

CONTROL POINTS

NUMBER	TAG	DESCRIPTION	DISPLAY ON GRAPHIC	ALARM	REMARKS
PACKAGED ROOFTOP UNIT - SINGLE ZONE					
01	AV	OUTDOOR AIR HUMIDITY	■		GLOBAL (INCLUDE ENTHALPY BASED ON T4H)
02	AV	OUTDOOR AIR TEMPERATURE	■		GLOBAL
03	AV	BUILDING STATIC PRESSURE (IF PRESENT)	■		BACNET DATA, UNITS WITH RELIEF FANS
04	AV	BUILDING STATIC PRESSURE SETPOINT (IF PRESENT)	■		BACNET DATA, UNITS WITH RELIEF FANS
05	OS	OCCUPANCY SENSOR (IF PRESENT)	■		REFER TO ELECTRICAL LIGHTING PLANS
06	CO2	SPACE CARBON DIOXIDE (IF PRESENT)	■		REFER TO FLOOR PLANS FOR LOCATIONS
07	CO2	SPACE CARBON DIOXIDE SETPOINT (IF PRESENT)	■		BACNET DATA
08	HS	INDOOR AIR HUMIDITY	■		WEIGHTED AVERAGE OF ASSOCIATED SENSORS
09	HS	INDOOR AIR HUMIDITY SETPOINT	■		BACNET DATA
10	TS	INDOOR AIR TEMPERATURE	■		WEIGHTED AVERAGE OF ASSOCIATED SENSORS
11	TS	INDOOR TEMPERATURE SETPOINT	■		BACNET DATA
12	MV	OCCUPANCY MODE	■		BACNET DATA
13	MV	MORNING WARMUP STATUS (IF PRESENT)	■		BACNET DATA
14	MV	UNIT STATUS	■		BACNET DATA
15	AFM	OUTDOOR AIR FLOW	■		REFER TO EQUIPMENT SCHEDULES
16	AFM	OUTDOOR AIR FLOW DCV MINIMUM SETPOINT	■		BACNET DATA
17	AFM	OUTDOOR AIR FLOW DCV MAXIMUM SETPOINT	■		BACNET DATA
18	AV	RETURN AIR TEMPERATURE	■		BACNET DATA
19	AV	RETURN AIR HUMIDITY (IF PRESENT)	■		BACNET DATA
20	BV	RELIEF FAN ENABLE/DISABLE (IF PRESENT)	■		BACNET DATA
21	AV	RELIEF FAN SPEED CONTROL (IF PRESENT)	■		BACNET DATA
22	MV	RELIEF FAN STATUS (IF PRESENT)	■		BACNET DATA
23	MV	RELIEF FAN VFD FAULT STATUS (IF PRESENT)	■		BACNET DATA
24	AV	RETURN AIR DAMPER POSITION (IF PRESENT)	■		BACNET DATA
25	AV	OUTDOOR AIR DAMPER POSITION	■		BACNET DATA
26	AV	OUTDOOR AIR DAMPER MINIMUM POSITION SETPOINT	■		BACNET DATA
27	AV	ECONOMIZER ENABLE/DISABLE	■		BACNET DATA
28	AV	ECONOMIZER MINIMUM POSITION SETPOINT	■		BACNET DATA
29	MV	ECONOMIZER STATUS	■		BACNET DATA
30	BV	PRE-FILTER STATUS (IF PRESENT)	■		BACNET DATA
31	BV	FINAL FILTER STATUS	■		BACNET DATA
32	AV	MIXED AIR TEMPERATURE (IF PRESENT)	■		BACNET DATA
33	AV	DX COIL DISCHARGE AIR TEMPERATURE/SUCTION PRESSURE	■		BACNET DATA
34	AV	DX COIL DISCHARGE AIR TEMPERATURE SETPOINT	■		BACNET DATA
35	AFM	SUPPLY AIR FLOW	■		REFER TO EQUIPMENT SCHEDULES
36	AFM	SUPPLY AIR FLOW MINIMUM SETPOINT	■		BACNET DATA
37	AFM	SUPPLY AIR FLOW MAXIMUM SETPOINT	■		BACNET DATA
38	BV	SUPPLY FAN ENABLE/DISABLE (IF PRESENT)	■		BACNET DATA
39	AV	SUPPLY FAN SPEED CONTROL	■		BACNET DATA
40	MV	SUPPLY FAN STATUS (IF PRESENT)	■		BACNET DATA
41	MV	SUPPLY FAN VFD FAULT STATUS (IF PRESENT)	■		BACNET DATA
42	MV	GAS FIRED HX ENABLE/DISABLE	■		BACNET DATA
43	AV	GAS FIRED HX STAGING/MODULATION	■		BACNET DATA
44	MV	DX COOLING ENABLE/DISABLE	■		BACNET DATA
45	AV	DX COOLING STAGING/MODULATION	■		BACNET DATA
46	BV	HOT GAS REHEAT ENABLE/DISABLE (IF PRESENT)	■		BACNET DATA
47	AV	HOT GAS REHEAT MODULATION (IF PRESENT)	■		BACNET DATA
48	MV	DX HEATING ENABLE/DISABLE	■		BACNET DATA
49	AV	DX HEATING STAGING/MODULATION	■		BACNET DATA
50	AV	DISCHARGE AIR TEMPERATURE	■		BACNET DATA
51	AV	DISCHARGE AIR TEMPERATURE COOLING SETPOINT	■		BACNET DATA
52	AV	DISCHARGE AIR TEMPERATURE HEATING SETPOINT	■		BACNET DATA
53	ES	EMERGENCY SHUTDOWN RELAY	■		HARD WIRED SAFETY
54	MV	EMERGENCY OVERRIDE COMMAND	■		BACNET DATA

CONTROL POINTS

NUMBER	TAG	DESCRIPTION	DISPLAY ON GRAPHIC	ALARM	REMARKS
PACKAGED ROOFTOP UNIT - VARIABLE AIR VOLUME					
01	AV	OUTDOOR AIR HUMIDITY	■		GLOBAL (INCLUDE ENTHALPY BASED ON T4H)
