

Target Basement Level Air Handler & Zone Temperature Controls

Description

TD80028

1. Operating Philosophy

1.1. Purpose

The purpose of air handler and zone temperature operations are to:

1. Control the seventeen zone air temperatures. The seventeen zones include utility tunnel, PCE, SCE, south stairwell, HVAC/electrical, south corridor, delay/RCRA area, center corridor, HP office, men's locker room, women's locker room, DI water, counting lab, control room, fork lift charge (cold), communication, and north stairwell.
2. De-energize air handler fan/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 freeze protection for air handlers
5. Provide humidity control for the output of the air handlers

1.2. Assumptions

1. Outside air mixed with return air will always be utilized when the air handler is running.
2. The zone air handlers for the south stairwell, men's locker room, women's locker room, fork lift charge area, and north stairwell only heat the zones, therefore, it may not always be possible to maintain this temperature at its setpoint
3. The zone air handlers for the SCE, HVAC/electrical, south corridor, delay/RCRA area, HP office, DI water, control room, and communication room only cool the zones, therefore, it may not always be possible to maintain this temperature at its setpoint.
4. Space temperature setpoints will not be automatically changed (such as between winter and summer). Manually changing the setpoints will be possible.
5. A smoke damper in the air handler outlet must be closed when the air handler fan/damper is de-energized and open when the fan/damper is energized. This action is provided by hardwiring in the MCC, not PLC logic. Closing the damper in response to a smoke detection signal from the fire alarm system is accomplished by de-energizing the fan/damper.
6. A mechanical stop will be provided to prevent the outside air damper from completely closing. This will provide a minimum of outside air at all times and enable the pressure control loop to function at all times.
7. Roof exhaust fans can only be energized when the basement air handler unit is energized.
8. Freeze protection will be provided as follows:
 - a. If the coil air discharge temperature falls below 40 degF, the logic will:
 - i. De-energize air handler fans/dampers
 - ii. Open the valve to the heating coil to 50% to add heat

- iii. Generate an operator alarm
9. Signals from the fire alarm system, would override these commands.

1.3. Operator Controls and Operating Modes

1. OFF: Air handler and zone heaters are not in use. Roof exhaust fans and basement level air handler unit fan are de-energized. 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 space humidity based on the following table: 79 DegF if humidity is below 15%, 63 DegF if humidity is above 40%, and use linear interpolation if humidity is between 15% and 40%. Utilize a 1% deadband around the 15% and 40 % values to avoid constant switching. For example, if the setpoint is 79 DegF because the humidity is below 15%, don't change the setpoint until the humidity is above 16%. If the setpoint is being interpreted because the humidity is between 15% and 40%, don't set the setpoint to 79 DegF until the humidity falls below 14%. The supply temperature will be maintained (via heating control valve or chilled water control valve) and automatically transitions from one configuration to the other as appropriate. Fans/dampers are energized. Zone heaters will modulate the heating/cooling control valve to maintain the zone temperature setpoint. Roof exhaust fans will be energized or de-energized as commanded.
3. Heat: Air handler is forced to control discharge temperature with heat. Fans/dampers are energized. Outside air damper is opened, 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. Roof exhaust fans will be energized or de-energized as commanded.
4. Cool: Air handler is forced to control supply temperature with chilled water. Fans/dampers are energized. Outside air damper is opened, humidity valve is closed, and heating water valve is closed. Chilled water valve is modulated. Zone heaters will be de-energized. Roof exhaust fans will be energized and de-energized as commanded.
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. Roof exhaust fans are energized and de-energized as commanded. Zone heaters will modulate the heating/cooling control valve to maintain the zone temperature setpoint.
6. Exhaust Fan On: The roof exhaust fan is energized if the basement level air handler unit is energized.
7. Exhaust Fan Off: The roof exhaust fan is de-energized.

2. Operator Interface Definitions

2.1. Local Hardware/Manual Operator Controls

1. HOA switch on MCC for supply fan/damper starter (*HS2512, HS2518, HS2521, HS2529*)

2. Pressure differential indicator across air filter (*PDI2512*)
3. Chilled water supply temperature indicator (*TI2512D*)
4. Chilled water return temperature indicator (*TI2512C*)
5. Heated water supply temperature indicator (*TI2512B*)
6. Heated water return temperature indicator (*TI2512A*)
7. Humidifier water pressure indicator (*PI2512*)
8. Humidifier water pressure indicator hand valve (*HV2512*)
9. Zone heater heated water return temperature indicator (*TI2560A, TI2561A, TI2562A, TI2563A, TI2550A, TI2551A, TI2552A, TI2553A, TI2554A*)
10. Zone heater heated water supply temperature indicator (*TI2560B, TI2561B, TI2562B, TI2563B, TI2550B, TI2551B, TI2552B, TI2553B, TI2554B*)
11. Zone cooling chilled water return temperature indicator (*TI2518A, TI2521A, TI2529A, TI2560C, TI2561C, TI2562C, TI2563C, TI2555A, TI2556A, TI2557A, TI2558A, TI2559A*)
12. Zone cooling chilled water supply temperature indicator (*TI2518B, TI2521B, TI2529B, TI2560D, TI2561D, TI2562D, TI2563D, TI2555B, TI2556B, TI2557B, TI2558B, TI2559B*)
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. Roof Exhaust Fans Off
 - i. Roof Exhaust Fans On

