

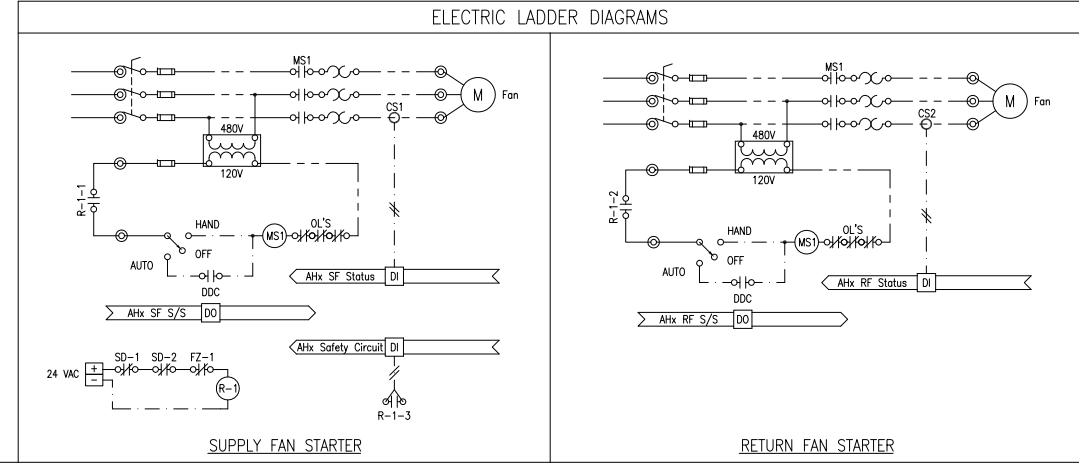
NOTE 1

NOTE 2

- NOTES**
- Provide with temperature display and communications port.
  - Provide multiple freezestats as required to achieve 1ft of linear element for each 1sq.ft. of coil face area. Preheat sensor shall be installed intertwined with freezeostat to cover the exact same area.

**BILL OF MATERIAL**

DESIG	QTY	MODEL NO.	DESCRIPTION
TS 1	1		Temp Sensor, Zone
TS 2 & 5	2		Temp Sensor, Duct
TS 3 & 4	2		Temp Sensor, Duct (Averaging)
V1 & 2	2		Valve Actuator
SD 1 & 2	2		Smoke Detector
FZ1	1		Freezestat 40F, DPDT
D-1, 2, 3	3		Damper Actuators



CONTROL SCHEMATIC

**SEQUENCE OF OPERATION**

- GENERAL: The CV air handler shall be fully controlled by the BAS. Air handler logic strategies for this unit shall include:
- Scheduled Occupancy: BAS shall determine the occupancy periods (occupied, unoccupied, preoccupancy, and setback). The following details the common control aspects related to the scheduled occupancy.
    - Occupied Period: BAS shall energize the AH during all occupied periods. Note that the beginning of the occupancy period shall be set sufficiently before the actual start of occupancy to obtain the required component of ventilation per IMC. Minimum OA flow setpoint shall be as scheduled on the drawings. "Normal" setpoints shall apply.
    - Unoccupied Period: The minimum OA damper position shall be 0%. If during the unoccupied period there is a request for occupancy override, the occupancy mode shall become active for an adjustable period. The unoccupied period and the preoccupancy period will typically overlap.
    - Setback Period: The BAS shall deenergize the unit except as required to maintain a setback temperature as indicated in the individual sequences with a 5F cycle differential. Generally, where setback temperatures apply in multiple zones, the worst zone shall control the system. Setback setpoints generally apply except during preoccupancy [and night purge]. If during the unoccupied period there is a request for occupancy override, the occupancy mode shall become active for an adjustable period.
    - Preoccupancy: BAS shall energize the AH continuously during the preoccupancy period. The minimum OA damper position shall be 0%. "Normal" setpoints shall apply. Preoccupancy duration shall be:
      - Optimum: The duration of the morning warm-up period shall vary according to outside air temperature and space temperature such that the space temperature rises to occupied period heating setpoint at the beginning of, but not before, the scheduled occupied period. The duration of the cool-down period shall vary according to outside air temperature and space temperature such that the space temperature falls to the occupied period cooling setpoint at the beginning of, but not before, the scheduled occupied period.
  - Airside Economizer: BAS shall modulate the mixing dampers to provide "free cooling" when conditions merit. The free cooling shall generally be staged before any mechanical cooling. While conditions merit, dampers shall be modulated in a DA PID loop to maintain mixed air temperature at a setpoint as specified for the individual unit. Economizer logic shall remain enabled during setback cooling where applicable. The following strategy shall be used to enable the economizer mode:
    - Dry Bulb Comparison: Economizer mode shall be active while the unit is energized AND when OA enthalpy falls below 28 btu/# AND outside air temperature falls below return air temperature (with 2F cycle differential). Economizer mode shall be inactive when OA enthalpy rises above 29 btu/# OR outside air temperature rises above return air temperature (with 2F cycle differential), dampers shall return to their scheduled minimum positions as specified above. Economizer shall remain enabled during setback cooling.
  - Sequenced Heating and Cooling: BAS shall control the heating and cooling coils and air side economizer as detailed for the particular AH. Program logic shall directly prohibit the heating and cooling valves as well as the heating valve and economizer damper to be open (or above minimum) simultaneously. This does not apply to cooling and reheat valves that are used simultaneously for dehumidification.
  - Mixed Air Low Limit Override: BAS shall override the signal to the OA damper via a proportional only loop to maintain a minimum mixed air temperature of 45F (adj.) (loop shall output 0% at 45F which shall be passed to the output via a low selector).
  - Freeze Safety: Upon operation of a freezeostat the following sequence shall occur:
    - The unit fans shall be deenergized. Typically supply and return fans where applicable shall be deenergized via a hardwired interlock, and an indication of the operation shall be displayed by the BAS.
    - All hot water valves and chilled water valves will be commanded to 100% open.
    - All hot water coil pumps and chilled water coil pumps will be commanded to run.
    - Outside air dampers shall fully close and return air dampers shall fully open.
    - BAS shall enunciate appropriate alarm and remove and lock out the start command.
  - Smoke Safety: Upon indication of smoke by a smoke detector, FAC shall deenergize the AH. Smoke detector shall notify the fire alarm system and BAS, shut down the fans, and close the smoke dampers via hard-wired interlock.
- Supply Fan:** BAS shall control the starting and stopping of the supply fan as follows:
- START/STOP: BAS shall command the operation of the supply fan and it shall run continuously whenever the AH is energized.
  - PROOF: BAS shall prove fan operation and use the status indication to accumulate runtime. Upon failure of the supply or return fan, BAS shall deenergize the other fan and enunciate a level 1 alarm.
- Return Fan:** BAS shall control the starting and stopping of the return fan as follows:
- START/STOP: BAS shall command the operation of the return fan and it shall run continuously whenever the supply fan status is proven.
  - PROOF: BAS shall prove fan operation and use the status indication to accumulate runtime.
- Return/Exhaust/OA Dampers:** BAS shall control the dampers as follows:
- CLOSED: When AH is deenergized, dampers shall remain in their "off" positions. When AH is energized during unoccupied period the dampers shall remain in their "off" positions, unless economizer is available.
  - MINIMUM OA CONTROL: During the occupied period, return, exhaust, and outside air dampers shall never be positioned less than the position set for the required minimum OA ventilation rate, per the balanced position minimum OA control strategy.
 