02	AV	OUTDOOR AIR TEMPERATURE	■		GLOBAL
03	AV	BUILDING STATIC PRESSURE (IF PRESENT)	■		BACNET DATA, UNITS WITH RELIEF FANS
04	AV	BUILDING STATIC PRESSURE SETPOINT (IF PRESENT)	■		BACNET DATA, UNITS WITH RELIEF FANS
05	CO2	SPACE CARBON DIOXIDE (IF PRESENT)	■		HIGHEST OF ASSOCIATED ZONES
06	CO2	SPACE CARBON DIOXIDE SETPOINT (IF PRESENT)	■		BACNET DATA
07	HS	INDOOR AIR HUMIDITY	■		HIGHEST OF ASSOCIATED ZONES
08	HS	INDOOR AIR HUMIDITY SETPOINT	■		BACNET DATA
09	TS	ZONE COOLING DEMAND	■		WEIGHTED AVERAGE OF ASSOCIATED SENSORS
10	TS	ZONE HEATING DEMAND	■		WEIGHTED AVERAGE OF ASSOCIATED SENSORS
11	MV	OCCUPANCY MODE	■		BACNET DATA
12	MV	MORNING WARMUP STATUS (IF PRESENT)	■		BACNET DATA
13	MV	UNIT STATUS	■		BACNET DATA
14	AFM	OUTDOOR AIR FLOW	■		REFER TO EQUIPMENT SCHEDULES
15	AFM	OUTDOOR AIR FLOW DCV MINIMUM SETPOINT	■		BACNET DATA
16	AFM	OUTDOOR AIR FLOW DCV MAXIMUM SETPOINT	■		BACNET DATA
17	AV	RETURN AIR TEMPERATURE	■		BACNET DATA
18	AV	RETURN AIR HUMIDITY	■		BACNET DATA
19	AV	RETURN AIR HUMIDITY SETPOINT	■		BACNET DATA
20	BV	RELIEF FAN ENABLE/DISABLE (IF PRESENT)	■		BACNET DATA
21	AV	RELIEF FAN SPEED CONTROL (IF PRESENT)	■		BACNET DATA
22	MV	RELIEF FAN STATUS (IF PRESENT)	■		BACNET DATA
23	MV	RELIEF FAN VFD FAULT STATUS (IF PRESENT)	■		BACNET DATA
24	AV	RETURN AIR DAMPER POSITION (IF PRESENT)	■		BACNET DATA
25	AV	OUTDOOR AIR DAMPER POSITION	■		BACNET DATA
26	AV	OUTDOOR AIR DAMPER MINIMUM POSITION SETPOINT	■		BACNET DATA
27	AV	ECONOMIZER ENABLE/DISABLE	■		BACNET DATA
28	AV	ECONOMIZER MINIMUM POSITION SETPOINT	■		BACNET DATA
29	MV	ECONOMIZER STATUS	■		BACNET DATA
30	BV	PRE-FILTER STATUS (IF PRESENT)	■		BACNET DATA
31	BV	FINAL FILTER STATUS	■		BACNET DATA
32	AV	MIXED AIR TEMPERATURE (IF PRESENT)	■		BACNET DATA
33	AV	DX COIL DISCHARGE AIR TEMPERATURE/SUCTION PRESSURE	■		BACNET DATA
34	AV	DX COIL DISCHARGE AIR TEMPERATURE SETPOINT	■		BACNET DATA
35	BV	SUPPLY FAN ENABLE/DISABLE (IF PRESENT)	■		BACNET DATA
36	AV	SUPPLY FAN SPEED CONTROL	■		BACNET DATA
37	MV	SUPPLY FAN STATUS (IF PRESENT)	■		BACNET DATA
38	MV	SUPPLY FAN VFD FAULT STATUS (IF PRESENT)	■		BACNET DATA
39	MV	GAS FIRED HX ENABLE/DISABLE	■		BACNET DATA
40	AV	GAS FIRED HX STAGING/MODULATION	■		BACNET DATA
41	MV	DX COOLING ENABLE/DISABLE	■		BACNET DATA
42	AV	DX COOLING STAGING/MODULATION	■		BACNET DATA
43	BV	HOT GAS REHEAT ENABLE/DISABLE (IF PRESENT)	■		BACNET DATA
44	AV	HOT GAS REHEAT MODULATION (IF PRESENT)	■		BACNET DATA
45	MV	DX HEATING ENABLE/DISABLE	■		BACNET DATA
46	AV	DX HEATING STAGING/MODULATION	■		BACNET DATA
47	AV	DISCHARGE AIR TEMPERATURE	■		BACNET DATA
48	AV	DISCHARGE AIR TEMPERATURE COOLING SETPOINT	■		BACNET DATA
49	AV	DISCHARGE AIR TEMPERATURE HEATING SETPOINT	■		BACNET DATA
50	AV	SUPPLY AIR STATIC PRESSURE	■		BACNET DATA, NOTE LOCATION ON AS-BUILTS
51	AV	SUPPLY AIR TEMPERATURE	■		BACNET DATA
52	ES	EMERGENCY SHUTDOWN RELAY	■		HARD WIRED SAFETY
53	MV	EMERGENCY OVERRIDE COMMAND	■		BACNET DATA

GENERAL CONDITIONS

- GENERAL NOTES:
- CONTROL CONTRACTOR SHALL PROVIDE ALL ASSOCIATED HARDWARE AND PROGRAMMING TO MEET THE FUNCTIONAL INTENT OF THE SEQUENCE OF OPERATIONS. POINT LISTS SHALL BE A GUIDE TO THE POINTS REQUIRED FOR CONTROL SYSTEMS. FINAL HARDWARE AND SOFTWARE POINTS, SHALL BE DETERMINED BY THAT REQUIRED OF THE SEQUENCE OF OPERATIONS. SET UP TRENDS FOR POINTS SCHEDULED, AND ALL FINAL POINTS SHALL BE TRENDALE.
