Thermal-Stor™

Installation & Operation Manual

Models: TSU 150 - 940

CAUTION:
This appliance is not intended for potable water.

⚠ WARNING This manual must only be used by a qualified heating installer / service technician. Read all instructions before installing. Perform steps in the order given. Failure to comply could result in severe personal injury, death, or substantial property damage.

Save this manual for future reference.

Lochinvar®
High Efficiency Water Heaters, Boilers and Pool Heaters

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Hazard definitions

The following defined terms are used throughout this manual to bring attention to the presence of hazards of various risk levels or to important information concerning the life of the product.

⚠ DANGER DANGER indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury.

⚠ WARNING WARNING indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.

⚠ CAUTION CAUTION indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury.

CAUTION CAUTION used without the safety alert symbol indicates a potentially hazardous situation which, if not avoided, may result in property damage.

NOTICE NOTICE indicates special instructions on installation, operation, or maintenance that are important but not related to personal injury or property damage.

Please read before proceeding

⚠ WARNING **Installer –** Read all instructions before installing. Perform steps in the order given.

Have this storage tank serviced/inspected by a qualified service technician, at least annually.

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

NOTICE When calling or writing about the appliance – Please have the model and serial number from the tank rating plate.

Consider piping and installation when determining appliance location.

Any claims for damage or shortage in shipment must be filed immediately against the transportation company by the consignee.

Factory warranty (shipped with appliance) does not apply to appliances improperly installed or improperly operated.

⚠ WARNING If the information in this manual is not followed exactly, a fire or explosion may result causing property damage, personal injury or loss of life.

This appliance MUST NOT be installed in any location where gasoline or flammable vapors are likely to be present.

WHAT TO DO IF YOU SMELL GAS

- Do not try to light any appliance.
- Do not touch any electric switch; do not use any phone in your building.
- Immediately call your gas supplier from a neighbor's phone. Follow the gas supplier's instructions.
- If you cannot reach your gas supplier, call the fire department.
- Installation and service must be performed by a qualified installer, service agency, or the gas supplier.

⚠ WARNING Failure to adhere to the guidelines on this page can result in severe personal injury, death, or substantial property damage.

When servicing the Thermal-Stor –

- To avoid severe burns, allow the appliance to cool before performing maintenance.

Appliance operation –

- Do not use this appliance if any part has been under water. The possible damage to a flooded appliance can be extensive and present numerous safety hazards. Any appliance that has been under water must be replaced.

CAUTION This appliance is not intended for potable water.

1 General information

The Lochinvar Thermal-Stor stratified solar tank is designed to use a solar thermal collector system, in conjunction with a back-up heat source, to provide water for a closed loop hydronic heating system. The appliance consists of a spherical heat exchanger connected to an unlined storage tank. The Thermal-Stor tank uses solar heated water pumped through the spherical heat exchanger to heat water in the tank. A backup heat source is used to maintain the desired tank temperature in the event that adequate solar heat is not available. Tank components and specifications are detailed in FIG.'s 1-1 and 1-2, as well as in Tables 1A - 1D on pages 4 through 6.

The Thermal-Stor buffer tank can provide both thermal storage volume and hydraulic separation between the boiler or heat pump and the building distribution system. The primary application of a buffer tank is to reduce boiler or heat pump cycling in systems operating below design load conditions, or in systems having several low Btu heat loads calling for heat at different times. The solar-assisted buffer tank provides thermal storage volume which can help reduce short-cycling, leading to longer runtimes, higher efficiency and longer equipment life for the solar thermal system and heat source. If piped correctly, the buffer tank can also function as a hydraulic separator, effectively separating the flow in the boiler loop from the flow in the distribution system (FIG.'s 4-2 and 4-3, on pages 14 and 15). This tank has many applications including geothermal, pool and space heating. Consult the factory if your specific application is not covered in this manual. This tank is not intended for use in gravity water heating applications.

Operating Restrictions:

- Maximum stored water temperature is 210°F.
- Maximum working pressure for the vessel is 125 psig.

Tank shipment

Tanks taller than 7.5 feet will be shipped horizontally. Four shipping legs are used to secure the tank to a pallet, and holes are provided in the top cover for access to lifting lugs. The shipping legs should be removed when the tank is removed from the shipping crate.

