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CEMLINE® WATER HEATER OVERVIEW

When troubleshooting a Cemline Water Heater it is important to understand the basic components of your water heater, their function, and how they interact with each other. In the most standard configuration a Cemline steam or boiler water fired hot water heater contains five components common to all water heaters. These are:

1. The heat exchanger or coil.
2. The steam/boiler water control valve
3. The temperature controller
4. The temperature sensors
5. The intra-tank recirculation pump

Additionally, in the case of a steam fired water heater you must also consider the steam traps and vacuum breaker, these are used with steam and their function is critical to efficient operation.

In this document we will overview each of these components and discuss some of the common issues that you may experience with them. Cemline uses a wide variety of manufacturers for these components; if you require a more detailed explanation of any specific component, please contact Cemline Tech Support for additional detail and copies of the component installation, operation, and maintenance manuals.

The following is a basic explanation of how a water heater functions: after the vessel is filled with water, the temperature sensors relay the temperature within the vessel to the temperature controller. If the temperature of the water within the vessel is below the desired setpoint, the temperature controller opens the control valve, which allows the steam/boiler water to enter the heat exchanger coil. The heat from the steam/boiler water is then transferred through the heat exchanger coil into the water within the vessel. The intra-tank recirculation pump moves the water within the vessel to ensure the water is evenly heated. As the water temperature rises or falls, the sensors continue to relay the temperature to the controller. When the temperature approaches the desired setpoint, the temperature controller begins to close the control valve to restrict the flow of the steam/boiler water. When the setpoint temperature is reached, the controller fully closes the control valve and stops the flow of the steam/ boiler water into the coil, while the intra-tank recirculatory continues to move the water. In the remaining sections, we will discuss the individual components, their function, and common issues that you may experience.

Heat Exchanger Coil – The heat exchanger coil is the heart of the Cemline water heater. The coil allows the steam or boiler water to transfer heat into the water within the vessel. It separates the heating medium (steam or boiler water) from the clean water within the vessel. If the heat exchanger coil is scaled, or if using steam, flooded with condensate, it will result in reduced heat transfer, leading to inefficient operation.

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Steam/Boiler Water Control Valve – The control valve is used to regulate the amount of steam or boiler water entering the coil, allowing the temperature of the water within the vessel to rise. The control valve can be pilot, air, or electronic operated. The most common failures for the steam/boiler water control valve either cause it to not open or cause the heating medium to leak through. This will result in unreliable temperature control.

Temperature Controller – The temperature controller is used to control the temperature of the water within the vessel. When a pilot operated steam/boiler water control valve is used, the pilot valve itself is temperature controller, and the temperature setpoint is set by using the handwheel on the pilot valve to increase or decrease the tension on the spring within the pilot. Typically, the pilot valve itself will not fail unless there is debris or contamination in the valve; the sensing bulb and capillary is usually the cause of any failure. With an air or electronic control valve, a Cem-Trol® or Cem-Trol® II controller is used to set the setpoint. Typically, when the Cem-Trol controllers fail they blow fuses or will not turn on.

Temperature Sensors – There are two types of temperature sensors used depending on which type of control valve is used. If a pilot operated control valve is used, a sensing bulb with a fluid-filled capillary is used. As the fluid is heated, it expands and exerts pressure through the capillary to close the pilot valve. As the fluid cools, it contracts and allows the pilot valve to open. When a sensing bulb fails, it is most frequently because the sensing bulb has lost its fluid charge.

Air and electronic operated control valves use 1000Ω RTD temperature sensors in conjunction with the Cem-Trol or Cem-Trol II controllers. The 1000Ω RTD sensors are resistance based and change value as the temperature rises and falls. The 1000Ω RTD sensors can be tested with an Ohm meter using the chart below. If the sensor short circuits, the Cem-Trol controller will display 32°F. If the sensor is an open circuit, the Cem-Trol will display 212°F or 245°F depending on the software version. A bad temperature sensor can cause temperature undershoot, temperature overshoot, or a sensor error alarm.

Degrees Fahrenheit	Resistance In OHMS
40	1017
50	1039
60	1060
70	1082
80	1104
90	1125
100	1147
110	1168
120	1190
130	1211
140	1232
150	1254
160	1275
170	1296
180	1317

The Intra-Tank Recirculation Pump - The intra-tank recirculation pump runs continuously whenever power is applied to the water heater and moves the water within the vessel, mixing it to create an even temperature throughout the vessel. This prevents stratification of the water and prevents hot and cold pockets within the vessel. If the intra-tank recirculation pump is not functioning properly, you may experience inefficient or inconsistent heating of the water. In some cases, the intra-tank recirculation pump is used to draw the heated water across the primary temperature sensor to allow for the most accurate temperature reading such as the instantaneous heaters (SEH, BPH, PFH Series) and Reverse-flow SWH models. In these cases, you may experience overshoot because the heated water is not being drawn across the primary temperature sensor and the control valve will remain open longer than required.

WHEN USING STEAM

Steam Traps and Vacuum Breaker - When using steam as the heating medium, the coil can become flooded with condensate if the main steam trap fails or if the vacuum breaker fails to relieve a vacuum condition. A vacuum condition will lead to a negative pressure differential that will prevent the steam traps from draining properly. If the auxiliary drip trap fails, condensate can form in front of the steam control valve. This leads to steam hammer, as the steam picks up the undrained condensate and carries it into the U-bend of the tubes in the heat exchanger coil.