# SEQUENCE OF OPERATION (TYP. FOR AHU-47):

A. GENERAL: THE SYSTEM SHALL BE CONTROLLED BY A STAND-ALONE CONTROL SYSTEM. WITH THE H-O-A SWITCH IN THE "AUTO" POSITION, THE SYSTEM SHALL START THROUGH THE BAS SYSTEM AND OPERATE AS DESCRIBED BELOW, PROVIDED THE SAFETIES HAVE BEEN SATISFIED.

B. DISABLED MODE – WHEN THE AHU IS IN THE DISABLED MODE:
1. THE SUPPLY FAN SHALL BE DE-ENERGIZED.
2. THE OUTSIDE AIR DAMPER SHALL BE CLOSED AND THE RETURN AIR DAMPER SHALL BE OPEN.
3. THE CHILLED WATER COIL VALVE SHALL BE CLOSED TO THE COIL.
4. STEAM COIL VALVE SHALL BE OPEN TO THE COIL, THE FACE DAMPERS SHALL BE OPEN AND THE BYPASS DAMPER SHALL BE CLOSED.

C. UNOCCUPIED PERIOD OPERATING MODE:
1. THE UNIT SHALL OPERATE DURING THE UNOCCUPIED PERIOD UNDER THE FOLLOWING CONDITIONS:
A. THE TEMPERATURE AT ANY SPACE SENSOR IS BELOW THE UNOCCUPIED PERIOD HEATING SETPOINT.
B. THE TEMPERATURE AT ANY SPACE SENSOR IS ABOVE THE UNOCCUPIED PERIOD COOLING SETPOINT.
C. AN UNOCCUPIED PERIOD OVERRIDE BUTTON IS PUSHED AT ANY SPACE SENSOR.
2. THE UNOCCUPIED PERIOD SHALL BE PROGRAMMED AS PER MMC REQUIREMENTS.
3. WHILE IN THE UNOCCUPIED PERIOD OPERATING MODE, THE DISCHARGE AIR TEMPERATURE SHALL BE AS SPECIFIED BELOW FOR THE NORMAL OPERATING MODE.
4. DURING THE UNOCCUPIED PERIOD OPERATING MODE, THE TERMINAL UNITS SHALL OPERATE AS SPECIFIED BELOW FOR THE NORMAL OPERATING MODE.

D. START-UP MODE (MORNING WARM-UP/PULL-DOWN):
1. THE START-UP MODE SHALL BE OPTIMIZED BY THE BUILDING MANAGEMENT SYSTEM TO ADJUST THE START TIME TO THE BUILDING RESPONSE TIME.
2. DURING THE START-UP MODE, THE OUTSIDE AIR DAMPER SHALL BE FULLY CLOSED.

E. EMERGENCY POWER START-UP MODE:
2. IF POWER IS INTERRUPTED, THE UNIT FANS SHALL RAMP BACK TO NORMAL SPEED AT A RATE NOT GREATER THAN 10 HZ PER MINUTE.