Use field-supplied insulation to pack the shipping and lug compartments, then use the factory provided covers to conceal compartments upon final installation.

Table 1A
Thermal-Stor
Tank Component Materials

Component	Material
Tank	Steel SA414-G
Insulation	Polyurethane Foam
Jacket	Pre-paint Sheet Metal

Table 1B
Spherical Heat Exchanger
Component Materials

Component	Material
Housing	Steel S 235 JR
Heat Exchanger Coil	Copper
Insulation	Polyurethane Foam
Jacket	Polypropylene

1 General information *(continued)*

Figure 1-1 *Thermal-Stor solar stratified tank components*

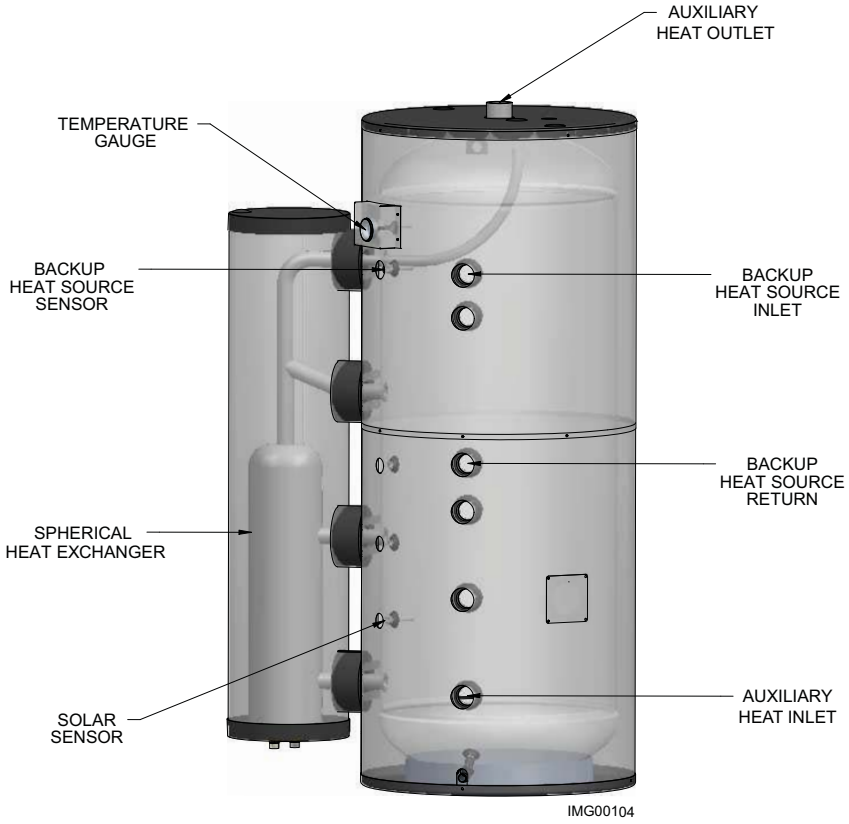
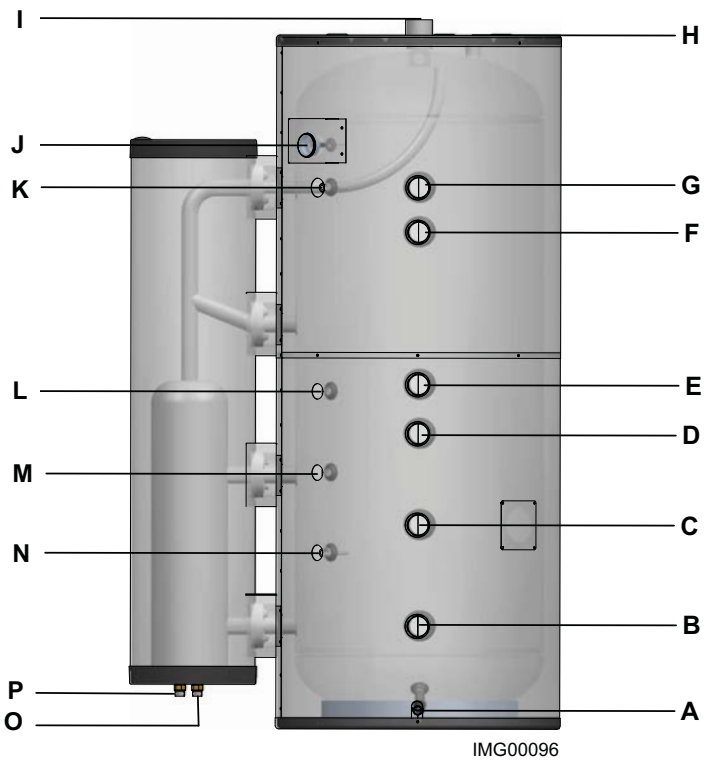


