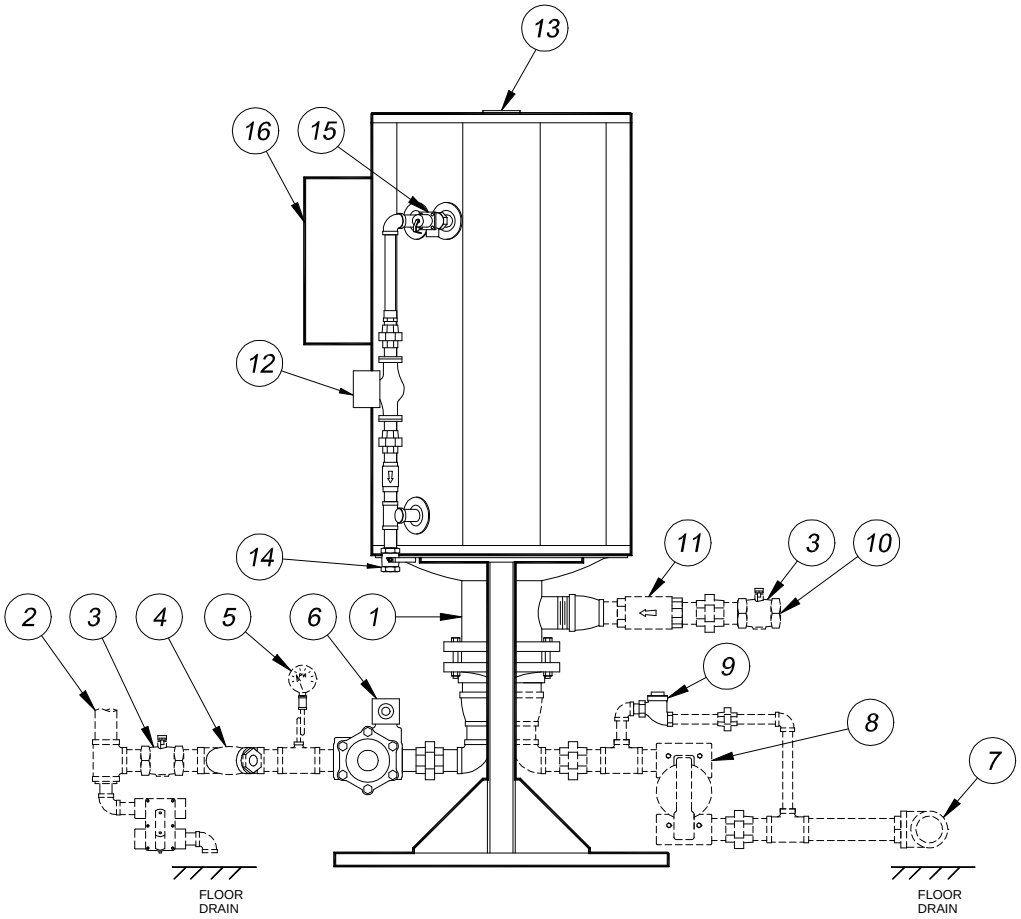
INSTALLATION & MAINTENANCE MANUAL FOR

QuickDraw â

SEMI-INSTANTANEOUS
ENERGY: STEAM TO WATER
U-TUBE SINGLE-WALL & DOUBLE-WALL HEAT EXCHANGERS



Typical Construction
Figure 34-1

1. U-tube Heat Exchanger
2. Steam Inlet **
3. Shutoff Valve **
4. Y-Strainer *
5. Steam Pressure Gauge *
6. Steam Valve
7. Condensate Drain **
8. Main Steam Trap *
9. Thermostatic Trap
10. Potable Water Inlet
11. Check Valve **
12. Intratank Circulator *
13. Potable Water Outlet
14. Tank Drain Valve
15. Relief Valve
16. Control Enclosure

* Optional

** Not supplied by PVI
(shown with dashed lines)

CAUTION: TEMPERATURES HIGHER THAN 125°F. INCREASE THE RISK OF SCALD INJURY!

IMPORTANT: Clearances for servicing and inspection are 18" at top, sides and rear and a minimum of one tank diameter in front.

