

Sequence of Operation for Variable Volume Type FAHU with Plate Heat Recovery

Below sequence of operation is for Variable Volume Type FAHU with Plate Heat Recovery system. The system shall be variable volume package Fresh Air Handling Unit. The scope of the unit shall consist of:

Supply Side accessories

- Intake motorized damper
- Panel (Pleated)Filter
- Bag Filter
- Cooling Coil
- Supply Fan (with VFD)
- Plate Heat Exchanger
- Intake and discharge attenuators
- Sensors and controls (refer to BMS Schematic Diagrams)

Exhaust Side Accessories

- Exhaust motorized damper
- Panel (Pleated Filter)
- Exhaust fan (with VFD)
- Intake and Discharge attenuators
- Sensors and controls (refer to BMS Diagrams)

AHU Sequence of Operation



- The fresh air handling units (FAHU's) shall serve the fresh air requirements of Kitchen area and other Back of House (BOH) areas such as plant rooms and store rooms.

- The Variable Volume fresh air handling units (FAHUs) shall operate under the dictates of one of the DDC controllers inbuilt time schedules and control in the following manner.
- On FAHU's start-up, the fresh air and exhaust motorized dampers with their respective positions confirmed by damper feedback shall open and shall be interlocked with the fresh (supply) and extract air fans respectively.
- Proof of fan start shall be sensed via the differential pressure switch fitted across motor.
- Duct mount temperature sensors located fresh (supply) air duct shall modulate the 2 port valve of the cooling coil to maintain the fresh (supply) air set point temperature of 12°C (adjustable).
- These AHU's are distributing conditioned air via VAV units to the conditioned spaces. When the VAV modulating dampers start closing, the pressure in the supply duct rises. The supply air duct is provided with pressure sensor at 2/3rd distance, which gives 0-10vdc signal to DDC corresponding to increase in the duct pressure.
- On receiving the signal, the DDC gives a 0-10vdc to the fan motor VFD to reduce the speed. The supply pressure set point will be adjustable as per load requirement. The operator can adjust the supply pressure set point from BMS Workstation at any time.
- A variable volume return fan shall be provided. The extract fan shall be disabled when the BMS signals a shutdown period.
- The exhaust fan operation signal shall be disabled if a supply fan fail signal is received by the BMS. The fan shall be enabled when the BMS signals for the air handling plant to operate and the outside air and exhaust air dampers are proven open. The fan operation shall be proven when the differential air pressure switch signal is detected.
- When the proven signal is not detected, following a 30second start-up period, a fan failure warning signal shall be sent to the BMS and the fan operation signal shall be removed. The fan operation signal shall be disabled when an overload relay in MCC has tripped.
- The extract and associated fresh (supply) air fan shall be interlocked so that they only operate in unison. A hand/off/auto selector switch shall be located on the extract fan control panel. The extract fan motor shall be hardwired to this selector switch, the supply fan fail and the damper proving end switches.

Interlocking of Dampers & Fans

- When the Kitchen Exhaust fan is activated (either within the kitchen or via BMS), an individual command to start the supply air VAV boxes damper will be motored to the fully open (design) position (in case of the VAV boxes are partially open to suit the room temperature requirement during night setback). Once the respective VAV damper position have reached the desired point, software shall provide the required confirmation to the DDC controllers and the fresh (supply) air fan and extract fan will be abled.
- Therefore the operation of supply air VAV boxes is interlocked with Kitchen extract fan, such that if the kitchen extract fan run the make-up air system shall be available. When the Kitchen extract fan is closed, the supply air VAV boxes shall modulate to satisfy the room temperature requirement.

Temperature Control Philosophy

- The supply air volume control set point shall have a minimum set point (adjustable) determined during commissioning, this set point shall be increased linearly when the zone temperature rises above the cooling set point of 12°C (adjustable). The maximum and minimum supply temperatures shall be defined as 22°C and 11°C. Variation of supply air temperature is to operate as follows:-
- The BMS is to review the outputted motorized (modulating) damper positional feedback. The fan operation shall be proven when the differential air pressure switch signal is detected.
- When the proven signal is not detected, following a 30second start-up period, a fan failure warning signal shall be sent to the BMS and the fan operation signal shall be removed. The fan operation signal shall be disabled when an overload relay in MCC has tripped.
- Once flow is established the system will allow its temperature control algorithm to operate and the exhaust fan shall be started.
- A chilled water coil with a 2 port pressure independent control valve shall be provided for fresh (supply) air dehumidification and sensible cooling. The CHW valve shall be positioned closed when the air handling plant is not operating and when the BMS signals a low outside temperature.
- The chilled water valve shall be fully open when the BMS signals a high outside temperature. The valve shall fully open when the fresh (supply) air fan is proven and the BMS signals an optimum

cooling start operation. The valve position shall be modulated for supply air temperature control when a normal operating period is signalled by the BMS and the supply fan is proven.

- The CHW valve's position is modulated in response to a PI control signal in order to obtain the required set point.
- A variable volume fresh (supply) air fan shall be provided with VFD for commissioning and system operation flexibility to operate as variable volume. The fresh (supply) air fan shall be disabled when the BMS signals a shutdown period.
- A hand/off/auto selector switch shall be located on the fresh (supply) air fan control panel. The fresh (supply) air fan motor shall be interlocked to this selector switch and to the extract fan fail and the damper feedback.
- A smoke detection device shall be provided in the extract (return) air ductwork. On sensing smoke the fresh (supply) air fan (and extract fan) shall be stopped and an alarm raised at the BMS central supervisor. The detector shall be manually reset by the Fire Alarm Panel.
- A variable volume extract fan shall be provided with VFD for initial commissioning and flexibility. The extract fan shall be disabled when the BMS signals a shutdown period. The fan operation signal shall be disabled if a supply fan fail signal is received by the BMS.
- Monitoring of the cleanliness of the air filters shall be provided by sensors measuring the differential pressure across the filters. An alarm shall be generated to BMS in case the differential pressure across each filter bank exceeds the set-point decided during commissioning (adjustable).
- The supply air temperature set point shall be scheduled linearly when the BMS signals normal operation. The supply air temperature shall be fixed according to outdoor air temperature, typically at 12.0°C (adjustable) whenever outdoor air temperature is above 22°C (adjustable).
- If the supply air temperature rises above a set point of 24°C or below a set point of 10°C during normal operation the **BMS** shall give a supply air temperature high/low warning.