

Bureaucratic Affairs Building Heat Exchanger Leaving Water Temperature Control

Overview

This sequence applies to the Bureaucratic Affairs Building hot water system steam heat exchanger. The heat exchanger serves finned tube radiation, reheat coils, and a warm-up coil. It is intended to be in operation any time either of the heating hot water pumps are in operation to deliver 170°F water to the loads.

Steam Valve Control

A temperature sensor located in the discharge piping from the heat exchanger serves as an input to a direct acting Proportional plus Integral (PI) control loop. The output of the control loop is used to modulate a normally open steam valve via a 4-20 ma signal that, in turn generates a 3-15 psi pneumatic signal via an electro-pneumatic signal convertor for valve actuation.

The set point of the loop is reset based on outdoor air temperature. The reset schedule set points shall be operator adjustable by an operator with administrator credentials. The initial set points are as follows:

- The hot water supply temperature is 170°F when the outdoor air temperature is 7.4°F. These values represent the design conditions.*
- The hot water temperature is 102.5°F when the outdoor air temperature is 55°F. These values target matching the finned tube radiation performance to the perimeter heating load at 55°F outdoors with a 72°F indoor temperature.*

The set point is are limited to a maximum of 170°F and a minimum of 102.5°F, no matter what the output of the reset calculation is.

When the building is unoccupied, the hot water set point shall be maintained at 140°F to provide capacity for the night set back cycle when it is initiated.

As the supply temperature deviates above set point, the output of the control loop modulates from 4 ma towards 20 ma (3 psi towards 15 psi to the actuator), causing the normally open valve to modulate closed. As the supply temperature deviates below set point, the output of the control loop modulates from 20 ma towards 4 ma (15 psi towards 3 psi to the actuator), causing the normally open valve to modulate closed.

On a loss of power, a spring in the valve actuator drives the valve fully open.

The control loop gains *and set points* shall be tuned during the commissioning process through the warranty period, including monitoring of its operation by the commissioning provider to verify that the initial gain settings are appropriate for all of the operating conditions encountered over the course of a typical year. During the first year of operation after final acceptance, if signs of instability emerge, the control contractor shall re-tune the loop as needed to restore stability.

Interlock with Hot Water System Operation

Differential pressure switches are provided on each pump piped across the gauge taps on the pump suction and discharge flanges. The status of these switches is used to provide pump proof of operation input to the various control processes associated with the hot water system.

For the heat exchanger steam valve control process:

- If either of the pumps is in operation the heat exchanger control process shall be allowed to run.
- If neither of the hot water pumps are in operation, the heat exchanger control process is shut down to avoid wind-up and the output will be held at the last value generated by the control process prior to shut down.
- *If both of the hot water pumps are off, the steam valve shall be commanded fully closed.*

Trends and Graphics

Provide trends for the following points per the point list requirements.

- *Outdoor air temperature*
- *Hot water supply temperature*
- *Hot water return temperature*
- *Pump status*
- *Control loop set point*
- *Steam valve command*

These points shall also be displayed on the graphic for the hot water system.

Provide an alarm for the hot water supply temperature per the requirements of the point list. Alarms shall be annotated on the system graphic but the alarm messages shall be routed to the alarm printer to prevent tying up the operator work station during an emergency.