO CENTRAL BAS.

### C. FAN POWERED VAV BOXES

1. OCCUPANCY - THE OCCUPANCY MODE CAN BE COMMUNICATED OR HARDWIRED TO THE VAV VIA A BINARY INPUT. VALID OCCUPANCY MODES FOR THE VAV SHALL BE:

OCCUPIED: NORMAL OPERATING MODE FOR OCCUPIED SPACES OR DAYTIME OPERATION. WHEN THE UNIT IS IN THE OCCUPIED MODE THE VAV SHALL MAINTAIN THE SPACE TEMPERATURE AT THE ACTIVE OCCUPIED HEATING OR COOLING SETPOINT. APPLICABLE VENTILATION AND AIRFLOW SETPOINTS SHALL BE ENFORCED. THE UNOCCUPIED MODE SHALL BE THE DEFAULT MODE OF THE VAV. UNOCCUPIED: NORMAL OPERATING MODE FOR UNOCCUPIED SPACES OR NIGHTTIME OPERATION. WHEN THE UNIT IS IN UNOCCUPIED MODE THE VAV SHALL MAINTAIN THE SPACE TEMPERATURE AT THE STORED UNOCCUPIED HEATING OR COOLING SETPOINT REGARDLESS OF THE PRESENCE OF A HARDWIRED OR COMMUNICATED SETPOINT. WHEN THE SPACE TEMPERATURE EXCEEDS THE ACTIVE UNOCCUPIED SETPOINT THE VAV SHALL MODULATE FULLY CLOSED.

2. COOLING OPERATION - WHEN THE UNIT IS IN COOLING MODE, THE VAV SHALL MAINTAIN THE SPACE TEMPERATURE AT THE ACTIVE COOLING SETPOINT BY MODULATING THE AIRFLOW BETWEEN THE ACTIVE COOLING MINIMUM AIRFLOW SETPOINT TO THE MAXIMUM COOLING AIRFLOW SETPOINT. BASED ON THE VAV OCCUPANCY MODE, THE ACTIVE COOLING SETPOINT SHALL BE ONE OF THE FOLLOWING:

SETPOINT	DEFAULT VALUE (ADJ.)
OCCUPIED COOLING SETPOINT	74°F
UNOCCUPIED COOLING SETPOINT	85°F
OCCUPIED STANDBY COOLING SETPOINT	85°F
SHELL SPACE COOLING SETPOINT	80°F
OCCUPIED MIN COOLING AIRFLOW SETPOINT	SEE VAV SCHEDULE
OCCUPIED MAX COOLING AIRFLOW SETPOINT	SEE VAV SCHEDULE

3. HEATING OPERATION - WHEN THE UNIT IS IN HEATING MODE, THE BAS SHALL MAINTAIN THE SPACE TEMPERATURE AT THE ACTIVE HEATING SETPOINT. THE BAS SHALL MAINTAIN THE MINIMUM HEATING SETPOINT AND ENERGY EFFICIENT ELECTRIC REHEAT IN STAGES. BASED ON THE VAV OCCUPANCY MODE, THE ACTIVE HEATING SETPOINT SHALL BE ONE OF THE FOLLOWING:

SETPOINT	DEFAULT VALUE (ADJ.)
OCCUPIED HEATING SETPOINT	70°F
UNOCCUPIED HEATING SETPOINT	80°F
SHELL SPACE HEATING SETPOINT	80°F
OCCUPIED STANDBY HEATING SETPOINT	87°F
OCCUPIED MIN HEATING AIRFLOW SETPOINT	SEE VAV SCHEDULE

PARALLEL FAN CONTROL SHALL BE FIRST STAGE OF HEATING. AS SPACE TEMPERATURE CONTINUES TO DECREASE, ELECTRIC REHEAT SHALL ENERGIZE IN STAGES.

REHEAT CONTROL: REHEAT SHALL ONLY BE ALLOWED WHEN THE PRIMARY AIR TEMPERATURE IS 3°F BELOW THE CONFIGURED REHEAT ENABLE SETPOINT. [70°F] OPERATOR CONFIGURABLE. THE REHEAT WILL BE ENABLED WHEN THE SPACE TEMPERATURE DROPS BELOW THE ACTIVE COOLING SETPOINT AND THE AIRFLOW IS IN THE MINIMUM COOLING AIRFLOW SETPOINT. DURING REHEAT THE VAV SHALL OPERATE AT ITS MINIMUM HEATING AIRFLOW SETPOINT AND ENERGIZE THE ELECTRIC REHEAT IN STAGES. DURING MORNING WARM UP, VAV BOX SHALL USE BOX ELECTRIC REHEAT TO MAINTAIN SPACE TEMPERATURE.