Table 1C
Thermal-Stor Tank Specifications

Model	Tank Diameter (in.)	Jacket Diameter (in.)	Hydronic Tappings (NPT)	Boiler Supply/ Return (NPT)	Tank Water Volume (gal.)	Full Weight (lbs)
TSU150	24	28	2"	2"	140	1775
TSU200	28	32	2"	2"	190	2300
TSU257	30	34	2"	2"	240	2875
TSU350	36	40	2"	2"	340	3775
TSU423	36	40	2"	2"	420	4650
TSU504	42	46	2"	2"	495	5475
TSU650	48	52	2"	2"	645	7050
TSU752	48	52	2"	2"	745	8100
TSU940	48	52	2"	2"	920	10000

1 General information

Figure 1-2 *Thermal-Stor tappings*



Thermal-Stor Elements	
A	Drain Valve
B	Auxiliary Heat Return
C	Low Temp Water Return
D	High Temp Water Return
E	Backup Heat Source Return
F	Space Heat Supply
G	Backup Heat Source Supply
H	Relief Valve / Air Vent
I	Auxiliary Heat Outlet
J	Heat Source Thermometer
K	Backup Heat Source Sensor
L	Sensor (Optional)
M	Sensor (Optional)
N	Solar Sensor
O	Spherical Exchanger, Inlet (Red Label)
P	Spherical Exchanger, Outlet (Blue Label)

Table 1D
Tapping Measurements (From Floor)

Model	A (in.)	B (in.)	C (in.)	D (in.)	E (in.)	F (in.)	G (in.)	H (in.)	I (in.)	O (in.)	P (in.)
TSU150	2 1/4	10 3/4	21 1/4	28 3/4	33	50 1/4	55 1/4	71	75 3/4	3 1/2	3 1/2
TSU200	2 1/4	11 1/4	22 3/4	33	38 1/2	55 1/2	60 1/2	76	80	4 1/4	4 1/4
TSU257	2 1/4	15 1/2	34 1/2	42 1/2	49	62 3/4	67 3/4	87	91 3/4	8 1/2	8 1/2
TSU350	3 1/4	17	36 3/4	46 1/2	52 3/4	61 1/4	66 1/4	87 1/4	91 1/4	10	10
TSU423	3 1/4	17	40 1/4	52	58 1/4	75 3/4	80 3/4	100	104	10	10
TSU504	2 1/2	18 1/2	33 1/2	42 1/4	49	59 3/4	64 3/4	87	91 1/2	11 1/2	11 1/2
TSU650	2 1/4	20 1/2	36 3/4	44 1/2	51	60 3/4	65 3/4	88	93	13 1/2	13 1/2
TSU752	2	20 1/2	38 1/4	50	57 1/2	70	75	100	104 3/4	10 1/2	10 1/2
TSU940	2 1/4	20 1/2	49	63	70 1/2	88 1/2	93 1/2	124	129	13 1/2	13 1/2

1 General information *(continued)*

Spherical heat exchanger

The Thermal-Stor uses a copper finned tube spherical heat exchanger to provide optimum solar stratified charging. The spherical exchanger helps maintain optimal use of solar energy for hydronic heating. The multi-functional design improves efficiency in every system. Insulated with polyurethane foam, the spherical heat exchanger and tank maintain a space-saving design with minimal heat loss. Refer to FIG. 1-3 and Tables 1E and 1F for additional spherical heat exchanger information and measurements.