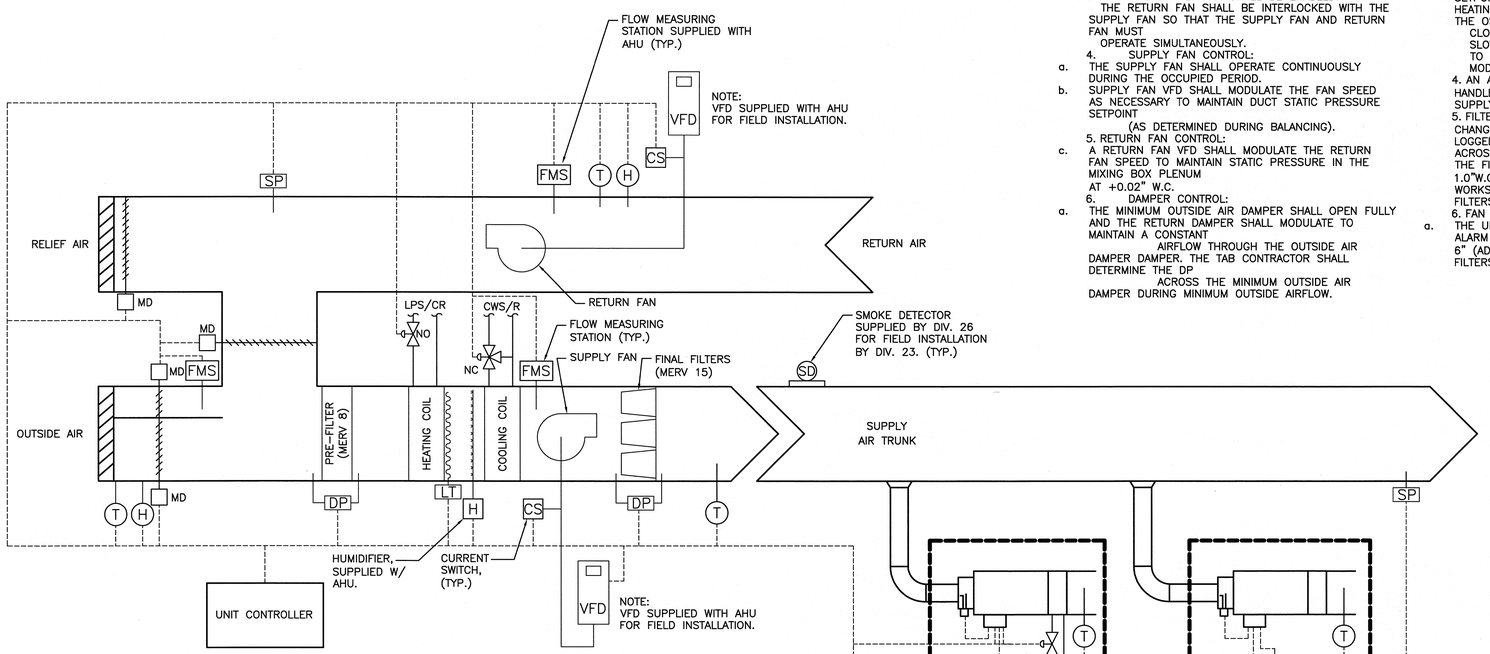
F. NORMAL OPERATING MODE:
1. THE UNIT SHALL GO INTO NORMAL OPERATING MODE WHEN THE BUILDING ENTERS THE OCCUPIED PERIOD.
2. THE MINIMUM OUTSIDE AIR DAMPER SHALL OPEN FULLY.
3. THE SUPPLY FAN SHALL BE ENABLED. THE RETURN FAN SHALL BE INTERLOCKED WITH THE SUPPLY FAN SO THAT THE SUPPLY FAN AND RETURN FAN MUST OPERATE SIMULTANEOUSLY.
4. SUPPLY FAN CONTROL:
a. THE SUPPLY FAN SHALL OPERATE CONTINUOUSLY DURING THE OCCUPIED PERIOD.
b. SUPPLY FAN VFD SHALL MODULATE THE FAN SPEED AS NECESSARY TO MAINTAIN DUCT STATIC PRESSURE SETPOINT (AS DETERMINED DURING BALANCING).
5. RETURN FAN CONTROL:
c. A RETURN FAN VFD SHALL MODULATE THE RETURN FAN SPEED TO MAINTAIN STATIC PRESSURE IN THE MIXING BOX PLENUM AT +0.02" W.C.
6. DAMPER CONTROL:
a. THE MINIMUM OUTSIDE AIR DAMPER SHALL OPEN FULLY AND THE RETURN DAMPER SHALL MODULATE TO MAINTAIN A CONSTANT AIRFLOW THROUGH THE OUTSIDE AIR DAMPER DAMPER. THE TAB CONTRACTOR SHALL DETERMINE THE DP ACROSS THE MINIMUM OUTSIDE AIR DAMPER DURING MINIMUM OUTSIDE AIRFLOW.
b. ECONOMIZER DAMPER CONTROL – IF THE OSA ENTHALPY IS LESS THAN THE RA ENTHALPY, THE OSA DAMPER AND RETURN AIR DAMPER SHALL SHALL BE MODULATED TO MAINTAIN DISCHARGE AIR TEMPERATURE AT SETPOINT. IF THE OSA ENTHALPY IS LESS THAN THE RA ENTHALPY, THE OSA DAMPER IS 100% OPEN AND THE DISCHARGE AIR TEMPERATURE IS ABOVE SETPOINT, THEN MECHANICAL COOLING SHALL BE ENABLED AS DESCRIBED BELOW TO MAINTAIN SETPOINT. IF OSA ENTHALPY IS GREATER THAN THE RA ENTHALPY, THEN MECHANICAL COOLING SHALL BE ENABLED TO MAINTAIN SETPOINT.
c. RELIEF DAMPER CONTROL – MODULATE THE RELIEF DAMPER TO MAINTAIN THE SPACE DIFFERENTIAL PRESSURE (DP) AT SETPOINT. THE BUILDING DP SHALL BE DETERMINED BY CALCULATING A RUNNING AVERAGE OF THE PAST 15 MINUTES OF DP READINGS. ONE READING SHALL BE TAKEN PER 5 SECONDS. THE SYSTEM DP SENSOR SHALL BE PLACED AS INDICATED ON THE DRAWINGS.
d. THE MINIMUM OUTSIDE AIR AND ECONOMIZER DAMPERS SHALL FAIL CLOSED. THE RELIEF DAMPER SHALL FAIL CLOSED. THE RETURN DAMPER SHALL FAIL OPEN.