THE BUILDING AUTOMATION SYSTEM SHALL PROVIDE THE ABILITY TO AUTOMATICALLY COMMISSION AND CALIBRATE THE VAV AIR SYSTEM. THE FOLLOWING TESTS SHALL BE PERFORMED. AT A MINIMUM, CALIBRATION OF THE AIR VALVE / DAMPER, VERIFICATION OF AIR FLOW THROUGH THE VAV BOX. VERIFICATION OF LOCAL REHEAT PERFORMANCE FOR MULTIPLE STAGES OF ELECTRIC REHEAT.

THE BUILDING AUTOMATION SYSTEM (BAS) SHALL PROVIDE THE ABILITY TO INITIATE THE AUTO-COMMISSIONING /AUTO-CALIBRATION COMMAND DIRECTLY FROM THE USER INTERFACE. SPECIAL SERVICE TOOLS SHALL NOT BE REQUIRED.

THE BAS SHALL PROVIDE THE ABILITY TO STAGGER THE AUTO-COMMISSIONING /AUTO-CALIBRATION SEQUENCE FOR GROUPS OF VAV BOXES TO ALLOW THE SEQUENCE TO BE PERFORMED DURING OCCUPIED HOURS, IF NECESSARY.

#### 4. AUTO-COMMISSION OF VAV BOXES. THE VAV BOXES SHALL ALLOW THE OPERATOR TO PERFORM ON AN INDIVIDUAL OR GROUP BASIS AUTO-COMMISSIONING REPORT FOR THE VAV AIR SYSTEM WHICH CONTAINS THE RESULTS OF THE

AUTO-COMMISSIONING / AUTO-CALIBRATION TESTS WHICH IS PRINTABLE AND REMAIN IN MEMORY UNTIL THE NEXT AUTO-COMMISSIONING TEST IS INITIATED. THIS REPORT SHALL CONTAIN, AT A MINIMUM, THE FOLLOWING INFORMATION FOR EACH VAV BOX IN THE SYSTEM: NAME OF VAV BOX, DATE AND TIME THE VAV BOX WAS TESTED, PRESENCE OF ANY ALARMS, SPACE TEMPERATURE AND SETPOINT, ACTIVE AIRFLOW (IN CFM), AIR VALVE / DAMPER POSITION WHEN THE VAV BOX REACHES 25% OF THE MAXIMUM COOLING AIRFLOW SETPOINT, AIR VALVE / DAMPER POSITION WHEN THE VAV BOX REACHES 100% OF THE MAXIMUM COOLING AIRFLOW SETPOINT, DISCHARGE AIR TEMPERATURE OF THE VAV BOX WHEN THE VAV LOCAL FAN IS OFF, DISCHARGE AIR TEMPERATURE OF THE VAV BOX WHEN THE VAV LOCAL FAN IS ON, DISCHARGE AIR TEMPERATURE OF THE VAV BOX WHEN THE HOT HEAT IS ACTIVE.

#### D. EXHAUST FANS

ALL FANS SHALL BE STARTED AND STOPPED ON A PROGRAMMED BASIS (ADJ.) BY THE BAS BASED ON BUILDING OCCUPANCY. ALL FANS SHALL HAVE STATUS AND OVER-RIDE CAPABILITY FROM THE BAS.

#### E. THERMOSTATS & TEMPERATURE SENSORS

THERMOSTATS SHALL BE PROVIDED WHERE INDICATED ON THE DRAWINGS AND PER THE SPECIFICATIONS. ALL THERMOSTATS (EXCEPT DUCTLESS SPLIT SYSTEMS) SHALL BE FURNISHED AND INSTALLED BY THE BAS CONTRACTOR. THERMOSTATS SHALL HAVE MANUAL ADJUSTMENT AND SYSTEM OVERRIDE CAPABILITY. COORDINATE ALL FINAL SETPOINTS, SETBACK SCHEDULE, MORNING WARM-UP, COOL-DOWN, ETC WITH OWNER DURING OWNER TRAINING (SEE SPECIFICATIONS FOR OWNER TRAINING REQUIREMENTS). THERMOSTATS SHALL BE RESET AFTER 3 HOUR (ADJ.) TIME DELAY IN ORDER TO MINIMIZE CRITICAL ZONES. THERMOSTATS SHALL PROVIDE A DEADBAND OF 5° (ADJ.) WITHIN WHICH THE SUPPLY OF HEATING OR COOLING ENERGY TO THE ZONE CAN BE REDUCED TO THE MINIMUM. ALL OCCUPANCY SETPOINTS AND TEMPERATURE SETTINGS SHALL BE VERIFIED BY THE OWNER PRIOR TO FINAL PROGRAMMING. THERMOSTAT PROGRAMMING AND SCHEDULES SHALL BE PROGRAMMED IN THE PRESENCE OF THE OWNER AND THE COMMISSIONING AGENT PRIOR TO PROJECT COMPLETION.

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REVISIONS

NO.	DESCRIPTION	DATE

PROJECT: 1342  
DATE: 11/11/16  
DRAWN BY: ECC  
CHECKED BY: GPK

**MECHANICAL  
SEQUENCE  
OF  
OPERATION**

M2.1

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OPTIMA # 16-0194

Order Plans