

Makeup Air Handler & Zone Temperature Controls Description TD80029

1. Operating Philosophy

1.1. Purpose

The purpose of the makeup air handlers and zone temperature operations are to:

1. Control the ten zone air temperatures. The ten zones include high bay airlock, utility vault #1, utility vault #2, utility vault #3, utility vault #4, bottom loading area, carbon filter room, service gallery, manipulator gallery, and decon room.
2. De-energize makeup air handler fans/dampers upon detection of smoke
3. Provide the operator with modes of operation that insure adequate control and aid in trouble shooting and startup testing
4. Provide humidity control for the output of the makeup air handlers
5. Provide manual control of makeup air fan speeds to control air flow.

1.2. Assumptions

1. The makeup air fan will be set to 100% speed in all modes except Air Flow Control mode.
2. Outside air will always be utilized when the makeup air handlers are running.
3. The high bay airlock zone air handler only heats the zone, therefore, it may not always be possible to maintain this temperature at its setpoint
4. The zone air handlers for the utility vault #1, utility vault #2, utility vault #3, utility vault #4, bottom loading area and carbon filter room only cool the zones, therefore, it may not always be possible to maintain this temperature at its setpoint.
5. Space temperature setpoints will not be automatically changed (such as between winter and summer). Manually changing the setpoints will be possible.
6. A smoke damper in the air handler outlet must be closed when the makeup air handler fans/dampers are de-energized and open when the fans/dampers are energized. This action is provided by hardwiring in the MCC, not PLC logic. Closing the dampers in response to a smoke detection signal from the fire alarm system is accomplished by de-energizing the fans/dampers.
7. The Fire Alarm Control Panel (FACP) provides a hardwired signal to shutdown the makeup air handler fans/dampers in response to detection of smoke.
8. A freeze warning alarm will be provided if the preheat discharge temperature falls below 45 degF.

1.3. Operator Controls and Operating Modes

1. OFF: Makeup air handler and zone heaters are not in use. All dampers are closed, heating valve is closed, chilled water valve is closed, and humidity valve is closed. Setpoints remain at last setting.
2. Auto: Logic determines the air handler coil discharge temperature setpoint from the actual outside air temperature based on the following table: 85 DegF if outside air temperature is below 13 DegF, 53 DegF if outside air temperature is above 53

DegF, and use linear interpolation if outside air temperature is between 13 DegF and 53 DegF. Utilize a 2 DegF deadband around the 13 DegF and 53 DegF values to avoid constant switching. For example, if the setpoint is 85 DegF because the outside air temperature is below 13 DegF, don't change the setpoint until the outside air temperature is above 15 DegF. If the setpoint is being interpreted because the outside air temperature is between 13 DegF and 53 DegF, don't set the setpoint to 85 DegF until the outside air temperature falls below 11 DegF. The preheat coil discharge temperature will be maintained by modulating the heating control valve, while the supply air temperature will be maintained by modulating the cooling control valve. Fans/dampers are energized. Zone heaters will modulate the heating/cooling control valve to maintain the zone temperature setpoint. Space humidity will be controlled to the humidity setpoint by modulating the humidifier setpoint.

3. Heat: Air handler is forced to control space temperature with heat. Fans/dampers are energized. Humidity valve is closed, and chilled water valve is closed. Heating water valve is modulated. Zone heaters will modulate the heating/cooling control valve to maintain the zone temperature setpoint.
4. Cool: Air handler is forced to control space temperature with chilled water. Fans/dampers are energized. Humidity valve is closed, and heating water valve is closed. Chilled water valve is modulated. Zone heaters will modulate the heating/cooling valve to maintain the zone temperature setpoint.
5. Humidity Only: Air handler is forced to control humidity with the humidifier valve. Heating water control valve and chilled water control valve are closed. Zone heaters will modulate the heating/cooling control valve to maintain the zone temperature setpoint.