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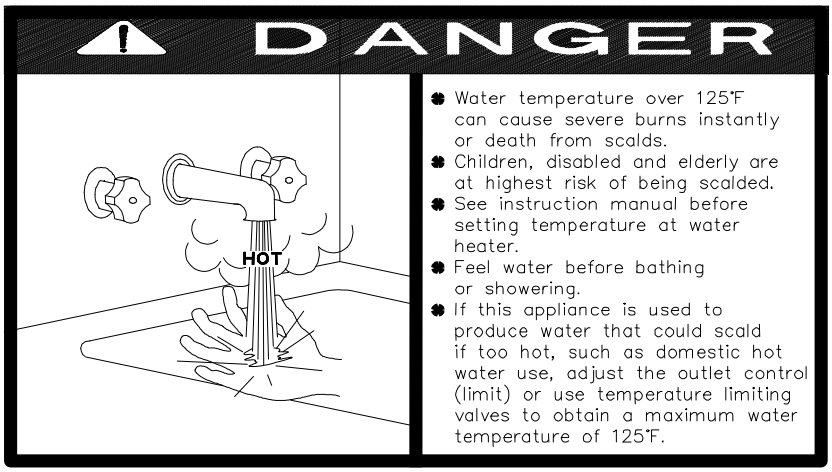
WARNING! Setting the temperature selector to higher settings provides hotter water which increases the risk of scald injury. Households with small children or invalids may require a 125°F or lower temperature setting to reduce the risk of scald injury. Allow a few days of operation at your selected setting to determine the correct temperature setting consistent with your needs.



CONNECTING UNIT

CAUTION
All steam and water supply lines should be flushed before connecting the unit.

1. Use backup wrenches on all screwed pipe connections to prevent damage to brazed joints or studded connections. Shutoff valves and dielectric unions should be installed in steam and water lines to allow maintenance on the unit. Steam supply, water supply and condensate lines must be supported before connecting the unit.

ELECTRICAL

The heater is wired for 120 volts and must be electrically grounded in accordance with local codes, or in the absence of local codes, with the latest edition of the National Electrical Code ANSI/NFPA. When unit is installed in Canada, it must conform to the CSA C22.1, Canadian Electrical Code, Part 1 and/or local electrical codes.

1. Branch circuit protection and disconnecting means must be furnished by the installer. Refer to the wiring diagram provided with this unit when installing or troubleshooting the electrical components of this heater.
2. All wiring must be in accordance with all local, state, or federal codes.
3. Provide proper overload protection for the system's circulating pump.

NOTE: Use only copper wire of proper sizing for incoming service. Damage resulting from use of aluminum wiring will be excluded from coverage under the warranty of this unit.

STEAM WITH SINGLE-WALL / DOUBLE-WALL (con't)

RELIEF VALVE PIPING

The water heater is supplied with a pressure and temperature relief valve, sized in accordance with ASME requirements. Each relief valve should be piped to a suitable floor drain. No reducing coupling or other restriction can be installed in the discharge line. It is strongly recommended that this valve should be manually operated at least once a year.

WARNING!
Make sure the safety relief valve is piped to a proper drain per instructions. Scalding injury and/or water damage can occur from either the manual lifting of the lever or the normal operation of the valve if it is not piped to a proper drain. Insure that the safety relief valve piping is of the proper material and rating for the temperature and pressure of the system and that it is secured to prevent possible injury. If valve fails to flow water or reseat, consult the factory. The relief valve is a primary safety device.

STEAM & CONDENSATE CONNECTIONS

1. The condensate trap controls the discharge of condensate based on the load on the heat exchanger, thus preventing the discharge of live steam through the unit. Appropriately sized traps are available from your PVI representative. The steam trap must have a pressure rating equal or more than the maximum steam pressure supplied to the water heater. The trap must also be sized according to the steam flow shown on the heater decal.

2. Connect the steam supply to the steam inlet fitting on the unit as shown in Figure 34-1. A Y-strainer (100 mesh recommended) must be installed ahead of and near the unit to prevent particles of scale and other solids from damaging the seats of the steam valve. It is good practice to install a blowdown valve on the Y-strainer piped to a suitable location that can be opened at intervals to clean the strainer screen. A condensate trap may be located upstream of the steam valve. This trap will drain the condensate that collects in the piping and must be plumbed to a suitable drain or the condensate receiver plumbing.

3. Connect condensate trap inlet at or below the outlet of the heat exchanger. The ability to lift condensate via steam pressure cannot be assured on Quickdraw products due to the possible use of a modulating steam valve or multiple solenoid steam control system. The recommended methods of condensate distribution are:
   a. Plumb to a condensate receiver and pump or vacuum return to the condensate return header.
   b. Plumb to a pneumatic/electric actuated condensate pump trap for return to the condensate return header.
   c. Drain to atmosphere – (would require constant make-up of boiler water).

   Inadequate drainage of condensate can adversely affect heat transfer and limit the performance of the water heater. Please note, damage to the water heater attributed to poor condensate drainage is **not** covered in the product warranty.

4. On the Quickdraw semi-instantaneous steam heater, the 3/4" thermostatic trap must be plumbed in parallel with the main steam trap for optimal operation of the heater. It speeds the removal of air from the heat exchanger when the steam valve opens. It also serves the second purpose of a vacuum breaker to protect the heat exchanger and allow proper drainage of condensate. (See Figure 34-1.)