 - CONTROL CONTRACTOR TO UPDATE POINTS LIST BASED ON FACTORY PROVIDED CONTROLS.
 - CONTROL CONTRACTOR SHALL HAVE EQUIPMENT ABLE TO RUN IN STAND-ALONE MODE WITH DEFAULT SETTINGS (ADJUSTABLE) UPON COMMUNICATION LOSS.

SEQUENCE OF OPERATIONS

- PACKAGED ROOFTOP UNIT - SINGLE ZONE CONTROLS (RTU-102A, RTU-102B):
- PROVIDE UNIT CONTROLS FOR SINGLE ZONE PACKAGED ROOFTOP UNIT SYSTEM
 - RUN CONDITIONS - SCHEDULED: THE UNIT SHALL RUN SUBJECT TO ITS OWN INTERNAL SAFETIES AND CONTROLS. THE UNIT SHALL RUN ACCORDING TO A USER DEFINABLE TIME SCHEDULE IN THE FOLLOWING MODES:
 - OCCUPIED MODE: THE UNIT SHALL MAINTAIN
 - A 75°F (ADJ.) COOLING SETPOINT.
 - A 70°F (ADJ.) HEATING SETPOINT.
 - A 50% (ADJ.) HUMIDITY SETPOINT.
 - A 800 FPM (ADJ.) CO2 SETPOINT.
 - STANDBY MODE: THE UNIT SHALL MAINTAIN
 - A 78°F (ADJ.) COOLING SETPOINT.
 - A 65°F (ADJ.) HEATING SETPOINT.
 - A 50% (ADJ.) HUMIDITY SETPOINT.
 - UNOCCUPIED MODE (NIGHT SETBACK): THE UNIT SHALL MAINTAIN
 - A 60°F (ADJ.) COOLING SETPOINT.
 - A 60°F (ADJ.) HEATING SETPOINT.
 - A 50% (ADJ.) HUMIDITY SETPOINT.
 - STARTSTOP: CONTROLLED DEVICES SHALL RESPOND AS FOLLOWS:
 - WHEN INDEXED TO STOP: DISABLE SUPPLY/RELIEF FANS SIMULTANEOUSLY, COOLING OFF, HEATING OFF, OUTDOOR DAMPER 100% CLOSED, RETURN AIR DAMPER 100% OPEN.
 - WHEN INDEXED TO START: ENABLE SUPPLY FAN FIRST, WITH OPERATION OF SYSTEM TO RESUME AFTER START-UP DELAY.
 - EMERGENCY SHUTDOWN: THE UNIT SHALL SHUT DOWN AND GENERATE AN ALARM UPON RECEIVING A SIGNAL FROM A FIELD INSTALLED EMERGENCY SHUTDOWN RELAY SIGNAL.
 - A2L REFRIGERANT DETECTION: THE FACTORY INSTALLED CONTROLLER SHALL MONITOR THE REFRIGERANT SYSTEM AND CLOSE THE OUTDOOR AIR DAMPERS, ENABLE THE SUPPLY FAN, DISABLE DX COOLING/HEATING, DISABLE GAS/ELECTRIC HEATING, AND GENERATE AN ALARM UPON DETECTION OF A2L REFRIGERANT. THE SUPPLY FAN SHALL RUN A MINIMUM OF 5 MINUTES AFTER NO A2L REFRIGERANT IS DETECTED.
 - SUPPLY/RETURN AIR SMOKE DETECTION: THE UNIT SHALL SHUT DOWN AND GENERATE AN ALARM UPON RECEIVING A SIGNAL FROM A FIELD INSTALLED SUPPLY OR RETURN AIR SMOKE DETECTOR STATUS.
 - ZONE SETPOINT ADJUST: THE OCCUPANT SHALL BE ABLE TO ADJUST THE ZONE TEMPERATURE HEATING AND COOLING SETPOINTS AT THE ZONE SENSOR. A ZONE SETPOINT ADJUST LOCKOUT ENABLE/DISABLE SHALL BE PROVIDED.
