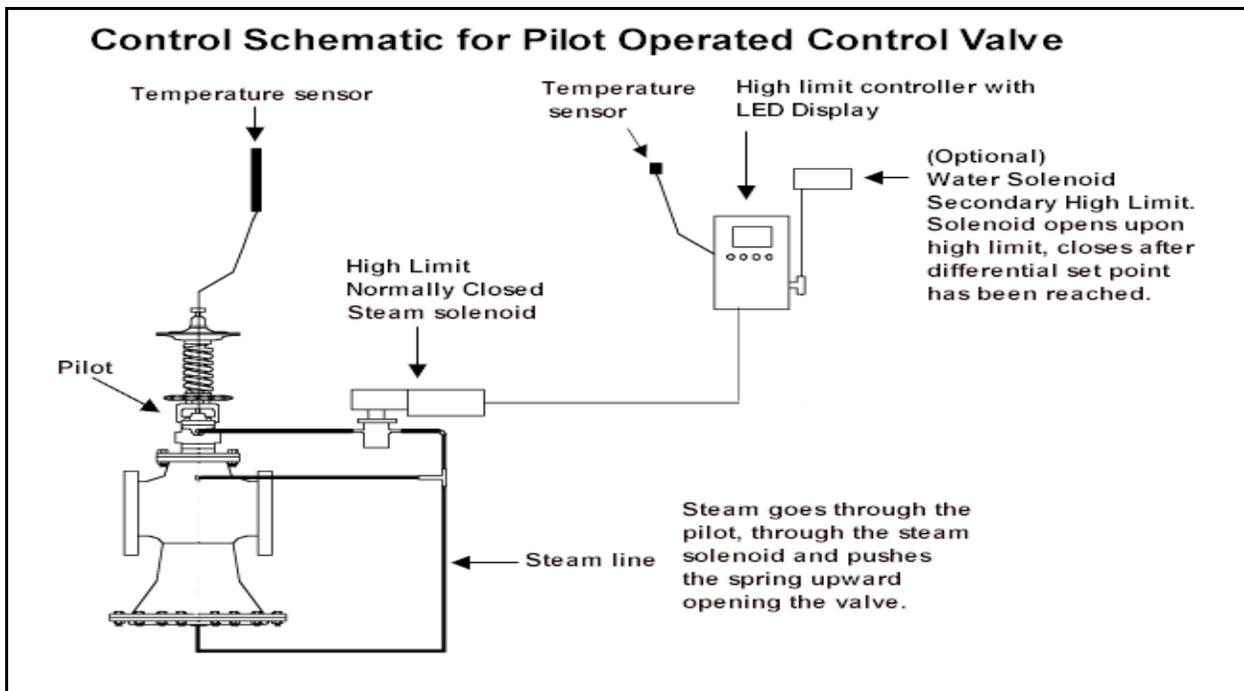


TECHNICAL PAPER: Proper operation of a pilot-operated control valve and an electronic high limit controller when used with Cemline steam fired water heaters.

The operation of the pilot operated control valve and the high limit controller works as follows. The control valve has a temperature sensing gas or liquid filled bulb submerged in the heated water. As a demand for hot water changes, the gas or liquid expands or contracts applying more pressure to the control valve's spring. Eventually the control valve closes as the water in the tank reaches the operating set point. As the control valve opens, more steam will pass through the control valve and as the control valve closes, less steam will pass through the control valve. Cemline puts a high limit steam solenoid valve into the steam line that runs from the pilot to the spring of the control valve (see diagram below). The steam solenoid prevents steam going from the pilot to the control valve main spring if there is no power to the unit and/or if the temperature in the tank rises above the set point of the high limit controller.

One of the more frequently occurring problems is the water heater operating from the high limit and not the pilot. This occurs when the high limit controller is set at a lower temperature than the pilot.

Example: The pilot operated control valve is set at 150 °F and the high limit controller is set at 140 °F. When the temperature of the heated water goes to 140 °F, the high limit controller closes the steam solenoid which cuts off the steam supply from the pilot to the control valve, thus closing the control valve. Even though the control valve is closed, the pilot is still calling for steam to open the control valve. When the temperature in the tank cools, the high limit temperature controller opens the steam solenoid allowing steam to pass to the control valve, immediately causing the control valve to fully open. With the control valve wide open, a large influx of steam enters the coil. Immediately, the water in the tank heats up and it may rise to above 140 °F again, thus the cycle repeats itself. To prevent this situation from happening again be sure to set the high limit temperature at least 10 °F higher than the operating temperature.



How to properly set the control valve and high limit for operation.

When setting the control valve and the high limit for operation the first step is to temporarily set the high limit at a temperature that is 30 °F above the desired operating temperature. Note: to set the high limit see the IOM manual for the T775A electronic temperature controller. By setting the high limit 30 °F higher than the desired operating temperature, the high limit will not interfere or hinder the setting of the pilot control.

The operating temperature of the water heater is set by adjusting the temperature regulating mechanism on the pilot operated control valve. The temperature regulating mechanism is a hand wheel on a Spence valve, a screw on an Armstrong valve, and a red temperature-adjusting knob on Spirax-Sarco valve.

To set Spence Control Valves:

To adjust the temperature of the heated water, turn the hand wheel all the way down so there is no tension on the spring. At this point, the control valve will be completely closed. Slowly, turn the wheel up putting tension onto the spring. This will begin to open the control valve and increase the temperature in the water heater. Monitor the temperature inside the tank by looking at the LED display on the high limit controller. Turn the wheel up a few turns putting more tension on the spring, and then allow the temperature in the tank to stabilize. Repeat the process of turning the hand wheel and letting the temperature in the tank stabilize. Once the temperature is at the desired set point stop adjusting the hand wheel, this is the operating temperature.

To set Armstrong Control Valves:

To adjust the temperature of the heated water, turn the screw all the way up so there is no tension on the spring. At this point, the control valve will be completely closed. Slowly, turn the screw down putting tension onto the spring. This will begin to open the control valve and increase the temperature in the water heater. Monitor the temperature inside the tank by looking at the LED display on the high limit controller. Turn the screw down a few turns putting more tension on the spring, and then allow the temperature in the tank to stabilize. Repeat the

process of turning the spring and letting the temperature in the tank stabilize. Once the temperature is at the desired set point stop adjusting the screw, this is the operating temperature.

To set Spirax Sarco Control Valves:

To adjust the temperature of the heated water, turn the red adjustment knob to the desired temperature as indicated on the red adjustment knob. After the heater has stabilized check the temperature on the LED display on the high limit controller. Re-adjustment of the temperature pilot may be necessary if the desired temperature is not being shown on the digital thermometer. Re-adjust by turning the pilot up or down depending on the desired temperature. Once the temperature is at the desired set point stop adjusting the knob, this is the operating temperature.

To set the high limit.

The limit control is set with the high limit controller (see the IOM manual for setting the high limit temperature). After the pilot has been set at the proper temperature the high limit(s) must be set. For proper operation, the pilot operated temperature controller should be set at the desired operating temperature and the high limit cut out temperature should be set 10 °F above the operating temperature. If the unit was supplied with an optional secondary water solenoid the secondary high limit is normally set 20 °F higher than the operating temperature. For example if the heater is to be operated at 140 °F the pilot operated temperature controller should be set at 140 °F, the high limit temperature should be set at 150 °F, and the secondary high limit should be set at 160 °F. This will allow for normal operation of the water heater.

Spence, Armstrong, and Spirax Sarco are trademarks of their respective companies.