2. Operator Interface Definitions

2.1. Local Hardware/Manual Operator Controls

1. HOA switch on MCC for supply fan starter (*HS2515, HS2516, HS2517, HS2519, HS2527, HS2528, HS2524, HS2525, HS2526*)
2. Pressure differential indicator across air filter (*PDI2500, PDI2501, PDI2502, PDI2503*)
3. Chilled water supply temperature indicator (*TI2500D, TI2501D, TI2502D, TI2503D*)
4. Chilled water return temperature indicator (*TI2500C, TI2501C, TI2502C, TI2503C*)
5. Heated water supply temperature indicator (*TI2500B, TI2501B, TI2502B, TI2503B*)
6. Heated water return temperature indicator (*TI2500A, TI2501A, TI2502A, TI2503A*)
7. Humidifier water pressure indicator (*PI2500, PI2501, PI2502, PI2503*)
8. Humidifier water pressure indicator hand valve (*HV2500, HV2501, HV2502, HV2503*)
9. Zone heater heated water return temperature indicator (*TI2575A, TI2524A, TI2525A, TI2526A*)

10. Zone heater heated water supply temperature indicator (*TI2575B, TI2524B, TI2525B, TI2526B*)
11. Zone cooling chilled water return temperature indicator (*TI2515A, TI2516A, TI2517A, TI2519A, TI2527A, TI2528A, TI2524C, TI2525C, TI2526C*)
12. Zone cooling chilled water supply temperature indicator (*TI2515B, TI2516B, TI2517B, TI2519B, TI2527B, TI2528B, TI2524D, TI2525D, TI2526D*)
13. FAULT indicator light on MCC
14. READY indicator light on MCC
15. RUN indicator light on MCC

2.2. Software HMI/EPICS Digital Operator Controls

1. Temperature control mode (selection switch)
 - a. Off
 - b. Semi- Auto (Heat Only)
 - c. Semi- Auto (Cool W/CHW)
 - d. Semi- Auto (Humidity Only)
 - e. Auto
 - f. Zone Heaters Off
 - g. Zone Heaters Auto
 - h. Air Control Off
 - i. Air Control Manual

2.3. Software HMI/EPICS Digital Displays

1. Mode switch status
 - a. OFF
 - b. Auto
 - c. Semi- Auto (Heat Only)
 - d. Semi- Auto (Cool W/CHW)
 - e. Semi- Auto (Humidity Only)
 - f. Zone Heaters Off
 - g. Zone Heaters Auto
 - h. Air Control Off
 - i. Air Control Manual
2. Smoke detector status from fire alarm system (*NE2500, NE2501, NE2502, NE2503*)
3. Supply air fan HOA switch status (*HS2515, HS2516, HS2517, HS2519, HS2527, HS2528, HS2524, HS2525, HS2526*)
4. Supply air fan/damper status (*F2500/SOV2500A/FCV2500A/SOV2500B/FCV2500B, F2501/SOV2501A/FCV2501A/SOV2501B/FCV2501B, F2502/SOV2502A/FCV2502A/SOV2502B/FCV2502B, F2503/SOV2503A/FCV2503A/SOV2503B/FCV2503B, F2515, F2516, F2517, F2519, F2527, F2528, F2524, F2525, F2526*)
5. Zone fan pressure differential status (*PDS2515, PDS2516, PDS2517, PDS2519, PDS2527, PDS2528, PDS2524, PDS2525, PDS2526*)

2.4. Software HMI/EPICS Analog Operator Controls

1. Temperature cooling sp (return air for building space)

2. Temperature heating sp (return air for building space)
3. Zone temperature sp (zone temperatures)
4. Humidity sp (humidity for building space)
5. Air flow speed sp (fan speed)