 - ZONE UNOCCUPIED OVERRIDE: THE FACTORY INSTALLED CONTROLLER SHALL ALLOW AN OCCUPANT TO OVERRIDE THE SCHEDULE AND PLACE THE UNIT INTO AN OCCUPIED MODE FOR AN ADJUSTABLE PERIOD OF TIME. AT THE EXPIRATION OF THIS TIME, CONTROL OF THE UNIT SHALL AUTOMATICALLY RETURN TO THE SCHEDULE. A ZONE UNOCCUPIED OVERRIDE LOCKOUT ENABLE/DISABLE SHALL BE PROVIDED.
 - ZONE STANDBY MODE (ZONES WITH OCCUPANCY SENSORS): THE UNIT CONTROLLER SHALL MONITOR THE OCCUPANCY STATUS OF THE ZONES LIGHTING SYSTEM OCCUPANCY SENSORS AND MAINTAIN STANDBY MODE. IF OCCUPANCY IS NOT SENSED AND SCHEDULING CALLS FOR OCCUPANCY, WHEN SCHEDULING CALLS FOR OCCUPANCY AND ZONE STANDBY MODE EXCEEDS AN ADJUSTABLE AMOUNT OF HOURS, PLACE ZONE INTO UNOCCUPIED MODE UNTIL NEXT COMMAND FOR OPTIMAL START OR ZONE UNOCCUPIED OVERRIDE IS ACTIVATED. USER ADJUSTABLE TIME DELAYS SHALL BE PROVIDED FOR ENABLING AND DISABLING ZONE STANDBY MODE BASED ON OCCUPANCY STATUS.
 - ZONE OPTIMAL START: THE UNIT CONTROLLER SHALL START THE UNIT PRIOR TO SCHEDULED OCCUPANCY BASED ON THE TIME NECESSARY FOR THE ZONES TO REACH THEIR OCCUPIED COOLING, HEATING, HUMIDITY, AND INDOOR AIR QUALITY SETPOINTS FOR BOTH COOLING AND HEATING OPERATION. THE START TIME SHALL AUTOMATICALLY ADJUST BASED ON CHANGES IN OUTSIDE AIR TEMPERATURE, ZONE TEMPERATURE, ZONE HUMIDITY, AND INDOOR AIR QUALITY.
 - SUPPLY FANS: THE SUPPLY FAN(S) SHALL RUN ANYTIME THE UNIT IS COMMANDED TO RUN BY THE FACTORY INSTALLED CONTROLLER, UNLESS SHUTDOWN ON SAFETIES. TO PREVENT SHORT CYCLING, THE SUPPLY FAN(S) SHALL HAVE A USER DEFINABLE (ADJ.) MINIMUM RUNTIME.
 - SUPPLY FANS) SPEED CONTROL: THE FACTORY INSTALLED CONTROLLER SHALL MONITOR THE ZONE TEMPERATURE AND MODULATE THE SUPPLY FANS) VFD/ECM SPEED BETWEEN THE AIRFLOWS SCHEDULED, MEASURED BY A FAN INLET AIR FLOW MEASURING STATION BASED ON A PID ALGORITHM AS THE SECOND STAGE, TO MAINTAIN ZONE COOLING, HEATING, AND INDOOR AIR QUALITY REQUIREMENTS. THE SUPPLY FANS) VFD/ECM SPEED SHALL NOT DROP BELOW A USER DEFINABLE (ADJ.) MINIMUM THROUGH ONE OF THE FOLLOWING:
 - WHEN ZONE TEMPERATURE IS GREATER THAN ITS COOLING SETPOINT PLUS DEAD BAND, THE SUPPLY FANS) VFD/ECM SPEED SHALL MODULATE BETWEEN THE MINIMUM COOLING AIRFLOW (ADJ.) AND THE MAXIMUM AIRFLOW (ADJ.) UNTIL THE ZONE IS SATISFIED.
 - WHEN ZONE TEMPERATURE IS BETWEEN THE COOLING SETPOINT AND THE HEATING SETPOINT, THE SUPPLY FANS) VFD/ECM SPEED SHALL MAINTAIN THE MINIMUM COOLING AIRFLOW (ADJ.).
 - WHEN ZONE TEMPERATURE IS LESS THAN ITS HEATING SETPOINT MINUS DEAD BAND, AND WARM AIR IS AVAILABLE FROM THE UNIT, THE SUPPLY FANS) VFD/ECM SPEED SHALL MODULATE BETWEEN THE MINIMUM HEATING AIRFLOW (ADJ.) AND THE MAXIMUM AIRFLOW (ADJ.) UNTIL THE ZONE IS SATISFIED.
 - UNOCCUPIED:
 - WHEN THE ZONE IS UNOCCUPIED THE SUPPLY FANS) VFD/ECM SPEED SHALL CONTROL TO ITS MINIMUM COOLING AIRFLOW (ADJ.) WITH THE SUPPLY FANS) BEING DISABLED.
 - WHEN ZONE TEMPERATURE IS GREATER THAN ITS UNOCCUPIED COOLING SETPOINT PLUS DEAD BAND, THE SUPPLY FANS) SHALL BE ENABLED AND THE SUPPLY FANS) VFD/ECM SPEED SHALL MODULATE BETWEEN THE MINIMUM COOLING AIRFLOW (ADJ.) AND THE MAXIMUM AIRFLOW (ADJ.) UNTIL THE ZONE IS SATISFIED.
