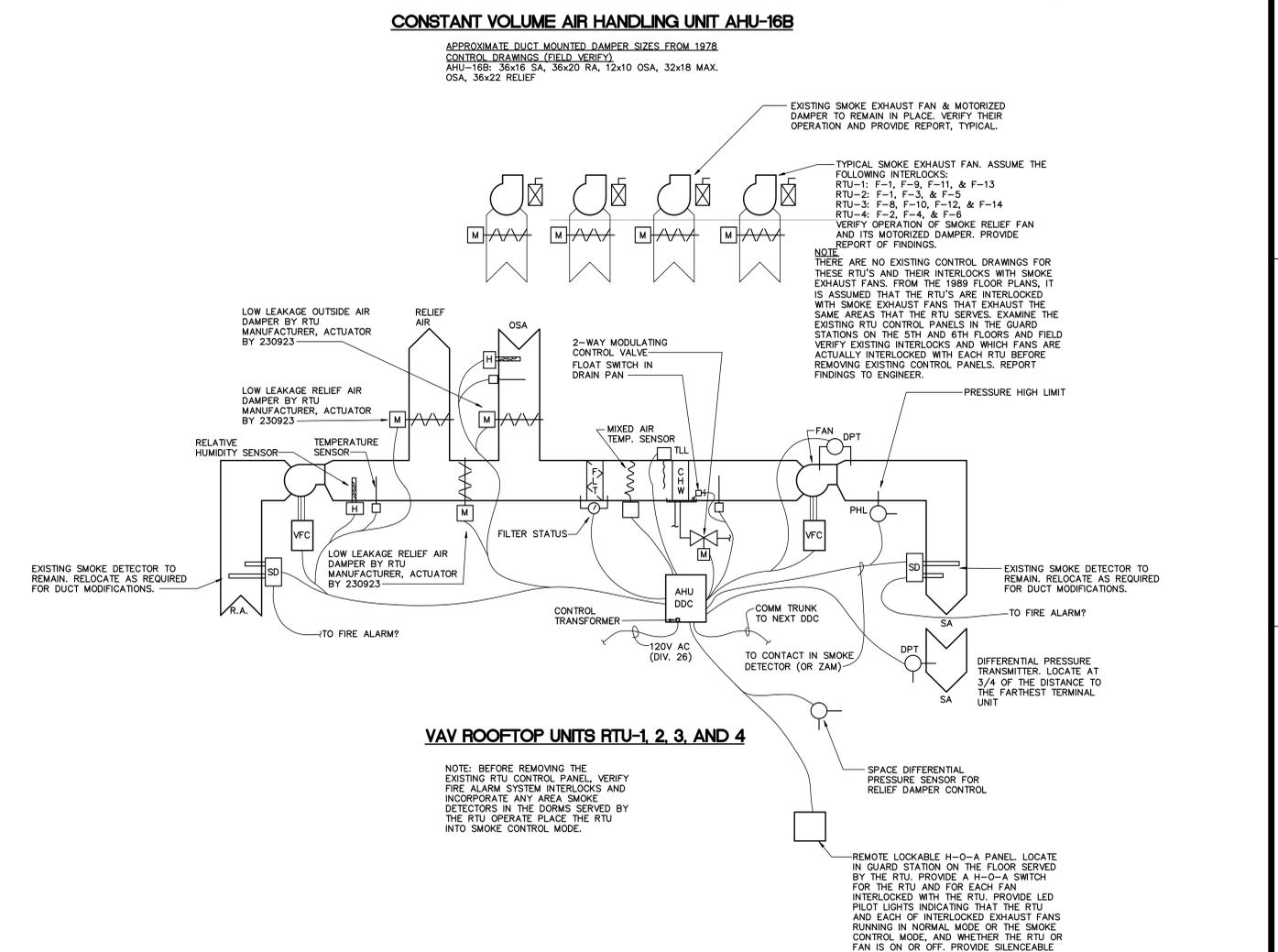


CONSTANT VOLUME AIR HANDLING UNIT AHU-11B

APPROXIMATE DUCT MOUNTED DAMPER SIZES FROM 1978 CONTROL DRAWINGS (FIELD VERIFY)
 AHU-11A: 18x10 OSA, 22x15 SA, 24x12 RA

SEQUENCE OF OPERATION

- VAV TERMINAL UNITS WITH DDC CONTROLS**
- Building Automation System Interface:**
 The Building Automation System (BAS) shall send the controller Occupied and Unoccupied commands. The BAS may also send a Heat/Cool mode priority shutdown command. Space temperature and/or space temperature setpoint. If communication is lost, the BAS shall default the VAV controller shall operate using its local setpoints.
- Occupancy Mode:**
 The occupancy mode shall be communicated or hardwired to the VAV. 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 occupied mode the VAV shall maintain the space temperature at the active heating or cooling setpoint. Applicable ventilation and airflow setpoints shall be enforced. The occupied 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 controller 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.
 Occupied Bypass:
 Mode used to temporarily place the unit into the occupied operation. Tenants shall be able to override the unoccupied mode from the space sensor. The override shall last for a maximum of 2 hours. The tenants shall be able to cancel the override from the space sensor at any time. During the override the unit shall operate in the occupied mode.
- Heat/Cool Mode:**
 The Heat/Cool mode shall be set by a communicated signal. The VAV shall compare the primary air temperature (as sensed at the terminal unit) associated AHU with the configured auto changeover setpoint to determine if the air is "hot" or "cold." Heating mode shall command the VAV to heat only. It implies the primary air temperature is hot. Cooling mode shall command the VAV to cool only. It implies the primary air temperature is cold.
- Heat/Cool Setpoint:**
 The space temperature setpoint shall be determined either by a local thermostat or the VAV default setpoint or a communicated signal. The VAV shall use the locally stored default setpoint if neither a local setpoint nor communicated setpoint is present. Both a local setpoint and communicated setpoint shall be used if the VAV shall use the communicated signal.
- Cooling Mode:**
 When the unit is in cooling mode the VAV controller shall maintain the space temperature at the active cooling setpoint by modulating the airflow. It shall be the active cooling minimum airflow setpoint to the maximum cooling airflow setpoint. Based on the VAV controller occupancy mode the active cooling setpoint shall be one of the following:
 Setpoint Default Value
 Occupied Cooling Setpoint deg F deg F
 Unoccupied Cooling Setpoint deg F deg F
 Occupied Min Cooling Airflow Setpoint See VAV Schedule
 Occupied Max Cooling Airflow Setpoint See VAV Schedule
- The VAV shall use the measured space temperature and the active cooling setpoint to determine the requested cooling capacity of the unit. The outputs shall be controlled based on the unit configuration and the requested cooling capacity.
- Heating Mode:**
 When the unit is in heating mode the VAV controller shall maintain the space temperature at the active heating setpoint by modulating the airflow. It shall be the active heating minimum airflow setpoint to the maximum heating airflow setpoint. Based on the VAV controller occupancy mode the active heating setpoint shall be one of the following:
 Setpoint Default Value
 Occupied Heating Setpoint deg F deg F
 Unoccupied Heating Setpoint deg F deg F
 Occupied Standby Heating Setpoint armup deg F deg F
 Occupied Min Heating Airflow Setpoint See VAV Schedule
 Occupied Max Heating Airflow Setpoint See VAV Schedule
- The VAV controller shall use the measured space temperature and the active heating setpoint to determine the requested heating capacity of the unit. The outputs shall be controlled based on the unit configuration and the requested heating capacity.
- Reheat Control:**
 Reheat shall only be allowed when the primary air temperature is deg F below the configured reheat enable setpoint of deg F. The reheat shall be enabled when the space temperature drops below the active cooling setpoint and the airflow is at the minimum cooling airflow setpoint. During reheat the VAV shall operate at its minimum heating airflow setpoint and energize the heat as follows:
 Proportional Hot Water Reheat:
 If the space temperature is below the heating setpoint the hot water reheat shall modulate as required to maintain the active heating setpoint.
 Space Sensor Failure:
 If there is a fault in the operation of the space sensor an alarm shall be announced at the BAS. Space sensor failure shall cause the VAV to drift the damper to minimum air flow. If the VAV is in the occupied mode drift shall be announced if the VAV is in the unoccupied mode.
 Smoke Control mode:
 When the terminal unit associated air handling unit or RTU is activated in smoke control mode each terminal unit associated with that AHU shall have its damper open full to the primary air stream.
- BUILT-UP AIR HANDLING UNITS AHU-22A, 23A, AND 24A:**
- The AHU supply fan will be energized through the BMS whenever the hand-off-auto switch is in the "auto" position. When the switch is in the "hand" position, the fan will run continuously. A differential pressure sensor at the supply fan shall prove airflow.
 - When the AHU is energized and the building is occupied, the minimum outside air damper shall be opened to provide the scheduled minimum outside air flow, the economizer outside air damper shall be closed (except when economizer cycle is in operation) to provide the scheduled minimum outside air flow, the relief damper shall open to relief building pressure, & the return air damper shall be opened. When the AHU is off, the outside air dampers, the relief air damper, & the return air dampers shall be closed.
 - When the AHU is energized and the building is unoccupied, the outside air damper shall remain closed, the relief damper shall remain closed, & the return air dampers shall be opened. When the AHU is in, the minimum outside air damper, the relief air damper, the return air damper, and the supply air dampers shall be closed.
 - Occupancy Mode: The occupancy mode shall be communicated or hardwired to the AHU controller. OCCUPIED MODE: The AHU shall run continuously when the system is scheduled to run in the occupied mode. The occupied mode shall be the default mode for the AHU. UNOCCUPIED MODE: [For this phase of the construction, the existing pneumatic VAV terminal units do not have the capability for unoccupied startup from the terminal unit thermostats or from override timers on the terminal unit thermostats, so the AHU shall be controlled by the programmed occupancy schedule only. The default schedule shall be 24 hours / day 7 days / week.] In a future project, the controller shall have the capability to energize the AHU in unoccupied mode whenever any of its associated VAV terminal units requires heating or cooling to maintain the space temperature at the active unoccupied heating or unoccupied cooling setpoint. UNOCCUPIED BYPASS: [For this phase of the construction, the existing pneumatic VAV terminal units do not have the capability for unoccupied startup from override timers on the terminal unit thermostats, so the AHU shall be controlled by the programmed occupancy schedule only. The default schedule shall be 24 hours / day 7 days / week.]
 - Steam Preheat Coil Control: Whenever the unit is on, the 1/3's & 2/3's steam control valves shall modulate to maintain steam coil discharge air temperature setpoint initially set as 54 deg F (adj). Setpoint shall be reset to maintain a 2 deg F (adj) deadband between the chilled water and steam coil setpoints.
 - Cooling Coil Control: Whenever the unit is on, the chilled water control valve shall modulate to maintain discharge air temperature setpoint initially set as 56 deg F (adj). If economizing is enabled, the outside air, return air, and relief air dampers shall modulate to maintain discharge air temperature setpoint. If the discharge air temperature sensor fails, the unit shall control the chilled water valve with the chilled water coil discharge air temperature sensor and an alarm shall be announced at the BMS.
 - Cooling coil circulating pump: The cooling coil circulating pump shall be energized at any time the outside air temperature is below 38 deg F (adj). For cooling coil circulating pumps that are not installed in the control valve bypass line, the pump shall operate whenever cooling is required.