2.5. Software HMI/EPICS Analog Displays

1. Outside air temperature (*TT2500C, TT2501C, TT2502C, TT2503C*)
2. Outside air humidity (*MT2500C, MT2501C, MT2502C, MT2503C*)
3. Preheat coil discharge air temperature (*TT2500B, TT2501B, TT2502B, TT2503B*)
4. Supply air temperature (*TT2500A, TT2501A, TT2502A, TT2503A*)
5. Supply air flow rate (*FT2500, FT2501, FT2502, FT2503*)
6. Building/zone space humidity (*MT2500A, MT2501A, MT2502A, MT2503A*)
7. Zone space air temperatures (*TT2515, TT2516, TT2517, TT2519, TT2527, TT2528, TT2524, TT2525, TT2526, TT2575*)
8. Building/zone heated water valve controller output (*IP2500A/TCV2500A, IP2501A/TCV2501A, IP2502A/TCV2502A, IP2503A/TCV2503A, IP2575/TCV2575, IP2524B/TCV2524B, IP2525B/TCV2525B, IP2526B/TCV2526B*)
9. Building/zone chilled water valve controller output (*IP2500B/TCV2500B, IP2501B/TCV2501B, IP2502B/TCV2502B, IP2503B/TCV2503B, IP2515/TCV2515, IP2516/TCV2516, IP2517/TCV2517, IP2519/TCV2519, IP2527/TCV2527, IP2528/TCV2528, IP2524A/TCV2524A, IP2525A/TCV2525A, IP2526A/TCV2526A*)
10. Humidity valve controller output (*MC2500, MC2501, MC2502, MC2503*)
11. Supply fan speed/status (*SC2500/ST2500, SC2501/ST2501, SC2502/ST2502, SC2503/ST2503*)

2.6. Software HMI/EPICS Alarms (via EPICS Alarm Handler)

1. Preheat coil discharge air temperature low (45 DegF)
2. High and low temperature (5 degrees above or below setpoint)
3. High and low humidity
4. Smoke detected (*NE2500, NE2501, NE2502, NE2503*)
5. Makeup air fan alarm (*YA2500, YA2501, YA2502, YA2503*)
6. Total supply air flow alarm (drop by 5% or more)

3. Operational Modes Descriptions

3.1. Control Logic Description

In the OFF mode, the makeup air handler is de-energized and the dampers and all control valves are closed. If all makeup air handlers supplying a zone heating/cooling unit are off, the zone heating/cooling unit is de-energized and control valves closed.

Automatic temperature controls used in the AUTO mode work as follows:

If the outside air temperature is less than 13 DegF, then set the temperature heating setpoint to 85 DegF. If the outside air temperature is greater than 53 DegF, then set the temperature heating setpoint to 53 DegF. If the outside air temperature is between 13 DegF and 53 DegF, use linear interpolation to set the temperature heating setpoint between 53 DegF and 85 DegF. Utilize a 2 DegF

deadband around the 13 DegF and 53 DegF values to avoid constant switching. For example, if the setpoint is 85 DegF because the outside air temperature is below 13 DegF, don't change the setpoint until the outside air temperature is above 15 DegF. If the setpoint is being interpreted because the outside air temperature is between 13 DegF and 53 DegF, don't set the setpoint to 85 DegF until the outside air temperature falls below 11 DegF.

If the supply air temperature is greater than the temperature cooling setpoint, modulate the chilled water control valve to maintain the temperature cooling setpoint.

If the makeup air handlers associated with a zone are not in the Off mode and the zone unit is in Auto, modulate the zone cooling/heater control valve to maintain the space temperature at the zone temperature setpoint. If the zone unit is turned Off or the associated makeup air handlers are in the Off mode, close the heating/cooling valve.

If the makeup air handler is not in the Off mode, modulate the setpoint to the humidity controller to maintain the space humidity at the humidity setpoint.

In the manual modes the makeup air handler is forced to cool with chilled water by modulating the chilled water valve, heat by modulating the heating water valve, or adjust the humidity by modulating the humidifier control valve respectively.

When a makeup air handler is energized and the air flow control is in the Off mode, the fan speed will be set to 100%. If the air flow control is in the Manual mode, the fan speed will be set to the air flow speed setpoint.





