Water heater maintenance

⚠WARNING Boiler water — read and comply with all requirements under "Boiler water restrictions," page 3.

⚠WARNING Water from opened drain valves, unions and other connections may be extremely hot. To avoid severe personal injury, death or substantial property damage:

- Tighten all drain hose connections.
- Direct hot water away from all persons.

ATTENTION USER!

⚠WARNING **Have the water heater serviced at least once annually** by a qualified service technician.

Follow the **maintenance procedures** below at least monthly.

Read "Water heater temperature adjustment," page 27.

Failure to comply with the above can result in severe personal injury, death or substantial property damage.

MONTHLY maintenance by user

- At least **MONTHLY**, visually check valves, pipes and fittings for leaks.
- Check hot water supply at several outlets. Make sure water temperature is not too hot.
- Call qualified service technician to repair leaks or address problems.

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ANNUAL start-up by qualified service technician

NOTICE Obtain an Inspection and service kit (see "Replacement parts," page 38) before attempting to perform the annual start-up. This kit contains items that will usually have to be replaced.

⚠WARNING Check water supply temperature at several outlets to ensure the water temperature is acceptable for intended use and that all temperature control devices are functioning properly. Read page 3 and verify that all requirements are met by the installation.

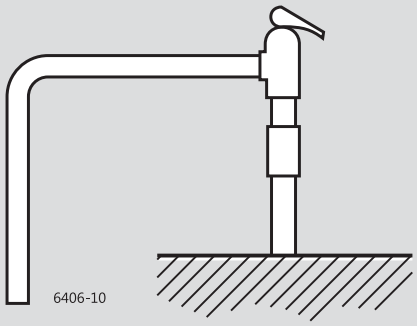
Perform the following procedures:

❑ Perform any procedures required by local codes.

❑ Verify system pressure both on domestic water and boiler water sides.

Figure 28 T&P valve operation

⚠WARNING Before operating the T&P relief valve, make sure no one is in front of or around the T&P relief valve discharge piping. Hot discharge water can cause severe personal injury or substantial property damage.



⚠WARNING Plugging T&P relief valve or discharge piping can cause excessive pressure in the water heater, resulting in severe personal injury, death or substantial property damage.

❑ Manually operate T&P relief valve at least once a year (see Figure 28). This will release some hot water. Move operating lever to open position for a few seconds and then move it back, allowing it to snap closed. After T&P relief valve is operated, if it continues to release water, close cold water inlet to water heater immediately. Follow draining instructions, and replace the T&P relief valve. If T&P relief valve weeps periodically, it may be due to thermal expansion. Install an expansion tank if not already installed.

❑ Follow instructions on circulator to oil it, if oil-lubricated.

❑ Check valves, pipes and fittings for leaks.

❑ Check function of all controls and valves (see control manufacturer's instructions).

❑ Review homeowner's maintenance responsibilities and their frequencies, including any not listed in the following paragraphs.

Drain the water heater if necessary during shutdown periods

1. Drain the water heater if it will be shut off and exposed to freezing temperatures. Freezing water will expand and may damage water heater.
   a. If boiler water contains sufficient antifreeze, then only the domestic water needs to be drained.
   b. If boiler water does not contain sufficient antifreeze, then the boiler water and the domestic water must be drained.

Troubleshooting

Troubleshooting procedures

NOTICE **Follow the troubleshooting guidelines step by step**. Always double-check your results. Skipping or not completing steps can lead to wrong conclusions, repeated callbacks to the job site and unhappy customers.

Preparation for troubleshooting

Tools needed

- ❑ Electrical meter to measure voltage and continuity.
- ❑ Pressure gauge (such as Watts #276H300 test gauge).
- ❑ Temperature gauge.
- ❑ Stopwatch.
- ❑ Bucket —
  1 gallon or larger, with volume markings.

Suggested parts to have on hand.

- ❑ Tank control (Thermostat) — see Replacement parts for part number.