 - WHEN ZONE TEMPERATURE IS LESS THAN ITS HEATING SETPOINT MINUS DEAD BAND, AND WARM AIR IS AVAILABLE FROM THE AIR HANDLING UNIT, THE SUPPLY FANS) SHALL BE ENABLED AND THE SUPPLY FANS) VFD/ECM SPEED SHALL MODULATE BETWEEN THE MINIMUM HEATING AIRFLOW (ADJ.) AND THE MAXIMUM AIRFLOW (ADJ.) UNTIL THE ZONE IS SATISFIED.
 - RELIEF FANS (IF PRESENT): THE RELIEF FANS) SHALL BE ENABLED BY THE UNIT CONTROLLER WHENEVER THE OUTDOOR AIR DAMPER IS COMMANDED OPEN BEYOND A USER DEFINABLE (ADJ.) SETPOINT AND CONTROLLED BASED ON BUILDING STATIC PRESSURE CONTROL TO PREVENT SHORT CYCLING, THE RELIEF FANS) SHALL HAVE A USER DEFINABLE (ADJ.) MINIMUM RUNTIME.
 - BUILDING STATIC PRESSURE CONTROL (IF PRESENT): THE FACTORY INSTALLED CONTROLLER SHALL MEASURE BUILDING STATIC PRESSURE AND MODULATE THE RELIEF FANS) SPEED TO MAINTAIN A POSITIVE (ADJ.) BUILDING STATIC PRESSURE SETPOINT IN-H2O. THE RELIEF FANS) VFD/ECM SPEED SHALL NOT DROP BELOW A USER DEFINABLE (ADJ.) MINIMUM SETPOINT.
 - DISCHARGE AIR TEMPERATURE SETPOINT - OPTIMIZED: THE UNIT CONTROLLER SHALL MONITOR THE DISCHARGE AIR TEMPERATURE AND SHALL MAINTAIN A DISCHARGE AIR TEMPERATURE SETPOINT RESET BASED ON A PID ALGORITHM TO MAINTAIN ZONE COOLING AND HEATING REQUIREMENTS. THE DISCHARGE AIR TEMPERATURE RESET PID ALGORITHM SHALL LIMIT DISCHARGE AIR TEMPERATURE RESET TO PREVENT DUCTWORK REACHING THE DEWPOINT TEMPERATURE OF THE SPACE.
 - DISCHARGE AIR TEMPERATURE SETPOINT FOR COOLING SHALL BE RESET AS FOLLOWS:
 - AS ZONE COOLING DEMAND INCREASES TO A MAXIMUM OF 100% (ADJ.), THE SETPOINT SHALL INCREMENTALLY RESET DOWN TO A (ADJ.) MINIMUM °F.
 - AS ZONE COOLING DEMAND DECREASES TO 0% (ADJ.), THE SETPOINT SHALL INCREMENTALLY RESET UP TO A (ADJ.) MAXIMUM °F.
 - DISCHARGE AIR TEMPERATURE SETPOINT FOR HEATING SHALL BE RESET AS FOLLOWS:
 - AS ZONE HEATING DEMAND INCREASES TO 100% (ADJ.), THE SETPOINT SHALL INCREMENTALLY RESET DOWN TO A (ADJ.) MINIMUM °F.
 - AS ZONE HEATING DEMAND DECREASES TO 0% (ADJ.), THE SETPOINT SHALL INCREMENTALLY RESET UP TO A (ADJ.) MAXIMUM °F.
 - THE MAXIMUM °F SHALL NOT EXCEED SCHEDULED VALUES TO MAINTAIN INDOOR AIR QUALITY REQUIREMENTS.
 - DX COOLING PRIMARY STAGE: THE FACTORY INSTALLED CONTROLLER SHALL MEASURE THE DISCHARGE AIR TEMPERATURE AND STAGE MODULATE UNITS WITH DIGITAL SCROLL/VARIABLE SPEED COMPRESSORS) THE COOLING TO MAINTAIN ITS COOLING DISCHARGE AIR SETPOINT AS THE PRIMARY STAGE. TO PREVENT SHORT CYCLING, THERE SHALL BE A DELAY BETWEEN STAGES, AND THE UNIT SHALL DE-ENERGIZE BELOW SETPOINT.
 - DX HEATING PRIMARY STAGE: THE FACTORY INSTALLED CONTROLLER SHALL MEASURE THE DISCHARGE AIR TEMPERATURE AND STAGE MODULATE UNITS WITH DIGITAL SCROLL/VARIABLE SPEED COMPRESSORS) THE HEATING TO MAINTAIN ITS HEATING DISCHARGE AIR SETPOINT AS THE PRIMARY STAGE. TO PREVENT SHORT CYCLING, THERE SHALL BE A DELAY BETWEEN STAGES, AND THE UNIT SHALL DE-ENERGIZE BELOW SETPOINT.
 - GAS HEATING SECONDARY STAGE: THE FACTORY INSTALLED CONTROLLER SHALL MEASURE THE DISCHARGE AIR TEMPERATURE AND STAGE MODULATE THE HEATING TO MAINTAIN ITS DISCHARGE AIR HEATING SETPOINT AS THE SECONDARY STAGE. TO PREVENT SHORT CYCLING, THERE SHALL BE A DELAY BETWEEN STAGES, AND EACH STAGE SHALL HAVE A MINIMUM RUNTIME. THE UNIT CONTROLLER SHALL CALCULATE LIQUID PROPANE MONTHLY USAGE BASED ON INPUT RATING, RUNTIME, AND MODULATION CAPACITY.
