Fresh Air Handling Unit with Heat Recovery Wheel

The Fresh Air Handling Unit with Heat Recovery Wheel are located in roof level of each block and supply fresh air to all the re-circulating AHU's in the respective towers (Block A, B, E & F).

Each unit is comprised of:

- Variable speed Supply Air Fan.
- Fixed Speed Extract Air Fan.
- Fixed Speed Smoke Extract Air Fan
- Heat recovery wheel, to pre-cool the fresh air supply at the point of entry to the cooling coil.
- 2-way cooling modulating valve (Primary & Secondary).
- Thyristor Heater
- Pre & Bag Filter for Fresh Air
- Pre Filter for Extract Air
- On/Off type Fresh Air Damper

The sequence of operation of the unit shall be as follows:

Supply Air Fan Control

i. The FAHU Supply air fan shall be operated by the BMS when:
   a) The HOA switch of the supply fan is in "Auto" position.
   b) The supply fan trip signal is in NORMAL state.

ii. Once the above conditions are satisfied, FAHU is enabled to start in Auto mode (based on time schedule) or using a plant enable button on the graphics in manual mode by operator. Once enabled BMS will automatically command fresh air damper to "OPEN".

iii. BMS will monitor the damper status. If the damper open status from damper end switch is not received within preset time delay of 120 sec after open command is issued then an alarm will be generated and latched on the BMS and FAHU enable command shall be disabled:

iv. After confirmation of dampers open status, BMS will command supply fan to start. Once the start command is issued then BMS shall monitor the differential pressure airflow switch of the fan. If the airflow switch signal is proved "ON" then BMS will enable temperature control loop to modulate the cooling coil valve, dehumidification control loop, Supply fan speed control loop, Exhaust Air Fan control and Heat Recovery Wheel Control.

v. If the fan run status from the Differential pressure airflow switch is not proved 'On' within preset time delay of 120 seconds after the start command is being issued then an alarm will be generated and latched on the BMS and the FAHU enable command shall be disabled. BMS will automatically command fresh air damper to close.

vi. The controls shall be programmed to operate the AHU for continuous 24 Hours, 7 days a week time schedule in normal mode of operation. Only in case of Fire Alarm signal for respective zone, BMS will operate the FAHU as per the detailed sequence mentioned below in Fire & Smoke mode operation.

vii. The operator can stop the FAHU from the BMS anytime; however, the default state of the FAHU when the DOC is reset or powered up is START.

viii. When the FAHU is stopped or if the run status from the Differential pressure airflow switch is not proved 'ON' then the cooling valve will be closed i.e., 0% will be shown on the BMS.

ix. To do the supply fan - start /stop, the manual mode check box provided in the graphics should be checked and then the Start/Stop button should be selected to START or STOP option as required. Please note that while starting the FAHU supply fan in manual mode, first Fresh Damper should be command to open and its status is confirmed Open. Operator should uncheck the mode checkbox to run the system in Auto mode.

Extract Air Fan Control

i. The FAHU Extract Fan shall be operated by the BMS when:

a) The HOA switch of the Extract fan is in "Auto" position.

b) The Extract fan trip signal is in NORMAL state.

c) FAHU Supply air fan run status is proved running

d) Fire Alarm signal is in Normal state

i. Once the above conditions are satisfied then BMS will automatically start the extract air fan. Once the start command is issued then BMS shall monitor the differential pressure airflow switch of the fan.

ii. If the Extract fan status from DPS switch is not received within preset time delay of 120 seconds after start command is issued then an alarm will be generated and latched on the BMS subsequently FAHU enable command shall be disabled.

iii. To do the extract fan - start /stop, the manual mode check box provided in the graphics should be checked and then the Start/Stop button should be selected to START or STOP option as required. Please note that while starting the FAHU extract fan in manual mode, first Fresh Damper should be commanded to open and its status is confirmed Open. Operator should uncheck the mode checkbox to run the system in Auto mode.

The following points monitored by BMS will have no action on the operation of the air- handling unit.

- Extract Air Temperature
- Heat Wheel Extract Air Temperature
- Off coil Supply Air Temperature/ Humidity
- Outside Air Temperature / Humidity

Heat Recovery Wheel Operation

Heat recovery wheel is used to pre-cool the fresh air at the point of entry to the FAHU before reaching it to cooling coil.

i. The Heat wheel shall be operated automatically when:

a) The Heat Wheel TRIP signal is in NORMAL position.

b) The extract air fan of the FAHU is running, i.e., run status is ON.

.c) Fire Alarm signal is in Normal state

ii. Once the above conditions are satisfied then BMS will automatically start the Heat Recovery Wheel.

iii. To Start/ Stop the HRW, the manual mode check box provided in the graphics should be checked and then the Start/Stop button should be selected to START or STOP option as required. Operator should uncheck the mode chf;3ckbox to run the system in Auto mode.

iv. The BMS will calculate the Fresh, Supply and exhaust air enthalpies for heat recovery wheel efficiency evaluation.