5. Locate the thermostatic trap in a tee six inches above the main condensate line between the heat exchanger and the main trap. Plumb its outlet to a point downstream of the main trap.

STEAM WITH SINGLE-WALL / DOUBLE-WALL (con't)

STEAM VALVES

1. One or more two-position, on-off, electric valves are used to control the flow of steam. The valves will return to the closed position when power is off. This feature will prevent an excessive temperature buildup in the event of a power failure. The valve manufacturer's operation and maintenance instructions are shipped with the unit. Refer to these instructions during start-up and file for future referencing on maintenance.

CAUTION

Most valve problems are caused by dirt or trash in the steam line. This is most likely to occur during installation. Teflon pipe tape, pipe joint compounds, metal particles and dirt will clog up strainers and orifices and prevent valve seats from closing. Clean all pipe line strainers at start-up and check the valves again after a few days operation as recommended by the valve manufacturer. Inspection of strainers and blowdown piping should be part of the normal maintenance routine on this equipment.

OPTIONAL SAFETY SYSTEMS

1. This heater may be supplied with a pressure gradient monitoring (PGM) system, consisting of a differential pressure switch, a delay timer and a steam purge valve. It serves as a safety system to prevent the contamination of potable water with steam. The pressure switch monitors both steam and potable water system pressure. If the potable water pressure falls to a point slightly above the steam pressure and stays there for a short period of time, then the heater shuts down, closes the steam valve and opens a steam purge valve to quickly reduce the steam pressure in the heat exchanger. The system requires a manual reset to begin operation again. Note that the system does not necessarily detect a leak, but it prevents steam from entering the potable water if there is a leak.

2. Another safety option is the tank purge system (sometimes called a double solenoid safety system). The tank temperature is monitored and if it exceeds an adjustable limit, the heater is shut down and a valve opens to dump the overheated water. This allows cold make-up water to enter the tank and quickly reduce the tank temperature.

START-UP OPERATION

1. After all the steam, condensate and water lines are installed and inspected, the steam supply source and the condensate receiver should be checked for correct operation. Steam supply pressure to the heater must be equal to or less than the supply pressure on the heater decal. A pressure reducing valve can be installed in the supply line to meet this requirement.

2. Steam is directed to the heat exchanger through a header and steam control valves. The steam control valves are normally closed, on-off, electric valves and solenoid-operated. Should an electrical power failure occur, steam valves will close and stop steam flow to the unit.

WARNING!

Excessive steam pressure can cause the steam valve(s) and condensate trap to malfunction and can cause the heat transfer rate to exceed the relief valve capacity which can result in an explosion causing damage, injury or death.

STEAM WITH SINGLE-WALL / DOUBLE-WALL (con't)

START-UP PROCEDURE

1. Fill tank with water; open relief valve to purge air from top of tank. Check for plumbing leaks.

2. Push control switch, located on the control box, to activate the steam valve and thermostats. Check steam valve for operation; the valve solenoid should "click" to open valves when operating switch is pushed "on". The tank circulating pump, if present, should also operate. Check thermostat settings. The temperature limiting device is set at 200°F. **Temperature setting:** The operating thermostat is set at the factory at approximately 130°F and the upper operating thermostat is set at approximately 125°F. Adjustment may be made by turning the operating thermostat dial to the desired temperature.
3. Push the operating switch, located on the control box, to "off" before opening manual main steam supply valve. This will allow condensate that has collected in the supply line to drain through the trap installed in front of the steam valve. When the steam supply line is free of condensate, push operating switch to "on", opening the electric on-off steam valves allowing steam to flow through the heat exchanger.

4. Open nearby hot water tap to maintain a flow of water through tank when starting up units. Observe condensate flow at the receiver or other collection site to verify satisfactory flow. Regulate flow of water through tank to allow steam valve to cycle off and on, and check operation of unit.

MAINTENANCE

1. A preventive maintenance program should be established to assure a long, trouble-free life for the water heater.

2. Scale will normally form in the tank during operation and will accumulate on the bottom of the tank. The scale is formed from the natural chemicals in the water that precipitate out during the heating cycles. Some water supplies contain more of these chemicals than others, and the scale buildup will occur more rapidly. Other factors affecting the scale buildup are the amount of hot water used and the temperature of the water. The more hot water used, the more fresh water containing the scale-forming chemicals is brought into the tank. As the temperature of the water increases, the rate of scale deposited will be increased. The unit should be inspected and cleaned as required by local water conditions.

CAUTION
The relief valve is a primary safety device.

3. It is required for safe practice to operate the temperature and pressure relief valve once a year by lifting the lever briefly. If the valve does not open and close properly when testing, it must be replaced.

4. The temperature limiting device and thermostat temperature sensors that extend into the water in the tank may become coated with scale, depending on the type of water in your area. This coating will affect accuracy of sensors and can allow water temperature to exceed the desired limits. These controls should be removed from tank and inspected at necessary intervals. Remove scale if present.