 - DEHUMIDIFICATION (IF PRESENT): THE FACTORY INSTALLED CONTROLLER SHALL MONITOR THE INDOOR HUMIDITY AND OVERRIDE THE COOLING SEQUENCE TO MAINTAIN INDOOR HUMIDITY AT OR BELOW SCHEDULED SETPOINTS. THE COOLING COIL DISCHARGE AIR TEMPERATURE SHALL BE 50°F (ADJ.), WHILE THE COMPRESSORS) AND RE-HEAT COIL VALVE ARE ENERGIZED/MODULATE, TO MAINTAIN THE COOLING COIL DISCHARGE AIR TEMPERATURE AND DISCHARGE AIR TEMPERATURE SETPOINT.
 - DEHUMIDIFICATION (IF PRESENT): THE FACTORY INSTALLED CONTROLLER SHALL MONITOR THE INDOOR HUMIDITY AND OVERRIDE THE COOLING SEQUENCE TO MAINTAIN INDOOR HUMIDITY AT OR BELOW SCHEDULED SETPOINTS. THE COOLING COIL DISCHARGE AIR TEMPERATURE SHALL BE 50°F (ADJ.), WHILE THE COMPRESSORS) AND RE-HEAT COIL VALVE ARE ENERGIZED/MODULATE, TO MAINTAIN THE COOLING COIL DISCHARGE AIR SETPOINT AND DISCHARGE AIR TEMPERATURE SETPOINT.

SEQUENCE OF OPERATIONS (CONT'D)

- PACKAGED ROOFTOP UNIT - SINGLE ZONE CONTROLS (CONT'D):
- EXTERNAL ECONOMIZER: THE FACTORY INSTALLED CONTROLLER SHALL MEASURE THE DISCHARGE AIR TEMPERATURE AND MODULATE THE ECONOMIZER DAMPERS IN SEQUENCE TO MAINTAIN A SETPOINT LESS THAN THE DISCHARGE AIR TEMPERATURE SETPOINT. THE OUTSIDE AIR DAMPERS SHALL MAINTAIN A MINIMUM ADJUSTABLE POSITION % (ADJ.) OPEN WHENEVER OCCUPIED.
 - THE ECONOMIZER SHALL BE ENABLED BY THE UNIT CONTROLLER WHENEVER:
 - THE OUTSIDE AIR TEMPERATURE IS LESS THAN THE RETURN AIR TEMPERATURE.
 - AND THE OUTSIDE AIR ENTHALPY IS LESS THAN THE RETURN AIR ENTHALPY.
 - AND INDOOR HUMIDITY IS LESS THAN THE RETURN AIR HUMIDITY.
 - AND INDOOR HUMIDITY IS GREATER THAN INDOOR HUMIDITY SETPOINT.
 - AND ZONE HEATING DEMAND IS NOT GREATER THAN 0% (ADJ.).
 - THE OUTSIDE AND RELIEF AIR DAMPERS SHALL CLOSE AND THE RETURN AIR DAMPER SHALL OPEN WHEN THE UNIT IS OFF. IF OPTIMAL START UP IS AVAILABLE, THE MIXED AIR DAMPER SHALL OPERATE AS DESCRIBED IN THE OCCUPIED MODE EXCEPT THAT THE OUTSIDE AIR DAMPER MINIMUM POSITION IS SET TO 0% (ADJ.).
 - MINIMUM OUTSIDE AIR VENTILATION CONTROL: THE FACTORY CONTROLLER SHALL MEASURE THE OUTSIDE AIRFLOW AND SPACE CO2 QUANTITY. RESET THE OUTDOOR AIR DAMPER POSITION TO MAINTAIN OUTDOOR AIRFLOW BETWEEN THE SCHEDULED MINIMUM DCV SETPOINT (ADJ.) AND MAXIMUM DCV SETPOINT (ADJ.), TO MAINTAIN CO2 LEVELS BELOW SETPOINT. DISCHARGE AIR TEMPERATURE SETPOINTS, AND ECONOMIZER CONTROL, SHALL TAKE PRIORITY OVER OUTDOOR AIR RESET.
 - PACKAGED ROOFTOP UNIT MONITORING: THE CONTROL POINTS SPECIFIED IN SPECIFICATION SECTIONS 23.7XX "CENTRAL HVAC EQUIPMENT" ARE CONTROLLED BY FACTORY INSTALLED CONTROLS WHICH SHALL BE INTEGRATED INTO THE BUILDING DDC SYSTEM.
 - ALARM SETPOINTS:
 - HIGH INDOOR HUMIDITY: IF THE INDOOR HUMIDITY IS GREATER THAN SETPOINT BY A USER DEFINABLE AMOUNT (ADJ.).
 - HIGH DISCHARGE AIR TEMP: IF THE DISCHARGE AIR TEMPERATURE IS GREATER THAN SETPOINT BY A USER DEFINABLE AMOUNT (ADJ.).
 - LOW DISCHARGE AIR TEMP: IF THE DISCHARGE AIR TEMPERATURE IS GREATER THAN SETPOINT BY A USER DEFINABLE AMOUNT (ADJ.).
 - HIGH COIL DISCHARGE AIR TEMP: IF THE DISCHARGE AIR TEMPERATURE OFF A COIL IS LESS THAN SETPOINT BY A USER DEFINABLE AMOUNT (ADJ.).
