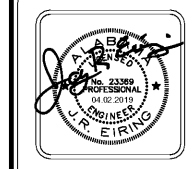


CIP-2017-001
UPGRADES TO THE MOBILE COUNTY METRO JAIL
FOR THE MOBILE COUNTY COMMISSION
MOBILE, ALABAMA



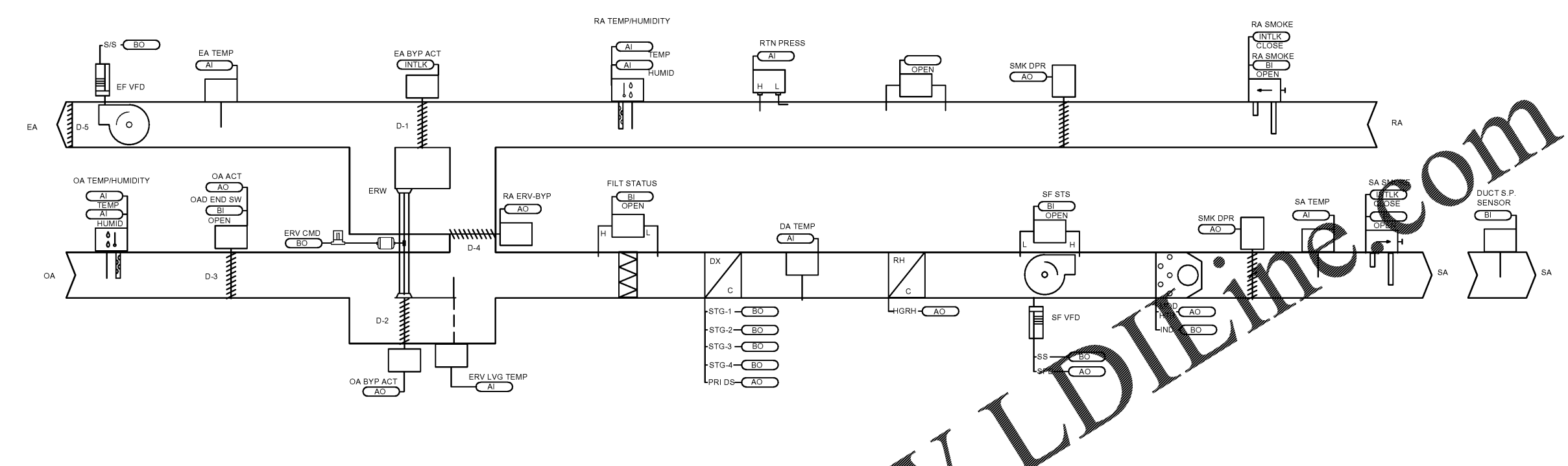
DRAWN: CW CHECK: TZ
DATE: APRIL 2, 2019 RTA

SHEET TITLE
HVAC CONTROLS

JOB NO.
PH&H1801GV

SEQUENCE NO.
127 of 175

M12



TYPICAL PACKAGED 100% OUTSIDE AIR UNIT (OAU) CONTROL SCHEMATIC

NOT TO SCALE
NOTE: REFER TO PLANS FOR LOCATIONS OF MISCELLANEOUS SMOKE DAMPERS AT FLOOR, SHAFT AND DUCT LOCATIONS

TYPICAL PACKAGED 100% OUTSIDE AIR UNITS SEQUENCE OF OPERATION

Building Automation System Interface:
The Building Automation System (BAS) shall send the controller 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. The BAS shall also send the controller a duct static pressure setpoint, discharge air temperature setpoint, relative humidity setpoint, and damper minimum position.

Emergency Stop:
When contact closure at terminals TOAU-9 & 10 are open, the unit operation shall be in Alarm Status and an alarm shall be generated. Unit shall revert to normal operation upon closure of OAU-TS 9 and 10. Important: Cycling power to unit may not resolve alarm condition.

Occupied Start Sequence:
When unit is powered, the unit controls shall be initialized. Initialization process requires 3 minutes. Unit shall be placed in occupied mode when signaled via BAS signal or contact closure across enable OAU-TS terminals 7 and 8, on customer supplied fan starting terminal board.

When enabled in the occupied mode, the outdoor air and return air damper shall be commanded to preset occupancy position. Supply fan shall be commanded to start and a preset signal of 50% (50-100% adj.) is sent as the supply fan. D or E. A differential pressure switch shall monitor the differential pressure across the indoor fan. If after 30 seconds the indoor fan proving switch does not prove air flow, the indoor fan is command off and signal an alarm.