 - Economizer: When the outdoor air dry bulb / wet bulb (enthalpy) conditions are favorable, the outside air damper, the relief air damper, and the return damper shall modulate and the chilled water valve shall modulate to maintain the supply air temperature setpoint. Mechanical cooling shall be locked out and the outside air damper shall be modulated between the minimum OSA position and the 100% open OSA position to allow outside air to be delivered for free cooling operation. If the outside air damper reaches 100% open (adj) and the supply air temperature setpoint cannot be maintained using outside air alone, the outside air damper shall be held at 100% open and the mechanical cooling shall be enabled. When the outdoor air dry bulb / wet bulb (enthalpy) conditions are favorable, the outside air damper shall be controlled to maintain minimum position, and mechanical cooling will be controlled to maintain supply air temperature at setpoint.
 - Supply / Return fan control: The fans shall be off in the unoccupied mode. When the unit controller is in the occupied mode, the supply fan variable speed controller's speed shall be modulated to maintain duct static pressure setpoint. [In a future phase, the duct static pressure setpoint reset between the minimum and maximum static pressure limits to maintain the critical zone VAV air damper in a position between 75 & 85% open (adj). Operator shall, from a front end BMS graphic, have the ability to dynamically select the VAV terminal units used in the calculation that determines which zone is deemed the critical zone and used to calculate the duct static pressure setpoint.] If the supply fan fails to prove status in 30 seconds (adjustable), the supply and return fans shall be commanded off, the outside air and relief dampers shall close, and an alarm shall be announced at the BMS. If the discharge high static pressure cut-off switch is tripped, the supply and return fans shall stop and the outside air / relief dampers shall close, and an alarm shall be announced at the BMS. A manual reset pressure cut-off switch shall be required to restart the fans.
 - Return Fan/relief damper control: The return fan speed shall track the supply fan speed according to the airflow measuring equipment at the AHU supply and return fan inlet collars, with an airflow difference equal to the minimum outside air damper airflow. The relief air damper / return air damper shall be modulated to outside differential pressure at 0.02" w.c. (adj).
 - Mixed air low limit: If the mixed air temperature sensor senses a mixed air temperature below 50 deg F (adj), the outside air damper shall modulate to a position less than the minimum OSA damper position. If the mixed air temperature sensor fails, an alarm shall be announced to the BMS. The outside air damper shall close if the mixed air temperature sensor has failed and the outside air temperature is below 40 deg F (adj).
 - If the low limit thermostat (set at 38°F) trips, the AHU shall be shut down, the AHU's dampers shall close, and an alarm shall be announced at the BMS. The cooling coil control valve and steam coil control valves shall be opened 100% for full flow through the coils. A manual reset shall be required to restart the AHU.
 - Duct smoke detectors in the return air streams shall send an alarm to the BMS and the Fire Alarm System any time products of combustion are detected. The AHU supply and return fans shall remain running, the outside air damper shall be opened, the return air damper shall be closed, & the relief air damper shall be opened. The AHU controller shall send a signal to all of its associated VAV terminal units thru their existing pneumatic interlock with the AHU to open their primary air dampers to the full open position.
 - Filter Status: A differential pressure switch shall monitor the differential pressure across the filter when the fan is running. If the switch closes during normal operation, a dirty filter alarm shall be announced at the BMS.
 - If communications with the BMS is lost, the AHU controller shall operate using default modes and setpoints.
 - Provide float switch in cooling coil drain pan. Upon sensing a high water level, the chilled water valve shall close to the cooling coil and an alarm shall be sent to the BMS.
 - End switches on control dampers shall be monitored by the BMS.
 - Provide pressure high limit switch in supply air duct to shut off the AHU when static pressures above setpoint are seen. This feature shall be able to be disabled in the smoke control mode, as well as other safety interlocks such as temperature low limit.



