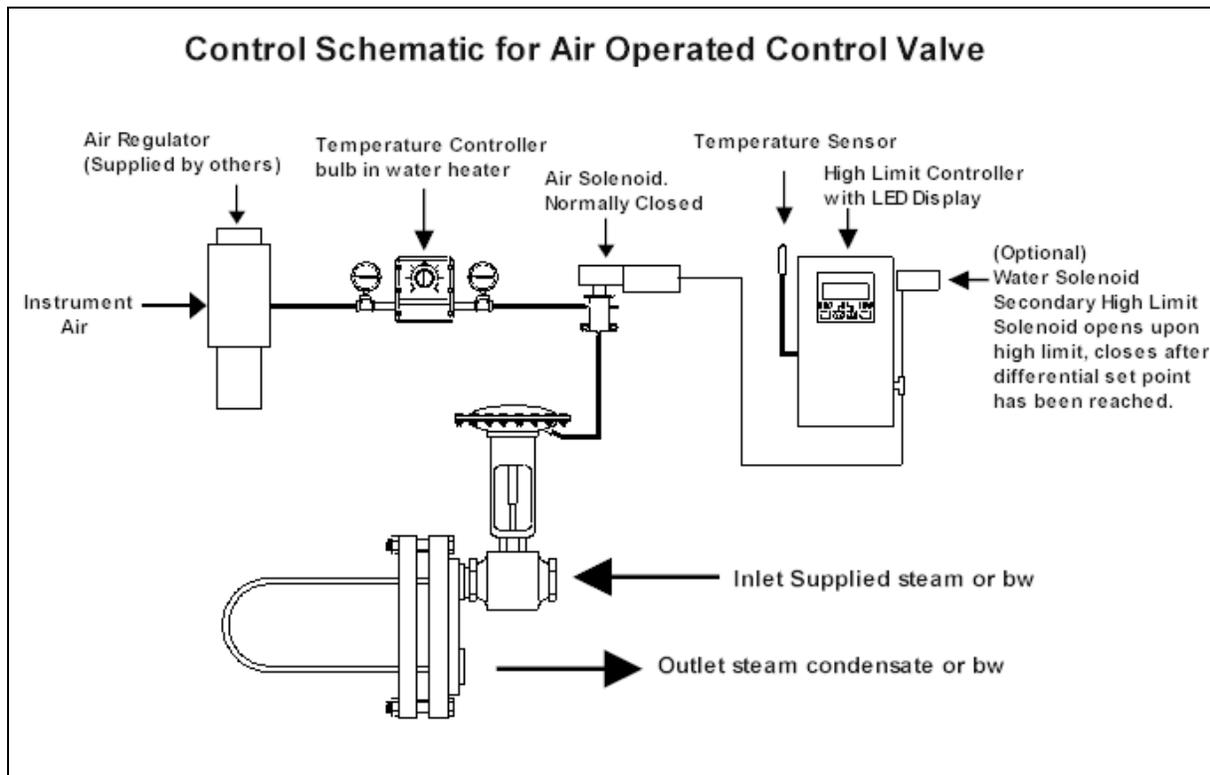


**TECHNICAL PAPER: Reduce temperature fluctuations in Cemline Water Heaters by regulating the air pressure to the pneumatically operated temperature control valves.**

The operation of the air operated temperature controller and the high limit controller works as follows. The air operated temperature controller has a temperature-sensing bulb submerged in the heated water. As demand for hot water changes, the air operated temperature controller sends more or less of an air signal to the control valve thereby, opening or closing the control valve. When the control valve opens more steam or boiler water is able to pass through the control valve and when the control valve closes less steam or boiler water is able to pass through the control valve. Cemline has placed a 3-way air solenoid valve into the air line that runs from the air operated temperature controller to the control

valve. The air solenoid prevents the supply of air from the air operated temperature controller to the control valve if there is no power to the unit and/or if the temperature in the tank rises above the set point on the high limit controller. See Cemline Technical Paper TP-062101 for basic instructions on how to set the operating temperature and high limit(s) set points on pneumatically operated control valves

The air operated temperature controller adjusts the operating temperature of the water heater by sending an air signal to a pneumatically operated control valve supplied with the heater. To set the operating temperature, turn the temperature controller to the desired set point. After the heater has stabilized check the temperature on the LED display of the high limit controller. Re-adjustment of the temperature controller may be necessary if the desired temperature is not being shown on the digital thermometer.



On occasion readjusting the temperature controller may not stabilize the water temperature. The valve may quickly stroke wide open followed by a rapid shut off. When the valve is wide open a large amount of steam enters the tube bundle causing the temperature to rise in the unit above the set point, then the valve closes as the set point has been met. As water flows through the unit while the valve is closed the temperature in the unit decreases. The rapid opening and closing of the valve is called valve hunting, which causes temperature swings in the heater.

One method of reducing the hunting of the valve is to reduce the air pressure going to the air operated temperature controller. The air operated temperature controller sends an air signal to the control valve providing energy to stroke the valve open/closed. Air operated controllers usually accept a 0 – 35 psig input air signal and then sends out a 0 – 30 psig to the valve based upon the temperature setting of the air operated controller. The amount of air pressure sent out to the valve is dependent upon the relationship between the water temperature and the set point of the air operated temperature controller and how much air pressure is being supplied to the air operated temperature controller.

For example, if the air signal to the controller is 0 psig the air signal to the valve will be 0 psig; at any temperature setting of the air operated temperature controller. If the air signal is 30 psig and the air operated temperature controller is set at a temperature lower than the actual temperature of the water in the tank the air signal from the controller to the valve will be 0 psig. The inverse would be true if the actual temperature in the tank is 40 °F and the air operated temperature controller is set at the

highest possible set point (350 °F) if the air signal to the controller is 30 psig the valve will receive at a least 25 psig air signal.

Often times, the controller will be supplied with 30 psig air signal. Most control valves stroke using a 3 – 15 psig air or a 5 – 12 psig air signal. The control valve will be wide open when supplied with a 15 psig or greater air signal and closed if the air signal is less than 3 psig. If the valve is quickly stroking wide open and the temperature is unable to stabilize reducing the air signal to the air operated temperature controller will prevent the valve from opening fully and prevent the temperature from overshooting. Therefore, Cemline recommends that initial air signal to the air operated temperature controller to be set between 15 –18 psig. If the unit is being used for lower loads than the water heater's original design the air signal may have to be reduced to between 5 –12 psig.

### **How to set and adjust the air signal to the pneumatically operated temperature controller to reduce temperature fluctuations in the water heater.**

Set the air operated temperature controller to the desired set point. Check the thermometer to see the temperature of the water in the heater. If the temperature is fluctuating on the high side of the set point reduce the air pressure going to the air operated temperature controller. Start by reducing the air pressure to 18 psig. Continue to reduce the pressure to the air operated temperature controller until the unit achieves a required set point. The instrument air may need to be reduced to as low as 5 psig depending upon the system conditions.

During this setting process the temperature set point on the air operated temperature controller



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may need to be adjusted up or down depending upon how the unit is reacting. Air operated temperature controllers have a wide set point range and as less air is supplied to the controller it may need to be adjusted to a higher temperature set point to allow the unit to maintain the desired temperature. If the air operated temperature controller has been adjusted please see the air operated temperature IOM manual for how to recalibrate the setting scale.

**To set the high limit.**

The limit control is set with the electronic high limit controller. (See the IOM manual for the setting the high limit temperature controller). For proper operation, the air 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.