Information needed before the service call

- ❑ Know the water heater model number.
- ❑ Know the boiler manufacturer and model number.
- ❑ Have the boiler manual and wiring and piping schematics readily available.
- ❑ Get the latest revisions from www.Weil-McLain.com.
- ❑ Review all manuals before leaving for the job site.

Troubleshooting *(continued)*

Figure 29 Typical problems and causes and page location for details

Problem	Check possible causes		Page
Insufficient hot water	**1** Undersized water heater? **2** Boiler system improperly sized? **3** Check component parts. **4** Check boiler operating temperatures.	**5** Check location of flow control devices. **6** Check for air in the system. **7** Clean the boiler water system. **8** Check tank control setting.	**31**
Excessive domestic water temperature	**1** Reduce stacking • Lower boiler operating temperature.	**2** Install a thermostatic mixing valve. **3** Install a recirculation loop.	**33**
Boiler relief valve lifting or weeping	**1** Undersized expansion tank? **2** Faulty boiler expansion tank? **3** Faulty boiler relief valve?	**4** Faulty boiler fill valve?	**33**
Temperature/ pressure relief valve lifting or weeping	**1** Undersized or missing domestic water side expansion tank? **2** Faulty domestic water side expansion tank? **3** Faulty T & P relief valve?	**4** High domestic water supply pressure? **5** Possible water hammering or pressure spikes? **6** Check boiler operating temperature.	**35**
Water on the floor near the tank	**1** Check for leaks from sources other than the water heater.	**2** T & P relief valve lifting and discharging? **3** Loose piping connections?	**35**
Top of tank or insulation wet	**1** Check for leaks from sources other than the water heater.	**2** Loose piping connections?	**36**
Water quality problems	**1** Water smells like "rotten eggs." **2** Milky water.	**3** Discolored water from the hot water faucet.	**36**

Troubleshooting *(continued)*

Insufficient hot water

7 Undersized water heater?

- There are many methods of sizing various applications, i.e. ASHRAE sizing tables or ASPE domestic water heating design manual.
  - Confirm the water demand required for the application.
- Confirm the flow rates of the fixtures.
  - For example, was the tank sized for shower heads at 2.0 gpm, while the actual heads are 5.0 gpm?
  - Use a bucket and a stopwatch to determine fixture flow rates.
- Evaluate the hot water usage pattern for a day.
  - Is the peak demand unusually high for the application?
- Has the demand for domestic hot water changed since the system was installed?
  - A bathroom remodeling project with a newly installed whirlpool tub will substantially change the domestic water demand.

8 Boiler system improperly sized?

- Can the boiler provide the required output to meet the domestic water load? Determine the boiler domestic water capacity, GPH, by the following:

$$\text{Boiler DHW capacity, GPH} = \frac{\text{Boiler output Btuh}}{\text{Temp. rise °F x 8.33}}$$

[Temp. rise °F = Required DHW temp. °F – Incoming temp. °F]

[8.33 = Density of water (lbs/gal) x 1 Btu/lb-°F]

- Example — A single family home with a 3.0 GPM shower fixture and a 150,000 Btuh output boiler capacity.
  - The shower demand of 3.0 GPM equals 180 GPH (60 times the GPM).
  - Is the boiler capacity enough to deliver this hot water flow at 115°F for an extended period? Determine the boiler capacity:

$$\text{Boiler DHW capacity, GPH} = \frac{\text{150,000 Btuh}}{\text{(115°F – 50°F) x 8.33}} = \text{277 GPH}$$

  - The boiler is capable of delivering 277 GPH (or 4.6 GPM) continuously, which is enough for this application.
- Measure the BTU input to the boiler by clocking the gas meter or finding the oil flow rate based on nozzle size and pump pressure.
- Does the hot water system need to be wired for domestic priority? For systems in which either the storage or BTU's available are marginal it is recommended to wire the domestic water heater in a priority manner.
- Is the boiler piping to the water heater properly sized to allow the required flow rate for maximum BTU transfer? The temperature differential of the boiler supply and return water should be 20°F to 30°F.
- Is the circulator between the boiler and the water heater properly sized to provide enough flow for maximum BTU transfer? Check the table below:

Pipe size	Flow, GPM	MBH	Pipe size	Flow, GPM	MBH
¾"	1 to 4	50 to 100	1½"	14 to 22	200 to 450
1"	4 to 8	100 to 180	2"	22 to 45	300 to 650
1¼"	8 to 14	160 to 300			

Troubleshooting *(continued)*

Insufficient hot water *(continued)*

9 Check component parts.

- Is the domestic water control functioning properly?
  - Check the water heater control (requires an electrical meter).
    1. Disconnect the field wiring to the water heater control terminals.
    2. Turn the control knob to the highest setting — clockwise — to initiate a call for heat.
    3. Check for continuity across the water heater control terminals. On a call for heat, these contacts should closed.
    4. Continue checking for continuity while turning the control knob to the lowest setting — counter clockwise — to satisfy the call for heat. The contacts should open, breaking the continuity.
    5. If any of these steps fail, replace the control.
- Is the control setting too low?
  - If the control setting is too low, the boiler may not have the opportunity to deliver the maximum BTU's required to completely heat the entire volume of water stored in the tank.
- During a call for heat by the water heater, does the boiler circulator begin pumping, does the zone valve open, does the boiler fire? Check every component in the system to ensure they are properly functioning.

10 Check boiler operating temperatures.

- If possible, increase the boiler operating temperature to 180°F or 200°F.
- Maintain a minimal temperature in the boiler during non-heating seasons.
  - A boiler typically has a higher standby loss than the indirect water heater.
  - After a long standby period, the colder boiler may absorb the stored energy within the water heater during the initial call for heat.

11 Check location of flow control devices.

- Lab tests have shown that during long standby periods the boiler piping can act as a thermal siphon and draw stored heat from the domestic water.
  - Locate flow control devices (zone valve, spring check valves...) or heat trap loops in the boiler piping close to the water heater.
  - Insulate all boiler piping to and from the water heater.

12 Check for air in the system; check water heater air vent.

- An air-bound water heater or boiler will not circulate system water properly, resulting in a lack of heat transfer.

13 Clean the boiler water system.

- A dirty boiler system can cause deposits to form on the water heater coil. This insulates the coil, reducing the heat transfer.
  - Clean the boiler system per the boiler manufacturer's instructions.
- Install a strainer in the boiler piping on older installations or for systems likely to carry sediment.

Troubleshooting *(continued)*

Excessive domestic water temperature

1 Reduce stacking.

- Excessive water temperature is usually the result of stacking within the water heater.
  - Stacking is the occurrence of various water temperatures layering within the water heater with the hottest water in the uppermost layer.
  - This layering or stacking effect typically occurs during small draws of hot water (typically less than 25% of the storage capacity) that are long enough to create a call for heat on the control, but are short enough not to deplete the stored energy within the tank.
  - Excessive stacking can occur when frequent short-to-moderate draws are taken in quick succession.
  - During this condition, the temperature of the domestic water can approach the temperature of the boiler water.
- REMEMBER — All water heaters (direct or indirect) will stack.
- To reduce stacking within the tank:
  - Reduce the boiler operating temperature to 160°F - 170°F. This will limit the maximum domestic outlet water temperature during high stacking water usage.

2 Install a thermostatic mixing valve.

- Installing a **thermostatic mixing valve** will provide uniform delivery temperature with minimal regard to water usage.

3 Install a recirculation loop.

- Installing a properly-sized recirculation loop not only provide prompt delivery of hot water, but it will provide circulation and mixing of the water within the tank.

Boiler relief valve lifting or weeping

1 Undersized expansion tank?

- Insufficient allowance for expansion on the boiler side can cause the boiler pressure relief valve to lift.
- The additional quantity of boiler water contained in the outer tank must be considered when sizing the boiler side expansion tank.