Figure 1-3 *Spherical heat exchanger w/ tank*

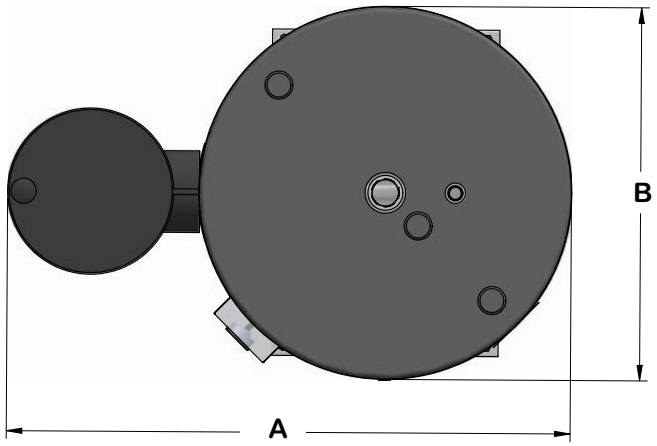


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Table 1E
Tank with Spherical Measurements

Model	Spherical Model	A (in.)	B (in.)
TSU150	**SHX40000**	44 1/2	28
TSU200	**SHX40000**	48 1/4	32
TSU257	**SHX40001**	50 1/4	34
TSU350	**SHX40001**	56 1/4	40
TSU423	**SHX40002**	56 1/4	40
TSU504	**SHX40002**	62 1/4	46
TSU650	**SHX40003**	71 1/4	52
TSU752	**SHX40003**	71 1/4	52
TSU940	**SHX40004**	71 1/4	52

Table 1F
Spherical Heat Exchanger Specifications

Model	Tank Diameter (in)	Jacket Diameter (in)	Jacket Height (in)	Solar Inlet Return (NPT)	HEX Surface Area (ft^2)	HEX Water Volume (gal)	Tank Water Volume (gal)	Total Water Volume (gal)
SHX40000	8 1/2	14	61	0.75"	28	0.55	7.9	8.45
SHX40001	8 1/2	14	61	0.75"	42	0.65	7.8	8.45
SHX40002	8 1/2	14	61	1"	59	1.1	7.35	8.45
SHX40003	11 3/4	17	61	1.25"	102	2.0	15.8	17.8
SHX40004	11 3/4	17	80	1.25"	102	2.0	15.8	17.8

2 Pre-installation

1. The installation must conform to the instructions in this manual and all applicable local, state, provincial, and national codes, laws, regulations, and ordinances. Installations in Canada must conform to B149.2 Installation Code.

2. If the heat source water contains antifreeze, a maximum 50/50 mixture of inhibited propylene glycol is recommended. The heat source water, including additives, must be non-toxic, having a toxicity rating or class of 1, as listed in the *Clinical Toxicology of Commercial Products*.

⚠ WARNING Do not use automotive, ethylene glycol or petroleum-based antifreeze. Do not use any undiluted antifreeze. This can cause severe personal injury, death, or substantial property damage.

3. Read and understand all installation requirements in this manual.

Table 2A
Recommended Antifreeze Concentrations

Glycol Freeze Protection	Percentage	Freeze Protection
Propylene Glycol Only	20	18°F
	30	8°F
	40	-6°F
	50	-28°F

Locating the Tank

1. Choose a location for the Thermal-Stor centralized to the piping system. You must also locate the Thermal-Stor where it will not be exposed to freezing temperatures. Additionally, you will need to place the tank so that the controls, drain, and inlet/outlets are easily accessible. This tank must not be installed outdoors, as it is certified as an indoor appliance, and must be kept vertical on a level surface.

2. Table 1C on page 5 shows the weight of all the tanks filled with water. Ensure that the location chosen for the tank is capable of supporting the weight.

CAUTION This tank must be placed where leakage from the relief valve, leakage from the related piping, or leakage from the tank or connections, will not result in damage to the surrounding areas, or to the lower floors of the building. A tank should always be located in an area with a floor drain or installed in a drain pan suitable for tanks. Lochinvar shall not be held liable for any such water damage.

3. The tank may be located some distance from the heat source provided that the pump is designed to provide enough flow for both units to perform properly. The further the distance from the tank to the heat source, the longer the response time will be to provide sufficient heat to the tank. Insulate piping between the heat source and the tank.

⚠ WARNING Failure to properly support the tank could result in property damage or personal injury.

