



TYPICAL PACKAGED ROOFTOP UNIT (RTU) CONTROL SCHEMATIC

NOT TO SCALE
NOTE: REFER TO PLANS FOR LOCATIONS OF MISCELLANEOUS SMOKE DAMPERS AT FLOOR, SHAFT AND DUCT LOCATIONS
SEE SHEET M-14 FOR ADDITIONAL REQUIREMENTS FOR OAU-1 AND OAU-2

PACKAGED ROOFTOP HEATING AND AIR CONDITIONING UNITS SEQUENCE OF OPERATION

Building Automation System Interface:
The Building Automation System (BAS) shall send the controller Occupied Bypass, Occupied Heat / Cool modes. If a BAS is not present, or communication is lost with the BAS the controller shall operate using default modes and setpoints. This facility operates 24/7/365.25. no unoccupied requirements are necessary

Occupied Mode:
During occupied periods, the supply fan shall run continuously and the outside air damper shall modulate to maintain the occupied space temperature setpoint. If economizing is enabled the outside air damper shall modulate to maintain the occupied space temperature setpoint.

Optimal Stop:
Not required. The system operates 24/7/365.25

Occupied Bypass:
Not required. The system operates 24/7/365.25

Cooling Mode:
The unit controller shall use the space temperature sensor and space temperature cooling setpoint to calculate the discharge air cooling setpoint and determine when to initiate requests for cooling. Discharge air setpoint shall be maintained by modulating the economizer or staging the DX cooling as required to maintain the discharge air setpoint. Once all economizing requirements have been met, compressor operation will be enabled if the economizer alone cannot meet the demand. Once compressor operation is started, the variable speed compressor will be modulated to maintain the discharge air temperature to the discharge air cooling setpoint. If the variable speed compressor reaches its maximum speed for stage one, there is additional demand for cooling, the controller will energize the first fixed speed compressor on circuit two. Once the first fixed speed compressor is energized, the variable speed compressor will be reduced to its minimum speed, then released back to discharge air temperature control. Additional stages will respond in the same manner. Once the active cooling demand has been satisfied, compressors will begin staging down in reverse order from the start-up sequence. Once the unit has staged down all fixed compressors, and there is no longer a demand for the variable speed compressor, the compressor will modulate down to its minimum speed and then will be de-energized, while adhering to all shutdown requirements.

Heating Mode:
The unit controller shall monitor space temperature and space temperature heating setpoint to determine when to initiate requests for heat. When the space temperature drops below the space temperature heating setpoint, the controller shall enable the modulating heat bank at high fire for 60 seconds. Then the controller shall modulate the heat bank to the necessary rate to satisfy the space temperature heating setpoint. The supply fan speed shall vary to meet zone heating requirements the heat bank output. Once the space temperature rises above the setpoint, the heating cycle shall be disabled.

Dehumidification:
Factory installed hot gas reheat shall allow application of dehumidification. Dehumidification shall be allowed only when the outside air temperature is above 40.0 deg. F and below 100.0 deg. F. The economizer outside air damper shall drive to minimum position during dehumidification.

Single compressor units:
On a call for dehumidification, the hot gas reheat coil valve shall energize and the compressor shall enable. When the humidity control setpoint is satisfied, the valve shall be de-energized and the compressor shall be disabled. If there is a call for cooling from the space temperature controller, while in reheat, the hot gas reheat coil valve shall be de-energized and the compressor continues to run.

Dual compressor units:
On a call for dehumidification, the hot gas reheat coil valve shall energize and both compressors shall enable. When the humidity control setpoint is satisfied, the valve shall be de-energized and both compressors shall be disabled. If there is a call for 1st stage cooling while in the dehumidification mode, no action shall take place. If there is a call for 2nd stage cooling, the reheat valve shall be de-energized, and the unit shall revert to the cooling mode. If 2nd stage cooling is satisfied and there is still a call for dehumidification, the hot gas reheat coil valve shall once again be energized.

Economizer Control / Comparative Enthalpy:
The supply air sensor shall measure the dry bulb temperature of the air leaving the evaporator coil while economizing. When economizing is enabled and the unit is operating in the cooling mode, the economizer shall modulate the damper to its minimum position and 100% to maintain the discharge temperature setpoint. Minimum position shall be calculated based on supply fan speed and supply air temperature starts to fall below supply air temperature setpoint, the outside air damper shall be at minimum position. Compressors shall be delayed from operating until the economizer has opened to 100% for 5 minutes.