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. Roof Exhaust Fans Off
 - i. Roof Exhaust Fans On
2. Smoke detector status from fire alarm system (*NE2512A, NE2512B*)
3. Supply air fan/damper HOA switch status (*HS2512, HS2518, HS2521, HS2529*)

4. Roof exhaust fan HOA switch status (*HS2539, HS2540*)
5. Supply air fan/damper status (*F2512/SOV2512A/FCV2512A/SOV2512B/FCV2512B, F2518, F2521, F2529*)
6. Roof exhaust fan status (*EF2539, EF2540*)
7. Roof exhaust fan pressure differential status (*PDS2539, PDS2540*)
8. Zone cooling fan pressure differential status (*PDS2518, PDS2521, PDS2529*)

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)

2.5. Software HMI/EPICS Analog Displays

1. Return air flow (*FT2512B*)
2. Coil discharge air temperature (*TT2512B*)
3. Supply air temperature (*TT2512A*)
4. Supply air flow rate (*FT2512A*)
5. Building/zone space humidity (*MT2512, MT2560, MT2561, MT2562, MT2563*)
6. Zone space air temperatures (*TT2518, TT2521, TT2529, TT2560, TT2561, TT2562, TT2563, TT2555, TT2556, TT2557, TT2558, TT2559, TT2550, TT2551, TT2552, TT2553, TT2554*)
7. Building/zone heated water valve controller output (*IP2512A/TCV2512A, IP2560A/TCV2560A, IP2561A/TCV2561A, IP2562A/TCV2562A, IP2563A/TCV2563A, IP2550/TCV2550, IP2551/TCV2551, IP2552/TCV2552, IP2553/TCV2553, IP2554/TCV2554*)
8. Building/zone chilled water valve controller output (*IP2512B/TCV2512B, IP2518/TCV2518, IP2521/TCV2521, IP2529/TCV2529, IP2560B/TCV2560B, IP2561B/TCV2561B, IP2562B/TCV2562B, IP2563B/TCV2563B, IP2555/TCV2555, IP2556/TCV2556, IP2557/TCV2557, IP2558/TCV2558, IP2559/TCV2559*)
9. Humidity valve controller output (*MC2512*)

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

1. Coil discharge air temperature low (45 DegF)
2. Coil discharge air temperature low low (40 DegF)
3. High and low temperature
4. High and low humidity
5. Smoke detected

3. Operational Modes Descriptions

3.1. Control Logic Description

In the OFF mode, the air handler, zone heaters, and roof exhaust fans are not in use. The dampers and all control valves are closed.

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

If the building space humidity is less than 15%, then set the temperature cooling setpoint and temperature heating setpoint to 79 DegF. If the building space humidity is greater than 40%, then set the temperature cooling setpoint and temperature heating setpoint to 63 DegF. If the building space humidity is between 15% and 40%, use linear interpolation to set the temperature cooling and temperature heating setpoint between 63 DegF and 79 DegF. Utilize a 1% deadband around the 15% and 40% values to avoid constant switching. For example, if the setpoint is 79 DegF because the humidity is below 15%, don't change the setpoint until the humidity is above 16%. If the setpoint is being interpreted because the humidity is between 15% and 40%, don't set the setpoint to 79 DegF until the humidity falls below 14%.

If the coil discharge temperature is less than temperature heating setpoint, close the chilled water valve, and modulate the heating control valve to maintain the temperature heating setpoint.

If the coil discharge temperature is greater than the temperature cooling setpoint, close the heating water valve and modulate the chilled water control valve to maintain the temperature cooling setpoint.

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

If the air handler is not in the Off mode, modulate the zone cooling/heater control valve to maintain the space temperature at the zone temperature setpoint. For zone air handlers in the counting laboratory, PCE room, utility tunnel, and center corridor; the temperature setpoint is based on the zone humidity. If the zone humidity is less than 33%, then set the zone temperature setpoint to 85 DegF. If the zone humidity is greater than 50%, then set the zone temperature setpoint to 72 DegF. If the zone humidity is between 33% and 50%, use linear interpolation to set the zone temperature setpoint between 85 DegF and 72 DegF. Utilize a 1% deadband around the 33% and 50% values to avoid constant switching. For example, if the setpoint is 85 DegF because the humidity is below 33%, don't change the setpoint until the humidity is above 51%. If the setpoint is being interpreted because the humidity is between 33% and 50%, don't set the setpoint to 72 DegF until the humidity falls below 32%.

In the manual modes the 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.

If the basement level air handler is energized, the roof exhaust fans will be energized when the corresponding ON command is selected. The roof exhaust fan will be de-energized if the corresponding OFF command is selected or the basement level air handler is de-energized.

Freeze protection will be provided as follows:

- If the coil discharge air temperature falls below 40 degF, the logic will:
 - a. De-energize air handler fans/dampers
 - b. Open the valve to the heating coil to 50% to add heat
 - c. Generate an operator alarm