AQUA PRO™ model	Boiler side volume — gallons
30	0.3
55	0.3
80	0.6
119	0.8

Troubleshooting *(continued)*

Boiler relief valve lifting or weeping

2 Faulty boiler expansion tank?

- Is the expansion tank defective, waterlogged or improperly charged?
  - Check for failed gaskets or bladders, or a faulty Schraeder valve.
  - Use a tire gauge to check the charge pressure of the tank.
- Turn the boiler limit up to a higher setting and let the system run at a higher temperature. This will simulate maximum expansion in the boiler system.
  - If the boiler relief valve lifts and/or there is a significant increase in the boiler system pressure, the expansion tank is flooded or undersized.

3 Faulty boiler relief valve?

- Is the boiler pressure relief valve functioning properly? Dirt and water deposits can accumulate under the valve seat.

4 Faulty boiler fill valve?

- Is the valve filling to the correct pressure?

Temperature/pressure relief valve lifting or weeping

1 Undersized or missing domestic water side expansion tank?

- Is there a thermal expansion tank installed on the domestic supply piping and is it properly sized?
  - A thermal expansion tank is required if the domestic supply piping includes a backflow preventer or pressure reducing valve.
  - Ensure the potable water expansion tank is properly sized according to the water heater volume and supply pressure.
  - During long periods when there are no draws from the tank (i.e. overnight), the T&P relief valve may lift or weep due to thermal expansion, but may function properly during normal periods of tank draws.

2 Faulty domestic water side expansion tank?

- Is the expansion tank defective, water logged or improperly charged?
  - Check for failed gaskets or bladders, or a faulty Schraeder valve.
  - Use a tire gauge to check the charged pressure of the tank.

3 Faulty T&P relief valve?

- Is the temperature/pressure relief valve functioning properly? Dirt and water deposits can accumulate under the valve seat.

Troubleshooting *(continued)*

Temperature/pressure relief valve lifting or weeping

4 High domestic water supply pressure?

- Check the domestic supply pressure entering the water heater.
  - If the pressure is over 70 psi it is recommended to install a pressure reducing valve. A thermal expansion tank is required if a PRV is installed.
  - This will prevent any pressure spikes or increases in pressure due to thermal expansion which may cause the T&P valve to lift or weep.

5 Possible water hammering or pressure spikes?

- Check the domestic system for possible sources of water hammering or pressure spikes.
  - Some appliances such as clothes washers and dishwashers utilize fast acting valves which may cause water hammering or pressure spikes through the domestic water system.
- Install water hammer arrestors as required per the manufacturer's instructions, or install flexible connectors to isolate the tank from the domestic system.

6 Check boiler operating temperature.

- If the boiler operating temperature is too high, stacking can occur in the water heater raising the domestic water temperature close to the boiler operating temperature. — Reduce the boiler operating temperature to 180°F. Also follow page 33 suggestions if the problem persists.

Water on the floor near the tank

1 Check for leaks from sources other than the water heater.

- Check for possible water seepage through foundation cracks. Did the water appear after a heavy rain?

2 Is the source of water from the T&P relief valve?

- Place a bucket under the discharge piping of the T&P relief valve and monitor it for a day or two. This is a procedure that can be done by the homeowner.
- If the T&P relief valve is the source, refer to page 35 of this guide.

3 Loose piping connections?

- Check all connections – boiler connections, domestic connections, etc.
- Check all the boiler connections to the water heater.
  - A build-up of corrosion is a sure sign of a leak.
- Excessive force or water hammer can damage the welds where the piping connections enter the water heater tank.
  - If water is leaking from around one of the tank connections, a weld may have been broken. Contact your Weil-McLain supplier to determine how to handle the problem.

Troubleshooting *(continued)*

Top of tank or insulation wet

1 Check for leaks from sources other than the water heater

- Check for possible overhead pipes leaking onto the tank.

2 Loose piping connections?

- Check all connections – piping connections to the tank and elsewhere if the vicinity.
- Check around valve stems.
- A build-up of corrosion around a joint is a sure sign of a leak.