Temperature Control Loop

The supply temperature sensor installed in the supply air duct after Thyristor heater will relay the measured signal (temperature) to the DOC controller, the DOC controller compares

this signal with the set-point (adjustable by the operator from BMS central) and generates an analogue output to the 2-way modulating cooling valve. Based on the difference between the two values, a Proportional - Integral - Derivative program will determine the percentage of the cooling coil valves opening to achieve the desired condition. Initially primary cooling coil valve (small cooling coil) will be modulated / open fully to achieve desired condition. In the event, if the primary cooling coil is unable to achieve desired condition after opening fully (100%) then Secondary cooling coil valve (Bigger Cooling Coil) will modulate to achieve desired condition, if applicable. The 2-way valve is mounted on the CHW return pipe. The default set-point value for the supply air temperature is 19.5 °C (Adjustable)

In the event if supply air temperature is below its set point and both cooling coil valves are fully closed then BMS will modulate electric heater current to achieve the desired supply air temperature condition.

Dehumidification Control

The supply air Humidity sensor installed in the supply air duct after Thyristor heater will relay the measured signal (humidity) to the DOC controller. If the supply air humidity is above its high humidity set point 70% RH (user adjustable) then BMS will modulate the cooling coil valve based on either Humidity control loop output or Temperature control loop output whichever is higher.

BMS will continuously monitor the supply air temperature and if it goes below its set point then BMS modulate electric heater current to achieve the desired supply air temperature condition.

Fan Speed Control Loop

In Normal mode the supply fan will be running at its maximum speed. But ari option will be provided in the graphics for the operator to change the speed if a requirement comes.

The extract air fan will always be running at constant speed.

Fire & ***Smoke Mode Operation***

Fire alarm system will provide common Fire Alarm signal for respective zone. On receipt of this signal BMS will shutdown the FAHU Extract air Fan and HRW. The supply air fan will continue to run to provide fresh treated air to one floor above and below the fired floor.

FAS system will close all the Fresh air dampers (SMFD) of all the recirculating AHU's except one floor above and below the fired floor, as applicable. This is used to minimize the impact of fire by pressurizing the floors (one above and one below) by fresh air.

Once the fire alarm signal is normalized BMS will automatically issue the command to switch ON the unit as per normal mode of operation.

Alarm Reset

When the supply air fan start command is issued by the BMS, then the BMS monitors the TRIP status of the fan & the RUN status of the fan from differential pressure switch. In case that if any of the status goes to OFF/ALARM condition, then BMS will generate a FAN FAIL ALARM (point will be displayed on the central graphic). This alarm shall be latched until the operator resets it. The unit start/stop command shall be OFF from the BMS until this alarm is reset.

When the extract air fan start command is issued by the BMS, then the BMS monitors the TRIP status of the fan & the RUN status of the fan from differential pressure switch. In case that if any of the status goes to OFF/ALARM condition, then BMS will generate a FAN FAIL ALARM (point will be displayed on the central graphic). This alarm shall be latched until the operator resets it. The unit start/stop command shall be OFF from the BMS until this alarm is reset.

Plant Reset

If the unit is in "Fail" condition, then the operator can reset this alarm by using the plant- reset button available on graphic screen or by putting the respective equipment H/O/A switch status in OFF or HAND mode and bringing it back to AUTO mode from local control panel (This provision is provided to facilitate the operator to reset respective equipment alarms in case graphic central communication fails with controllers). To do the Plant-reset, the manual mode check box provided in the graphics should be checked and then the RESET option should be selected. Once the RESET is activated it will come back to NORMAL state automatically after predefined delay time and mode checkbox will be unchecked automatically.

Alarms

The following alarms would be generated on BMS.

Pre Filter Dirty Alarm: This is generated when the pressure drop across pre filter exceeds the differential pressure switch setting and the filter is dirty.

Bag Filter Dirty Alarm: This is generated when the pressure drop across bag filter exceeds the differential pressure switch setting and the filter is dirty.

Supply Fan Trip: This is generated when the supply air fan motor is tripped as sensed by panel volt free contact.

Extract Fan Trip: This is generated when the extract air fan motor is tripped as sensed by panel volt free contact.

Heat Recovery Wheel Trip: This is generated when the HRW fan motor is tripped as sensed by panel volt free contact

Temperature High & Low: Temperature HIGH and LOW alarms will be generated if the supply air temperature rises above or falls below the supply air temperature alarm limits.

Humidity High & Low: Humidity HIGH and LOW alarms will be generated if the supply air humidity rises above or falls below the alarm limits.

Not In Auto: If any of the fan and HRW HOA switch is not in 'Auto' position as sensed by panel volt free contact then this alarm will be generated.

The above alarms are active on the BMS irrespective of whether the HOA switch is in "Hand" or "Auto" position.

Damper Fail: In case the damper fails to open or if the damper open status from the damper end switch is not giving the signal according to the command (given from the BMS) due to any reason then an alarm will be generated.

Supply Fan Fail: In case the fan fails to start or if the run status from the differential pressure switch is not giving the signal according to the command (given from the BMS) due to any reason or the fan is giving the trip status then an alarm will be generated.

Extract Fan Fail: In case the extract air fan fails to start or if the extract fan run status from the differential pressure switch is not giving the signal according to the command (given from the BMS) due to any reason or the fan is giving the trip status then an alarm will be generated.