

Commercial Water Heater and Storage Tank Descaling Procedure

1.0 Maintenance Objective & Frequency

The objective of this procedure is to remove accumulated calcium carbonate (lime) scale from the internal surfaces of commercial water heaters and storage tanks. Scale buildup acts as an insulator, reducing heat transfer efficiency, increasing energy consumption, and accelerating corrosion. This procedure restores thermal performance, extends equipment life, and maintains hot water delivery capacity.

Frequency: Perform this procedure annually, or more frequently if water hardness exceeds 10 grains per gallon (170 ppm) or if the manufacturer recommends a shorter interval. In high-demand facilities (e.g., hotels, laundries), consider semi-annual descaling.

2.0 Lockout/Tagout (LOTO) & Safety

- **Electrical Isolation:** Disconnect the main power supply to the water heater at the breaker panel. Apply a personal lock and tag. Verify zero voltage with a multimeter at the unit's electrical connection point.
- **Gas Isolation (if applicable):** Close the manual gas shutoff valve upstream of the unit. Lock and tag the valve. Verify gas pressure is zero using a manometer at the burner test port.
- **Water Isolation:** Close the cold water supply isolation valve to the water heater. Lock and tag the valve. Open a hot water tap downstream to depressurize the system.
- **Thermal Hazard:** Allow the water heater to cool to below 40°C (104°F) before beginning work. Hot water and steam can cause severe burns.
- **Chemical Hazard:** Descaling chemicals (e.g., sulfamic acid, citric acid) are corrosive. Wear chemical-resistant gloves, safety goggles, and a face shield. Ensure adequate ventilation. Have a neutralizing agent (e.g., baking soda solution) and eyewash station readily available.
- **Mandatory PPE:** Chemical-resistant gloves, safety goggles, face shield, rubber apron, and steel-toed boots.

3.0 Required Tools, Parts & Lubricants

- Descaling chemical: Commercial-grade sulfamic acid or citric acid based descaler (e.g., RectorSeal 5-5-5, or equivalent). Verify compatibility with tank lining (glass-lined, stainless steel, etc.).
- Circulation pump: 1/2 HP or larger, rated for chemical service, with appropriate hose connections (typically 3/4 inch NPT).
- Hoses: Two lengths of chemical-resistant hose (e.g., EPDM or Viton), long enough to reach from the pump to the tank drain and relief valve connections.
- Bucket or reservoir: 20-liter (5-gallon) plastic pail for mixing and circulating descaling solution.
- pH test strips or pH meter (range 0-14).
- Adjustable wrench (12-inch) and pipe wrenches (14-inch and 18-inch).
- Flathead and Phillips screwdrivers.
- Flashlight or inspection mirror.
- Bucket or drain hose for flushing.

- Teflon tape or pipe thread sealant.
- Replacement anode rod (if applicable and inspection indicates need).
- Neutralizing agent: Sodium bicarbonate (baking soda) or commercial neutralizer.

4.0 Step-by-Step Maintenance Procedure

1. Confirm LOTO is applied per Section 2.0. Verify the water heater is cool to the touch and the system is depressurized by opening a hot water tap until flow stops.
2. Drain the water heater. Attach a drain hose to the tank drain valve (typically at the bottom). Open the drain valve and a hot water tap to allow air in. Drain the tank completely. Collect a sample of the drained water in a clear container to assess scale content.
3. Remove the temperature and pressure (T&P) relief valve. Using a pipe wrench, unscrew the T&P valve from its fitting. Set aside. This port will be used as the return connection for the circulation pump.
4. Connect the circulation pump. Attach one hose from the pump discharge to the tank drain valve. Attach the second hose from the T&P valve port to the pump suction. Ensure all connections are tight and leak-free.
5. Prepare the descaling solution. In the 20-liter pail, mix the descaling chemical with water according to the manufacturer's instructions. Typically, a 5-10% solution by volume is used. For heavy scale, use the higher concentration. Stir until fully dissolved.
6. Prime the pump. Place the suction hose from the T&P valve port into the pail of descaling solution. Ensure the discharge hose from the drain valve is also directed into the pail. Start the pump. Allow the solution to circulate through the tank and back into the pail. Monitor for leaks at all connections.
7. Circulate the solution for 2-4 hours, or until the pH of the circulating solution stabilizes (indicating the acid is spent). Check pH every 30 minutes. Initial pH should be 2-3. When pH rises above 4-5, the solution is neutralized and descaling is complete. If pH remains low after 4 hours, drain and replace with fresh solution and continue.
8. Flush the system. After descaling, stop the pump. Disconnect the hoses. Open the tank drain valve fully to drain the spent solution into a suitable container for proper disposal (neutralize with baking soda to pH 6-8 before draining to sewer, per local regulations). Close the drain valve. Open the cold water supply valve and flush the tank for 10-15 minutes with fresh water. Open a hot water tap to allow flow. Repeat flushing until the drained water is clear and pH is neutral (6-8).
9. Inspect and replace the anode rod (if applicable). Remove the anode rod (typically located on top of the tank). Inspect for significant depletion (less than 1/2 inch diameter or exposed core wire). Replace if necessary. Apply Teflon tape to the threads of the new anode rod and torque to manufacturer specification (typically 30-50 ft-lbs).
10. Reinstall the T&P relief valve. Apply Teflon tape to the valve threads. Screw the valve back into its port and tighten with a pipe wrench to manufacturer torque specification (typically 25-35 ft-lbs). Do not overtighten.
11. Close the drain valve. Remove the drain hose. Ensure the drain valve is fully closed.
12. Restore water supply. Slowly open the cold water supply isolation valve. Open a hot water tap to vent air from the system. Allow the tank to fill completely. Check for leaks at the T&P valve, drain valve, and anode rod. Close the hot water tap once a steady stream flows.

5.0 Verification & Return to Service

1. Restore power or gas supply. Remove LOTO devices. For electric heaters, turn the breaker back on. For gas heaters, open the manual gas valve and relight the pilot (if applicable) per manufacturer instructions.
2. Set the thermostat to the desired operating temperature (typically 60°C / 140°F for commercial applications). Allow the water heater to heat up fully (may take 1-2 hours).

3. Verify operation. Check that the water heater cycles on and off normally. Confirm there are no unusual noises (e.g., rumbling, popping) indicating residual scale. Measure the hot water temperature at a nearby tap using a thermometer; it should match the thermostat setting within $\pm 3^{\circ}\text{C}$.
4. Check the T&P relief valve for proper operation. Lift the test lever briefly to ensure it opens and reseats correctly. Water should discharge and then stop completely when the lever is released.
5. Inspect all connections for leaks. Tighten as necessary. Confirm no water damage or moisture around the unit.
6. Record the maintenance in ServiceGrid. Log the date, descaling chemical used, circulation time, final pH, and any parts replaced (e.g., anode rod). Update the next scheduled descaling date based on the frequency noted in Section 1.0.
7. Dispose of all waste materials (spent descaling solution, used chemical containers) in accordance with local environmental regulations. Neutralize the solution to pH 6-8 before draining to sanitary sewer, if permitted.

Regulatory Disclaimer: This document is a generic maintenance template provided for educational and informational purposes only. It does not constitute professional engineering or reliability advice. The end-user assumes all liability for validating all step sequences, torque specs, and LOTO protocols against specific machinery OEM manuals before deployment to a live production floor.