WARNING!
To reduce the risk of electrical shock injury or death, on control systems using 120 volt external power, be certain switch is off and power disconnected before work is performed on this heater.

STEAM WITH SINGLE-WALL / DOUBLE-WALL (con't)

TROUBLESHOOTING NOTES

Problem:

1. No hot water at even low flow

a. **Cause**: Steam valve(s) not opening
Solution: Check that electrical coils are energized. If not, trace wiring problem. If so, the valve may be faulty, the steam pressure inadequate to open the valve (< 5 psi depending on the valve), or the linkage (if applicable) is out of adjustment.

b. **Cause**: Condensate flow is blocked
Solution: Float-type traps will not open if the inlet steam pressure exceeds the trap rating. Check steam pressure against the rating stamped on the trap. Check that there are no valves or clogged strainers between the heat exchanger and the condensate receiver.

c. **Cause**: PGM system tripped
Solution: The pressure gradient monitoring option prevents the steam valve from opening if the water pressure in the tank is within 10 psi of the steam pressure. Correct water pressure problem.

Problem:

2. Heater recovery is slow or outlet temperature is below setpoint:

a. **Cause**: Steam supply insufficient
Solution: Loss of steam delivery pressure, see below.

b. **Cause**: Condensate not draining
Solution: Check that there is not excessive condensate lift. For low pressure steam, any lift at all may affect performance. Check the sizing of the trap. Check that the condensate receiver is not pressurized. Check that there is no blockage in the condensate line from the trap to the receiver. Unclog any strainers in the system.

c. **Cause**: Condensate trap not operating
Solution: If the condensate temperature near the heat exchanger is considerably less than the steam temperature, then condensate is being backed up into the heat exchanger. Check that the supply steam pressure does not exceed the trap pressure rating. Check the trap for blockage or mechanical failure. Check that the trap is sized sufficiently for the load.

d. **Cause**: Heat exchanger is breached
Solution: If excessive condensate is draining, the heat exchanger may have a leak and be filling with water.

e. **Cause**: Heat exchanger is fouled
Solution: Inspect the heat exchanger for excessive scaling or fouling on the water side.

f. **Cause**: Abnormal operating conditions
Solution: The water temperature has a significant effect on the efficiency of the heat exchanger. Check if the setpoint is higher than specified. Confirm the measured flow rate with meters or by volume and rate. Check that there are no other loads on the heater.

Problem:

3. Steam delivery pressure to heat exchanger is low or drops off:

a. **Cause**: Low supply steam pressure.
Solution: Unclog strainer. Check for blockage or restrictions in the line between the boiler and the water heater. Check for low boiler output or upstream blockage and make necessary corrections.

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b. **Cause**: Steam valve(s) not fully opening
Solution: Check steam pressure before and after steam valve. The pressure drop should not be more than half of the inlet pressure. Check valve for blockage. Check linkage for adjustment. Check modulating signal (if applicable). Check the supplied voltage to the valve coil.

c. **Cause**: Piping flow restricted.
Solution: Calculate the flow velocity and expected friction loss. If excessive, larger inlet and outlet piping are necessary.

d. **Cause**: Main valve malfunction.
Solution: Refer to the valve manual for instructions on main valve repair.

e. **Cause**: Main valve undersized.
Solution: Check steam pressure before and after steam valve. Check valve capacity against the load. If insufficient, increase trim or valve size.

Problem:

4. Outlet water temperature not constant.

a. **Cause**: Insufficient recovery
Solution: If the thermostat or controller is always open, then the outlet temperature will vary with load. See above for causes of insufficient recovery.

b. **Cause**: Malfunctioning thermostat
Solution: Measure the tank temperature near the thermostat and compare to setpoint. The thermostat should turn on and off within 5°F of setpoint.

Problem:

5. Unusual noises coming from heater.

a. **Cause**: Flashing condensate
Solution: Pinging, rattling or banging noises are usually the result of condensate flashing to steam. Condensate not draining properly. Check that there is not excessive condensate lift. Check the sizing of the trap. Check that the condensate receiver is not pressurized. Check that there is no blockage in the condensate line from the trap to the receiver. Unclog any strainers in the system.

Problem:

6. Heat exchanger visibly leaking.

a. **Cause**: Plumbing connection loose
Solution: Check and tighten plumbing connection.

b. **Cause**: Double-wall heat exchanger tube leak
Solution: If one of the tube walls is breached, a double-wall heat exchanger will leak at the joint between the tubesheets. Isolate the heater and replace the heat exchanger.

Since PVI cannot control the use of the water heater, water conditions, or maintenance, the warranty on the water heater does not cover poor performance, structural failure, or leaking due to an excessive accumulation of scale.