CONSTANT VOLUME AIR HANDLING UNIT AHU-16B

APPROXIMATE DUCT MOUNTED DAMPER SIZES FROM 1978 CONTROL DRAWINGS (FIELD VERIFY)
 AHU-16B: 36x16 SA, 36x20 RA, 12x10 OSA, 32x18 MAX. OSA, 36x22 RELIEF

VAV ROOFTOP UNITS RTU-1, 2, 3, AND 4

NOTE: BEFORE REMOVING THE EXISTING RTU CONTROL PANEL, VERIFY FIRE ALARM SYSTEM INTERLOCKS AND INCORPORATE ANY AREA SMOKE DETECTORS IN THE DORMS SERVED BY THE RTU OPERATE PLACE THE RTU INTO SMOKE CONTROL MODE.

REVISIONS:

PROJECT #: 24308.00
 DATE: APRIL 10, 2015
 DRAWN BY: JTC
 DESIGNER: JTC
 CHECKED BY: AMS

Pickering
 Pickering Firm, Inc.
 Facility Design - Civil Engineering - Surveying
 Transportation - Natural / Water Resources
 6775 Lenox Center Court, Suite 300
 Memphis, TN 38117-9015
 901.728.0870

OGCB Incorporated
 306 Poplar Avenue, Suite 200
 Memphis, TN 38117-0200

Mechanical/Electrical Consulting Engineers

SBI-000320
HVAC RETROFIT PHASE II
SHELBY COUNTY CRIMINAL JUSTICE CENTER
 201 POPLAR AVENUE
 MEMPHIS, TENNESSEE 38103

SEAL:
 SHEET NUMBER:
M-804
 DESCRIPTION:
 TEMPERATURE CONTROLS III