Occupied Cooling Mode:
Occupied cooling mode shall be enabled when no call for dehumidification or heating is present and the space temperature rises +2.0 deg. F above the space cooling setpoint. With cooling mode enabled, cooling is reheat to 50% (only half) of the compressors are enabled). Controller shall enable stage 1 cooling. Following a cooling stage of cooling and after a 5-minute delay, if the space air temperature is higher than the space temperature setpoint by 1.0 deg. F, the controller shall stage the remainder of cooling stages to maintain the space temperature 1.0 deg. F below the space temperature setpoint. If a digital compressor is installed, the compressor shall modulate (load/unload) capacity to maintain the space temperature setpoint. When the space is satisfied, the cooling stages shall be disabled in reverse order. Cooling shall be disabled when space temperature drops below space cooling setpoint -2.0 deg. F. If economizing is enabled, the outdoor damper shall modulate to maintain the occupied space temperature setpoint.

Occupied Heating Mode:
Heating mode is enabled based on Outdoor Air Heating Setpoint (OAHS) when the outdoor air temperature is lower than the OAHS, then Heating Mode shall be enabled. During Heating Mode, the main unit controller shall modulate the gas heating output to maintain the Discharge Air Heating Setpoint. Maximum discharge air heating temperature is adjustable but cannot exceed 120.0 deg. F. Hot gas reheat is disabled when heating is enabled. In the event of an ignition failure on indirect fired gas heat, the main unit controller shall retry to ignite the gas heater three times before locking out the heater.

Occupied Heat Mode Enable:
Heating mode is enabled when no call for dehumidification and the outdoor air temperature is lower than the Outdoor Air Heating Setpoint (OAHS). When the outdoor air temperature rises above the outdoor heating setpoint minus a differential, the heating mode shall be deactivated.

Occupied Cool Mode Enable:
Cooling Mode is enabled when no call for dehumidification and the outdoor air temperature is above the Outdoor Air Cooling Setpoint (OACS). When the outdoor air temperature falls below the outdoor cooling setpoint minus a differential, the cooling mode shall be deactivated.

Digital Compressors: (Optional)
Main unit controller shall modulate digital compressor to maintain either Evap Leaving Temp Setpoint or Occupied Cooling Setpoint depending on mode of operation. Remaining compressors shall be staged as described in mode.

Discharge Air Temperature Reset Control:
The unit shall maintain the space temperature setpoints based on the heating or cooling mode of the unit, by resetting the Discharge Air Temperature Setpoint calculated by comparing the Active Space Temperature against the Active Space Temperature Setpoint. The BAS communicated value will take priority over the locally calculated value.

Occupied Dehumidification:
Dehumidification mode shall be enabled when no call for heating mode and the Space Dewpoint or Outdoor Air Dewpoint rises above the Space Dewpoint Setpoint or the Outdoor Air Dewpoint Setpoint. Dehumidification shall remain active until the outdoor air dewpoint rises above the outdoor air dewpoint setpoint by 3.0 deg. F, or if heating mode is enabled, evaporator controls based on Evap Leaving Temperature Setpoint. If evaporator leaving air temperature is above setpoint first stage (Compressor 1) shall start. If a 3-minute minimum delay the evaporator leaving air temperature is still above setpoint, the second, third, and fourth stages (Compressor 2, 3, and 4) shall stage on sequentially following individual 3-minute minimum delays between each call. As the evaporator leaving temperature approaches the evaporator leaving temperature setpoint, compressors 4, 3, and 2 shall be staged off sequentially with a 5 minute delay in between. As the evaporator leaving temperature falls below evaporator leaving temperature setpoint by 1.0 deg. F for 5 minutes, cooling stage 1 will be disabled. Should the space begin to over-cooled, the HGRH coil modulate to maintain the Occupied Cooling Setpoint.

Occupied Hot Gas Reheat:
During the dehumidification cycle, the Hot Gas Reheat shall be enabled and shall modulate to maintain the discharge air setpoint. The hot gas reheat coil shall go through a purge cycle every 30 minutes for 3 minutes. During the purge cycle, the hot gas reheat coil is bypassed 100%. The Heating cycle is disabled when the hot gas reheat cycle is enabled.

Occupied Hot Gas Reheat Purge:
Following a continuous 30-minute hot gas reheat operation at less than 100 percent reheat capacity a purge cycle shall be initiated. During the purge cycle, the hot gas reheat signal is set and held at 100 percent for a period of 3 minutes. Following the purge cycle, normal operation resumes.

Occupied Economizer:
Free cooling mode is enabled when the Outdoor Air Temperature is cooler than 5.0 deg. F below the Discharge Air Cooling Setpoint Active and the unit is in Economizer Mode. During Free Cooling Mode, mechanical cooling is locked out and the dampers shall modulate to maintain the Discharge Air Cooling Setpoint.

Occupied Ventilation Mode:
Ventilation Mode is enabled based on space temperature and outdoor air temperature. Operation in Ventilation Mode is enabled when the space temperature and the outdoor air temperature is within 2.0 deg. F of the Occupied Cooling Setpoint. Operation in Ventilation Mode continues until conditions call for dehumidification or when the space and outdoor air temperature is not within 2.0 deg. F of setpoint. During Ventilation Mode both cooling and heat shall be locked out and the outdoor air damper shall modulate to maintain the Occupied Cooling Setpoint (if equipped with optional modulating dampers).