 - LOW COIL DISCHARGE AIR TEMP: IF THE DISCHARGE AIR TEMPERATURE OFF A COIL IS GREATER THAN SETPOINT BY A USER DEFINABLE AMOUNT (ADJ.).
 - HIGH COIL DISCHARGE AIR TEMP: IF THE DISCHARGE AIR TEMPERATURE OFF A COIL IS GREATER THAN SETPOINT BY A USER DEFINABLE AMOUNT (ADJ.).
 - HIGH MIXED AIR TEMP: IF THE MIXED AIR TEMPERATURE IS GREATER THAN SETPOINT BY A USER DEFINABLE AMOUNT (ADJ.).
 - HIGH SUPPLY AIR STATIC PRESSURE: IF THE SUPPLY AIR STATIC PRESSURE IS GREATER THAN SETPOINT BY A USER DEFINABLE AMOUNT (ADJ.).
 - LOW SUPPLY AIR STATIC PRESSURE: IF THE SUPPLY AIR STATIC PRESSURE IS LOWER THAN SETPOINT BY A USER DEFINABLE AMOUNT (ADJ.).

SEQUENCE OF OPERATIONS (CONT'D)

- PACKAGED ROOFTOP UNIT - VARIABLE AIR VOLUME CONTROLS (RTU-101):
- PROVIDE UNIT CONTROLS FOR VARIABLE AIR VOLUME PACKAGED ROOFTOP UNIT SYSTEM
 - RUN CONDITIONS - REQUESTED: THE UNIT SHALL RUN SUBJECT TO ITS OWN INTERNAL SAFETIES AND CONTROLS. THE UNIT SHALL RUN WHENEVER:
 - A DEFINABLE NUMBER OF AIR TERMINAL UNIT CONTROLLERS OR AREAS ARE OCCUPIED.
 - A DEFINABLE NUMBER OF UNOCCUPIED AIR TERMINAL UNIT CONTROLLERS OR AREAS NEED HEATING OR COOLING.
 - STARTSTOP: CONTROLLED DEVICES SHALL RESPOND AS FOLLOWS:
 - WHEN INDEXED TO STOP: DISH SUPPLY/RELIEF FANS SIMULTANEOUSLY, COOLING OFF, HEATING OFF, OUTDOOR DAMPER 100% CLOSED, RETURN AIR DAMPER 100% OPENED.
 - WHEN INDEXED TO START: ENABLE SUPPLY FAN FIRST, WITH OPERATION OF SYSTEM TO RESUME AFTER START-UP DELAY.
 - EMERGENCY SHUTDOWN: THE UNIT SHALL SHUT DOWN AND GENERATE AN ALARM UPON RECEIVING A SIGNAL FROM A FIELD INSTALLED EMERGENCY SHUTDOWN RELAY SIGNAL.
 - A2L REFRIGERANT DETECTION: THE FACTORY INSTALLED CONTROLLER SHALL MONITOR THE REFRIGERANT SYSTEM AND CLOSE THE OUTDOOR AIR DAMPERS, ENABLE THE SUPPLY FAN, DISABLE DX COOLING/HEATING, DISABLE GAS/ELECTRIC HEATING, AND GENERATE AN ALARM UPON DETECTION OF A2L REFRIGERANT. THE SUPPLY FAN SHALL RUN A MINIMUM OF 5 MINUTES AFTER NO A2L REFRIGERANT IS DETECTED.
 - SUPPLY/RETURN AIR SMOKE DETECTION: THE UNIT SHALL SHUT DOWN AND GENERATE AN ALARM UPON RECEIVING A SIGNAL FROM A FIELD INSTALLED SUPPLY OR RETURN AIR SMOKE DETECTOR STATUS.
 - ZONE OPTIMAL START: THE UNIT CONTROLLER SHALL START THE UNIT PRIOR TO SCHEDULED OCCUPANCY BASED ON THE TIME NECESSARY FOR THE ZONES TO REACH THEIR OCCUPIED COOLING, HEATING, HUMIDITY, AND INDOOR AIR QUALITY SETPOINTS FOR BOTH COOLING AND HEATING OPERATION. THE START TIME SHALL AUTOMATICALLY ADJUST BASED ON CHANGES IN OUTSIDE AIR TEMPERATURE, ZONE TEMPERATURE, ZONE HUMIDITY, AND INDOOR AIR QUALITY.
 - SUPPLY FANS: THE SUPPLY FAN(S) SHALL RUN ANYTIME THE UNIT IS COMMANDED TO RUN BY THE FACTORY INSTALLED CONTROLLER, UNLESS SHUTDOWN ON SAFETIES. TO PREVENT SHORT CYCLING, THE SUPPLY FAN(S) SHALL HAVE A USER DEFINABLE (ADJ.) MINIMUM RUNTIME.
 - SUPPLY FANS) SPEED CONTROL: THE FACTORY INSTALLED CONTROLLER SHALL MONITOR THE ZONE TEMPERATURE AND MODULATE THE SUPPLY FANS) VFD/ECM SPEED BETWEEN THE AIRFLOWS SCHEDULED, MEASURED BY A FAN INLET AIR FLOW MEASURING STATION BASED ON A PID ALGORITHM AS THE SECOND STAGE, TO MAINTAIN ZONE COOLING, HEATING, AND INDOOR AIR QUALITY REQUIREMENTS. THE SUPPLY FANS) VFD/ECM SPEED SHALL NOT DROP BELOW A USER DEFINABLE (ADJ.) MINIMUM THROUGH ONE OF THE FOLLOWING:
 - WHEN ZONE TEMPERATURE IS GREATER THAN ITS COOLING SETPOINT PLUS DEAD BAND, THE SUPPLY FANS) VFD/ECM SPEED SHALL MODULATE BETWEEN THE MINIMUM COOLING AIRFLOW (ADJ.) AND THE MAXIMUM AIRFLOW (ADJ.) UNTIL THE ZONE IS SATISFIED.