Water quality problems

1 Water smells like "rotten eggs."

- The most common cause of water to smell like "rotten eggs" is a non-toxic sulfate reducing bacteria.
  - The bacteria usually enters into the water system through a break in the supply piping or during construction/maintenance of the supply piping.
  - The bacteria survives in the water system by converting sulfate (SO_4) in the water to hydrogen sulfide (H_2S) gas.
  - It is this gas that creates the "rotten egg" smell.
  - The presence of hydrogen sulfide can also affect the taste of the water.
- Along with the stench caused by this bacteria, black deposits that typically indicate pipe and/or fitting corrosion may also appear in the water.

⚠WARNING In extremely high concentrations, hydrogen sulfide gas can be toxic. However, the gas is detectable prior to reaching harmful levels.

- The bacteria will thrive in any water system under the following conditions:
  - High levels of sulfur in the water.
  - Activated hydrogen in the water from cathodic reactions within the tank.
  - Water with little or no dissolved oxygen.
  - Storing the domestic water below 130°F.
- Other causes of smelly water:
  - Chlorides of magnesium and calcium gives water a bitter taste.
  - Chloride of sodium will produce a salty tasting water.
  - Sulfates above 50 ppm in the water gives the water a medicinal taste.
  - Carbon dioxide in water with a low pH results in water that is fizzy.
  - Iron and tannic waters will produce water with a bad taste and odor.
- Treatment
  - The treatment of this situation requires the water system to be shock-chlorinated. Depending on the severity of the bacteria within the water system, several treatments may be needed.

Troubleshooting *(continued)*

Water quality problems *(continued)*

2 Milky water.

- When water is initially drawn from the faucet it appears to be milky or cloudy, but it becomes clear after the water is allow to stand for several minutes.
  - This is usually an indication that the water contains high levels of soluble gases, such as oxygen, chlorine, carbon dioxide, hydrogen sulfide or others.
  - As the water system pressure increases, the amount of gas that water can hold in a solution decreases.
  - When air and gases are forced out of the heated water, the problem may be evident in one or both of the following conditions:
    - Gases, in the form of small bubbles, may make the water appear milky from the tap, but clear after several minutes when those bubbles will separate.
  - This is similar to the reaction that occurs as air bubbles form on the walls of a pan shortly before the water begins to boil.
  - The release of dissolved gas can also create air pockets and air locks in the water system piping. This can cause spurts of air or gases when opening the hot water faucet.
- There is generally no cure for milky water caused by dissolve gases, although it can be reduced with aerated faucets. In some applications the amount of air and gases precipitating out of the water will reduced in time. It should be noted that these gases are not harmful to the end user.

3 Discolored water from the hot water faucet.

- The water from the hot water faucet appears discolored, either rusty, brown, black or yellow.
  - Because the tank is a composite material, which is resistant to corrosion, the problem is not tank-related.
  - The problem is usually a non-toxic iron-reducing bacteria that is commonly found in soil, well water, water treatment plants and piping systems.
  - The bacteria usually thrives in systems in which the soluble iron exceeds 0.2 ppm.
  - The bacteria will feed on the soluble iron in the water, producing "rusty-color" water as a by-product of the feeding process.
- Variables in which the bacteria can thrive:
  - Elevated levels of iron and manganese in the water.
  - Water with little or no dissolved oxygen.
  - Water storage temperatures below 140°F.
- Items that can potentially increase the presence of the bacteria:
  - Water softeners.
  - Well water.
  - Long periods of no water movement.
- Treatment
  - Treatment requires the water system to be shock-chlorinated.
  - Depending on the severity of the bacteria within the water system, several treatments may be needed.
  - Check the pH and chlorides of the water in the water heater tank and the boiler system.
  - The pH must be between 6 and 8.
  - Chlorides must be less than 200 ppm.
  - Note the pH and chloride readings on the warranty sheet.
- Items that can affect the pH reading:
  - Water softeners.
  - Water treatment plants.
  - Cl (chlorides) added, especially during the summer.
  - Fl (fluorides) added in treatment in large cities.
  - Elevated levels of iron, manganese, and sulfur.
- If the pH is high or low, this has a major effect on the metal tanks, piping and heat transfer surfaces.