Comparative Enthalpy:
Outside air enthalpy shall be compared with return air enthalpy point. The economizer shall be enabled when outdoor air enthalpy is less than return air enthalpy - 3.0 BTU/LB. The economizer shall be disabled when outdoor air enthalpy is greater than return air enthalpy.

Demand Control Ventilation (DCV) RTU-1 only:
As the supply fan speed command varies between minimum and maximum, the Building Design and DCV Minimum Position Targets shall be calculated linearly between the user selected setpoint based on the instantaneous supply fan speed. The Bldg. Design and DCV Minimum Position Targets will be used to calculate the Active OA Damper Minimum Position Target based on CO2 levels returned to the active Design and DCV CO2 setpoints.

The Design Minimum and DCV Minimum OA Damper Position setpoints at Minimum Fan Speed Command and the Design Minimum OA Damper Position setpoint at Middle Fan Speed Command shall have a range of 0-100% while the Design Minimum and DCV Minimum OA Damper Position setpoints at Full fan speed shall have a range of 0-50%.

Supply Fan Operation:
The supply fan shall be enabled while in the occupied mode. The unit controller shall vary the supply fan speed to optimize minimum fan speed in all cooling and heating modes. A differential pressure switch shall monitor the differential pressure across the fan. If the switch does not open within 40 seconds after a request for fan operation a fan failure alarm shall be announced, the unit shall stop, requiring a manual reset.

Smoke Detector and Smoke Evacuation System: All units in the facility shall shut down and all smoke dampers associated with each unit shall close in response to a signal from either the smoke detector indicating the presence of smoke or upon a signal from the smoke evacuation system. A signal shall be sent to the fire alarm panel and to the smoke evacuation system control panel to start the smoke evacuation system in the facility. The smoke detectors shall be interlocked to the unit through the dry contacts of the smoke detectors and alarm at the BAS operator console. A manual reset of the smoke detectors shall be required to restart the unit. Upon resetting of the unit smoke detectors and/or the smoke evacuation system, the units shall return to their normal, occupied sequence of operation. Prior to bid, coordinate all requirements with the electrical contractor, mechanical contractor and the fire alarm contractor and provide as required to accomplish the specified sequence of operation.

Filter Status:
A differential pressure switch shall monitor the differential pressure across the filter when the fan is running. If the switch closes for 2 minutes after a request for fan operation a dirty filter alarm shall be announced at the BAS.

ADDITIONAL CONTROL POINTS

TYPE	NAME	DESCRIPTION	SIGNAL
AI	BLDG-P	BUILDING STATIC PRESSURE	4-20MA
BO	CLG1-C	COOLING STAGE 1 COMMAND	24VAC MAINTAINED
BO	CLG2-C	COOLING STAGE 2 COMMAND	24VAC MAINTAINED
AI	DA-T	DISCHARGE AIR TEMPERATURE	NICKEL 1K RTD DRY CONTACT MAINTAINED
BI	FILT-S	FILTER STATUS	MAINTAINED
AI	RA-T	RETURN AIR TEMPERATURE	NICKEL 1K RTD
BI	LT-A	LOW TEMPERATURE ALARM	DRY CONTACT MAINTAINED
BI	DFLIT-SWITCH	DIRTY FILTER SWITCH	DRY CONTACT MAINTAINED
AO	HGRH-O	HOT GAS REHEAT OUTPUT	0-10 VDC
BO	SF-C	SUPPLY FAN COMMAND	24 VAC MAINTAINED
AO	SF-O	SUPPLY FAN OUTPUT	0-10 VDC DRY CONTACT
BI	SF-S	SUPPLY FAN STATUS	MAINTAINED
AI	ZN-T	ZONE TEMPERATURE	SAB
AI	ZN-H	ZONE HUMIDITY	SAB
BI	COND-A	CONDENSATE DRAIN LINE ALARM	DRY CONTACT MAINTAINED
BI	COND-B	CONDENSATE AUX. DRAIN PAN ALARM	DRY CONTACT MAINTAINED

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 UPGRADES TO THE MOBILE COUNTY METRO JAIL
 For The MOBILE COUNTY COMMISSION
 MOBILE, ALABAMA



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SHEET TITLE			
HVAC CONTROLS			
JOB NO.			
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