 - WHEN ZONE TEMPERATURE IS BETWEEN THE COOLING SETPOINT AND THE HEATING SETPOINT, THE SUPPLY FANS) VFD/ECM SPEED SHALL MAINTAIN THE MINIMUM COOLING AIRFLOW (ADJ.).
 - WHEN ZONE TEMPERATURE IS LESS THAN ITS HEATING SETPOINT MINUS DEAD BAND, AND WARM AIR IS AVAILABLE FROM THE UNIT, THE SUPPLY FANS) VFD/ECM SPEED SHALL MODULATE BETWEEN THE MINIMUM HEATING AIRFLOW (ADJ.) AND THE MAXIMUM AIRFLOW (ADJ.) UNTIL THE ZONE IS SATISFIED.
 - UNOCCUPIED:
 - WHEN THE ZONE IS UNOCCUPIED THE SUPPLY FANS) VFD/ECM SPEED SHALL CONTROL TO ITS MINIMUM COOLING AIRFLOW (ADJ.) WITH THE SUPPLY FANS) BEING DISABLED.
 - WHEN ZONE TEMPERATURE IS GREATER THAN ITS UNOCCUPIED COOLING SETPOINT PLUS DEAD BAND, THE SUPPLY FANS) SHALL BE ENABLED AND THE SUPPLY FANS) VFD/ECM SPEED SHALL MODULATE BETWEEN THE MINIMUM COOLING AIRFLOW (ADJ.) AND THE MAXIMUM AIRFLOW (ADJ.) UNTIL THE ZONE IS SATISFIED.
 - WHEN ZONE TEMPERATURE IS LESS THAN ITS HEATING SETPOINT MINUS DEAD BAND, AND WARM AIR IS AVAILABLE FROM THE AIR HANDLING UNIT, THE SUPPLY FANS) SHALL BE ENABLED AND THE SUPPLY FANS) VFD/ECM SPEED SHALL MODULATE BETWEEN THE MINIMUM HEATING AIRFLOW (ADJ.) AND THE MAXIMUM AIRFLOW (ADJ.) UNTIL THE ZONE IS SATISFIED.
 - RELIEF FANS (IF PRESENT): THE RELIEF FANS) SHALL BE ENABLED BY THE UNIT CONTROLLER WHENEVER THE OUTDOOR AIR DAMPER IS COMMANDED OPEN BEYOND A USER DEFINABLE (ADJ.) SETPOINT AND CONTROLLED BASED ON BUILDING STATIC PRESSURE CONTROL TO PREVENT SHORT CYCLING, THE RELIEF FANS) SHALL HAVE A USER DEFINABLE (ADJ.) MINIMUM RUNTIME.
 - BUILDING STATIC PRESSURE CONTROL (IF PRESENT): THE FACTORY INSTALLED CONTROLLER SHALL MEASURE BUILDING STATIC PRESSURE AND MODULATE THE RELIEF FANS) SPEED TO MAINTAIN A POSITIVE (ADJ.) BUILDING STATIC PRESSURE SETPOINT IN-H2O. THE RELIEF FANS) VFD/ECM SPEED SHALL NOT DROP BELOW A USER DEFINABLE (ADJ.) MINIMUM SETPOINT.
 - DISCHARGE AIR TEMPERATURE SETPOINT - OPTIMIZED: THE UNIT CONTROLLER SHALL MONITOR THE DISCHARGE AIR TEMPERATURE AND SHALL MAINTAIN A DISCHARGE AIR TEMPERATURE SETPOINT RESET BASED ON A PID ALGORITHM TO MAINTAIN ZONE COOLING AND HEATING REQUIREMENTS. THE DISCHARGE AIR TEMPERATURE RESET PID ALGORITHM SHALL LIMIT DISCHARGE AIR TEMPERATURE RESET TO PREVENT DUCTWORK REACHING THE DEWPOINT TEMPERATURE OF THE SPACE.
 - DISCHARGE AIR TEMPERATURE SETPOINT FOR COOLING SHALL BE RESET AS FOLLOWS:
 - AS ZONE COOLING DEMAND INCREASES TO A MAXIMUM OF 100% (ADJ.), THE SETPOINT SHALL INCREMENTALLY RESET DOWN TO A (ADJ.) MINIMUM °F.
 - AS ZONE COOLING DEMAND DECREASES TO 0% (ADJ.), THE SETPOINT SHALL INCREMENTALLY RESET UP TO A (ADJ.) MAXIMUM °F.
 - DISCHARGE AIR TEMPERATURE SETPOINT FOR HEATING SHALL BE RESET AS FOLLOWS:
 - AS ZONE HEATING DEMAND INCREASES TO 100% (ADJ.), THE SETPOINT SHALL INCREMENTALLY RESET DOWN TO A (ADJ.) MINIMUM °F.
 - AS ZONE HEATING DEMAND DECREASES TO 0% (ADJ.), THE SETPOINT SHALL INCREMENTALLY RESET UP TO A (ADJ.) MAXIMUM °F.
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