8. DISCHARGE AIR TEMPERATURE CONTROL:
a. THE DISCHARGE AIR TEMPERATURE SHALL BE MAINTAINED AT 52F.
b. IF THERE IS A CALL FOR COOLING, AND THE SYSTEM IS IN ECONOMIZER MODE, THE OUTSIDE AIR DAMPER AND THE RETURN AIR DAMPER SHALL MODULATE TO MAINTAIN DISCHARGE AIR TEMPERATURE AT SETPOINT.
c. IF THERE IS A CALL FOR COOLING AND THE SYSTEM IS NOT IN ECONOMIZER MODE, THE COOLING COIL CONTROL VALVE SHALL MODULATE TO MAINTAIN DISCHARGE TEMPERATURE AT SETPOINT.

9. HUMIDIFIER CONTROL
a. THE HUMIDIFIER CONTROL VALVE SHALL BE MODULATED TO MAINTAIN 35% RH AS MEASURED IN THE RETURN DUCT.
b. THE RETURN DUCT HUMIDITY LEVEL SHALL BE MONITORED AT THE USER WORKSTATION.
c. PROVIDE A HIGH LIMIT HUMIDITY SWITCH, AND AIRFLOW PROVING SAIL SWITCH.

G. SAFETY DEVICES:
1. THE UNIT SHALL GO INTO DISABLED MODE IF SMOKE IS DETECTED AT THE SMOKE DETECTOR LOCATED IN THE SUPPLY AND/OR RETURN DUCT.
2. IF THE FREEZESTAT SERPENTINED ACROSS THE COOLING COIL FACE SENSES A TEMPERATURE BELOW AT 36F (OR AS SET), THE UNIT SHALL GO INTO DISABLED MODE AND ALARM SHALL BE INITIATED.
3. IF THE DISCHARGE AIR TEMPERATURE DROPS BELOW SETPOINT BY 2 DEGREES FOR 5 MINUTES AND THE HEATING COIL VALVE IS FULLY OPEN, THE OSA ECONOMIZER DAMPER SHALL BE FULLY CLOSED, AND THE MINIMUM OSA DAMPER SHALL BE SLOWLY MODULATED TOWARDS CLOSED TO PREVENT THE UNIT FROM GOING INTO DISABLED MODE. A LOW OSA FLOW ALARM SHALL BE INITIATED.
4. AN ALARM SHALL BE ACTIVATED ANYTIME THE AIR HANDLER UNIT IS COMMANDED "ON" AND EITHER THE SUPPLY FAN OR RETURN FAN FAILS TO OPERATE.
5. FILTER MONITORING: THE PREFILTERS SHALL BE CHANGED OUT AT 0.5"W.C. AN ALARM SHALL BE LOGGED AT THE USER WORKSTATION WHEN THE DP ACROSS THE PREFILTERS REACHES THIS SETPOINT. THE FINAL FILTERS SHALL BE CHANGED OUT AT 1.0"W.C. AN ALARM SHALL BE LOGGED AT THE USER WORKSTATION WHEN THE DP ACROSS THE FINAL FILTERS REACHES THIS SETPOINT.
6. FAN SAFETIES:
a. THE UNIT SHALL GO INTO DISABLED MODE AND AN ALARM SHALL BE INITIATED IF A STATIC PRESSURE OF 6" (ADJ.) IS MEASURED DOWNSTREAM OF THE FINAL FILTERS.
b. THE UNIT SHALL GO INTO DISABLED MODE AND AN ALARM SHALL BE INITIATED IF A NEGATIVE STATIC PRESSURE OF 2.5" IS MEASURED AT THE INLET OF THE RETURN FAN.
c. INITIATE AN ALARM IF SUPPLY FAN IS ENABLED AND OPERATION IS NOT PROVEN BY A CURRENT SWITCH AFTER 2 MINUTES.
d. INITIATE AN ALARM IF SUPPLY FAN IS ENABLED AND RETURN FAN OPERATION IS NOT PROVEN BY A CURRENT SWITCH AFTER 2 MINUTES.
e. INITIATE AN ALARM IF DISCHARGE AIR TEMPERATURE DEVIATES FROM SETPOINT BY 4 DEGREES FOR 5 MINUTES.