Balanced Position: During the occupied period, applicable mixing and OA dampers shall never be positioned less than the position set for the required minimum OA ventilation rate. The minimum position output shall be determined by the balancer.
  - ECONOMIZER: BAS shall modulate the return, exhaust, and outside air dampers per the dry bulb comparison airside economizer strategy. Mixed air temperature setpoint shall be 5F (adj.) below the supply air temperature setpoint. Economizer output shall be restricted, as required, per the mixed air low limit override strategy.
- Space Temperature Control:** During periods of occupied operation (space is occupied, scheduled to be occupied or occupancy is detected) the operator may adjust the Normal (72F adj.) setpoint. Occupants may further adjust the Normal setpoint via the local sensor setpoint adjustment (the range of adjustment shall be configurable via the BAS, initially +/-2F). The BAS shall automatically apply an offset for cooling and heating set points during occupied periods as follows:
- Space cooling setpoint shall be the Normal space temperature setpoint plus 2F (adj.).
  - Space heating setpoint shall be the Normal space temperature setpoint minus 2F (adj.).
- During periods of unoccupied operation (space is scheduled unoccupied or no occupancy is detected for a preset period) the operator may adjust Setback heating (50F adj.), and Setback cooling (85F adj.) setpoints. The BAS will prevent the operator from entering a Setback heating setpoint higher than the Space heating setpoint OR entering a Setback cooling setpoint lower than the Space cooling setpoint.
- Discharge Temperature Control:** The discharge temperature setpoint shall be reset from the space temperature by two pid algorithms outputting temperature ranges, one for heating (RA) and one for cooling (DA) as follows:
- HEATING DISCHARGE SETPOINT: 75F to 100F (or the heating design temperature), both adjustable.
  - COOLING DISCHARGE SETPOINT: 50F (or the cooling design temperature) to 70F, both adjustable.
- Preheat Coil Valve:** Whenever the AH is energized, N.O. preheat coil valve shall modulate per the higher of:
- A RA PID loop to maintain discharge air at heating discharge air temperature setpoint (equal to discharge temperature setpoint defined above less 3F)
  - A proportional only loop maintaining a low limit of 45F preheat air temperature. When the unit is off the valve shall continue to modulate to maintain a preheat air temperature of 45F (adj.).
- Cooling Coil Valve:** Whenever the AH is energized, N.C. cooling coil valve shall modulate per a DA PID loop to maintain discharge air temperature set point. During unoccupied period, if AH is energized for heating, warm-up, the cooling coil valve shall remain closed.

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UNIVERSITY OF VIRGINIA  
 FACILITIES MANAGEMENT

HVAC CONTROLS STANDARDS

Eng	HJN
Drawn	HJN
Chkd	---
Appd	---
Issued	8/4/11
Job No.	10080
Scale	N/A
Proj Code	

STANDARD

AHU CV WITH  
 RETURN FAN  
 (SCHEMATIC)

07 OF 30  
 SHEET NUMBER

C-1.2a

DWG NUMBER