Power Exhaust w/Energy Recovery Ventilator:
The exhaust fan and energy recover ventilator (ERV) are interlocked with the supply fan operation in the occupied heating, dehumidification, or cooling modes. A factory installed temperature sensor shall be located downstream of the ERV. Mode calls shall be based off ERV leaving conditions. When enabled, the power exhaust fan shall run at factory setting (50-100% adj.). In the economizer mode or ventilation mode, the ERV shall be disabled, the ERV bypass dampers shall be commanded open and the powered exhaust fan shall be modulated to maintain the return air duct static pressure setpoint (adj.). In the economizer mode or ventilation mode or unoccupied mode, the ERV shall be disabled.

Standard ERV Frost Controls:
With ERV is enabled, when the Exhaust Temperature across the ERV drops below 28.0 deg. F, the ERV bypass dampers shall slowly modulate open to bring that temperature above 28.0 deg. F. If after the bypass dampers modulate to 100% open and the Exhaust Temperature across the ERV drops below 15.0 deg. F (2 F Deadband), the unit controller shall disable the ERV to remain off for 3 minutes. After 3 minutes, and with the Exhaust Temperature sensor above 28.0 deg. F, the ERV shall be enabled and the cycle shall repeat again.

Supply Fan Control:
The supply fan shall be enabled while in the occupied mode and cycled on during the unoccupied mode. When enabled the outdoor air damper shall be commanded to open. Outdoor air damper end switch closure shall initialize indoor fan by sending a preset run signal (50 - 100% adj.) to the indoor fan. A differential pressure switch across the fan shall monitor the differential pressure. After initializing the indoor fan, if the pressure switch does not prove flow within 60 seconds (adj.) a fan failure alarm shall be announced and the unit shall be disabled, requiring a manual reset.

Exhaust Fan Status:
A differential pressure switch shall monitor the differential pressure across the fan. If the switch is detected to be open for 30 seconds (adj.) after a request for exhaust fan operation a fan failure alarm shall be announced at the BAS and the exhaust fan shall stop. A manual reset shall be required.

Exhaust with Gravity Dampers:
In the occupied mode and after indoor fan status has been proven, the outdoor air damper status is open, and no unit alarms, the isolation dampers shall be powered and the power exhaust fan speed shall modulate to maintain a constant volume of airflow. During Unoccupied Mode the powered exhaust shall be disabled.

Smoke Detector and Smoke Evacuation System: All units shall shut down and all smoke dampers associated with each unit shall close in response to a signal from either 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. If the switch closes for 2 minutes during fan operation a filter maintenance 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-H	DISCHARGE AIR HUMIDITY	0-10VDC
AI	DA-T	DISCHARGE AIR TEMPERATURE	NICKEL 1K RTD DRY CONTACT
BI	EAFLT-S	EXHAUST AIR FILTER STATUS	MAINTAINED
AI	EA-H	EXHAUST AIR HUMIDITY	0-10 VDC
AI	EA-SP	EXHAUST AIR HUMIDITY SETPOINT	SAB
AI	EA-H	EXHAUST AIR HEAT RECOVERY HUMIDITY	0-10 VDC
AI	EAHR-T	EXHAUST AIR HEAT RECOVERY TEMPERATURE	NICKEL 1K RTD
AI	EA-T	EXHAUST AIR TEMPERATURE	NICKEL 1K RTD
BO	EF-C	EXHAUST FAN COMMAND	24VAC MAINTAINED
AO	EF-O	EXHAUST FAN OUTPUT	0-10V DC DRY CONTACT
BI	EF-S	EXHAUST FAN STATUS	MAINTAINED
AI	HR-T	HEAT RECOVERY TEMPERATURE	NICKEL 1K RTD
AI	HR-H	HEAT RECOVERY HUMIDITY	0-10 VDC
BO	HRW-C	HEAT RECOVERY WHEEL COMMAND	24VAC MAINTAINED DRY CONTACT
BI	HRW-S	HEAT RECOVERY WHEEL STATUS	MAINTAINED DRY CONTACT
AI	LT-A	LOW TEMPERATURE ALARM	DRY CONTACT MAINTAINED
BI	PFILT-S	PRE-FILTER STATUS	DRY CONTACT MAINTAINED
BI	DLFLT-SWITCH	DIRTY FILTER SWITCH	DRY CONTACT MAINTAINED
AO	HGRH-O	HOT GAS REHEAT OUTPUT	0-10 VDC
BO	RH-O	REHEAT OUTPUT	0-10 VDC
AO	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	CONDA	CONDENSATE DRAIN LINE ALARM	DRY CONTACT MAINTAINED
BI	COND-B	CONDENSATE AUX. DRAIN PAN ALARM	DRY CONTACT MAINTAINED