H. THE FOLLOWING POINTS SHALL BE AVAILABLE FOR MONITORING AT THE USER WORKSTATION:
1. OUTSIDE AIR TEMPERATURE.
2. MIXED AIR TEMPERATURE.
3. DISCHARGE AIR TEMPERATURE.
4. SUPPLY AIRFLOW.
5. RETURN AIRFLOW.
6. MINIMUM OUTSIDE AIRFLOW.
7. RETURN AIR HUMIDITY LEVEL.
8. SUPPLY FAN SPEED IN HZ.
9. RETURN FAN SPEED IN HZ.
10. SUPPLY FAN STATUS
11. RETURN FAN STATUS
12. FREEZE-PROTECTION PUMP STATUS
13. OUTSIDE AIR DAMPER POSITION
14. RETURN DAMPER POSITION
15. RELIEF DAMPER POSITION
16. PRE-FILTER PRESSURE DROP
17. FINAL FILTER PRESSURE DROP




# ZONE SEQUENCE OF OPERATION

A. VAV CONTROL: MODULATE THE VARIABLE AIR VOLUME DAMPER TO MAINTAIN ZONE TEMPERATURE AT SETPOINT. ON A RISE OF TEMPERATURE ABOVE THE COOLING SET POINT, THE VAV TERMINAL UNIT DAMPER SHALL MODULATE OPEN. AS THE TEMPERATURE DROPS BELOW THE SPACE SET POINT, THE TERMINAL UNIT SHALL MODULATE TOWARDS ITS MINIMUM CFM. AS THE SPACE TEMPERATURE CONTINUES TO FALL TO THE HEATING SET POINT, THE PROPORTIONAL HOT WATER VALVE SHALL MODULATE OPEN. FOR ZONES THAT CONTAIN RADIANT HEAT, THE RADIANT HEATING OPERATES INDEPENDENTLY FROM THE VAV CONTROLS.

B. PROVIDE NIGHT SETBACK AND MORNING WARM-UP AS REQUIRED BY THE ASSOCIATED SYSTEM.
C. IF DURING THE OCCUPIED PERIOD THE ZONE OCCUPANCY SENSORS ALL DETERMINE THAT THE ROOM IS UNOCCUPIED, THE BOX SHALL MODULATE TO MINIMUM POSITION. IF ANY ONE OF THE OCCUPANCY SENSORS SHOWS THAT THE SPACE IS OCCUPIED, THE TERMINAL BOX SHALL OPERATE AS NORMAL.
D. PROVIDE A TEMPERATURE SENSOR LOCATED IN THE DISCHARGE OF EACH TERMINAL BOX TO MONITOR THE DISCHARGE AIR TEMPERATURE AT THE BOX OUTLET. THIS POINT SHALL BE MONITORED AT THE USER WORKSTATION.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