108050000-TD0016-R00

Spallation Neutron Source

Injection Dump Makeup Air Handler Controls
Functional System Design (FSD)

January, 2003

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SNS Project Engineer

SNS

Operating Philosophy

Purpose:

The purpose of this air handler is to:

a) Condition outside air to an appropriate temperature and deliver it to the injection dump.
b) provide the operator with modes of operation that insure adequate control and aid in trouble shooting and startup testing
c) provide freeze protection

Assumptions:

1) This air handler has no smoke exhaust or tunnel exhaust role.
2) Outside air and discharge dampers will be closed when the air handler is de-activated and fully open when it is activated. (Modulation of dampers for control is not needed). Damper positions will be controlled by hardwiring in the MCC (no PLC logic is needed).
3) Temperature setpoints will not be automatically (such as between winter and summer). Manually changing the setpoints will be possible.
4) There is no energy saving attempt needed in the controls (except for heating only to 70 degF when heat is needed and cooling only to 85 degF when cooling is needed).
5) The pre-heat coil is used only to supply additional heat if the outside temperature is too low for the air handler to accommodate the heat load using only the re-heat coil.
6) There is no attempt to control humidity and no need for de-humidification.
7) Freeze protection will be provided as follows:
a) when air handler internal temperatures fall below 45 degF, the logic will issue a command to close the outside air damper and generate an operator alarm
b) if the temperature continues to fall below 40 degF, the logic will:
   De-energize air handler fans
   Open the valves to heating coils closest to the outside air to 50% to add heat
   Generate an operator alarm

Operator Controls and Operating Modes

1) Pre-heat, cooling coil discharge temperature, and air handler discharge temperature setpoints – the temperatures to which the pre-heat and cooling coil discharge air, and air handler unit discharge air are controlled.
2) OFF: Air handler is not in use. Fan is de-energized. Outside air damper is closed, heating valve is closed, chilled water valve is closed. Setpoints remain at last setting. If the pre-heat and cooling coil temperature falls below 45 degF, the pre-heat coil valve will be opened to prevent freezing.

3) Auto: Logic determines how the space setpoint temperature is to be maintained and automatically transitions from one configuration to the other as appropriate.
4) Pre-Heat Only: Air handler is forced to control pre-heat coil discharge temperature only. Fan is energized. Outside air damper is open, cooling coil and re-heat coil water valves are closed. Pre-heat coil water valve is modulated.
5) Cooling Only: Air handler is forced to control cooling coil temperature only. Fan is energized. Outside air damper is open, pre-heat coil and re-heat coil water valves are closed. Cooling coil water valve is modulated.
6) Re-Heat Only: Air handler is forced to control air handler discharge temperature only. Outside air damper is open, cooling coil and pre-heat coil water valves are closed. Re-heat coil water valve is modulated.

OPERATOR INTERFACE DEFINITIONS

Local Hardware/Manual Operator Controls

1) Air handler filter differential pressures *(PDI2350A, PDI2350B)*
2) Heating water supply temperature *(TI2350E)*
3) Heating water return temperature *(TI2350D)*
4) Cooling chilled water supply temperature *(TI2350G)*
5) Cooling chilled water return temperature *(TI2350F)*
6) HOA switch for air handler *(HS2350)*

Software HMI/EPICS Digital Operator (EPICS) Controls

1) Temperature Control Mode
   a. OFF (default)
   b. SEMI-AUTO – Pre-heat only
   c. SEMI-AUTO – Cooling only
   d. SEMI-AUTO – Re-heat only
   e. Auto

Software HMI/EPICS Digital Displays

1) Temperature Control Mode switch status
   a. OFF (default)
   b. SEMI-AUTO – Pre-heat only
   c. SEMI-AUTO – Cooling only
   d. SEMI-AUTO – Re-heat only
   e. AUTO
2) HOA switch status *(HS2350)*

<u>Software HMI/EPICS Analog Operator Controls</u>

1) Pre-heat temperature setpoint
2) Cooling temperature setpoint
3) Re-heat temperature setpoint

<u>Software HMI/EPICS Analog Displays</u>

1) Pre-heat discharge air temperature *(TT2350B)*
2) Air handler discharge temperature *(TT2350C)*
3) Space temperature *(TT2350A)*
4) Air handler supply air flow *(FT2350)*
5) Pre-heat control valve command position *(IP2350C)*
6) Cooling control valve command position *(IP2350B)*
7) Re-heat control valve command position *(IP2350A)*

<u>Alarms</u>

1) Pre-heat coil discharge air temperature high and low
2) Pre-heat coil discharge air less than 45 degF
3) Pre-heat coil discharge air less than 40 degF
4) Air handler discharge air temperature high and low
5) Air handler discharge air flow high and low

Control Logic States & Description

<u>Control Logic Description</u>

In the OFF mode the air handler is not in use. The dampers and all control valves are closed.

Unless signals are received from the fire alarm, PPS, or ODH systems, the freeze protection actions described above will be active at all times.

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

1) Mode switch is in Auto
2) Fan is turned on
3) Modulate pre-heat control valve to maintain the pre-heat discharge temperature at the pre-heat setpoint.
4) Modulate chilled water control valve to maintain the air handler discharge air temperature at the cooling setpoint.
5) Modulate the re-heat water control valve to maintain the air handler discharge air temperature at the re-heat setpoint.

Manual modes force the air handler to modulate only the pre-heating valve, cooling valve, or re-heat valve respectively as follows:

Semi-Auto (Pre-Heat Only)

1) Cooling control valve and re-heat control valve are closed
2) Fan is turned on, modulate pre-heat control valve to maintain Pre-heat setpoint

Semi-Auto (Cooling Only)

1) Pre-heat control valve and re-heat control valve are closed
2) Fan is turned on, modulate cooling control valve to maintain Cooling setpoint

Semi-Auto (Re-heat Only)

1) Pre-heat control valve and cooling control valve are closed
2) Fan is turned on, modulate re-heat control valve to maintain Re-heat setpoint