Recommended Clearances

The installation location must provide adequate clearances for servicing and proper operation of the appliance. A 12-inch vertical clearance is recommended from the top of the appliance. A zero clearance is allowed for the sides of the appliance. However, boiler and servicing clearances must be figured when locating the appliance.

3 Solar connections

A solar thermal system consists of several components selected to work together to convert solar energy into hot water for various applications. A controller is used to turn on a pump when the fluid in the solar collectors is warmer than the water in the Thermal-Stor tank plus the differential. The pump will transport hot fluid from the collector to the heat exchanger and replace it with cooler fluid returning. The collectors, pump station and heat exchanger should be connected with supply and return piping that is insulated to minimize heat losses (FIG. 3-1, page 10). The system should be equipped with over-temperature and over-pressure devices that prevent unsafe operating conditions. When multiple Thermal-Stor tanks are used, they should be connected in reverse-return arrangement (FIG. 3-2, page 10). This will help ensure that solar heated water is distributed evenly between the heat exchangers. Pressure drop and maximum operating values for the Thermal-Stor spherical heat exchanger are listed in Tables 3A - 3C.

Installation and commissioning must be carried out by a licensed contractor. Take appropriate safety measures when carrying out any installation work on the roof and observe all relevant accident prevention regulations. It is the installer's responsibility to comply with the building and installation codes in effect and all regulations that apply to the operation of a solar hot water system.

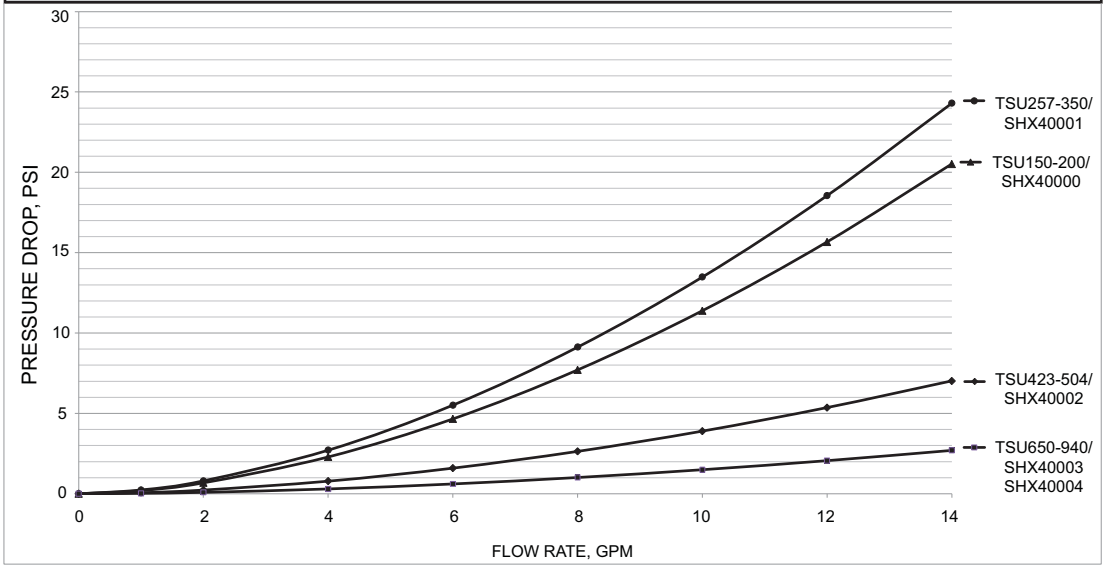
Table 3A
Spherical Heat Exchanger
Pressure Drop Values

MODEL	SPHERICAL MODEL	PRESSURE DROP PSI)							
		1 GPM	2 GPM	4 GPM	6 GPM	8 GPM	10 GPM	12 GPM	14 GPM
TSU150	SHX40000	0.20	0.68	2.29	4.66	7.71	11.39	15.67	20.52
TSU200									
TSU257	SHX40001	0.24	0.81	2.71	5.52	9.13	13.49	18.56	24.31
TSU350									
TSU423	SHX40002	0.07	0.23	0.78	1.59	2.64	3.90	5.36	7.02
TSU504									
TSU650	SHX40003	0.03	0.09	0.30	0.61	1.01	1.50	2.06	2.70
TSU752									
TSU940	SHX40004	0.03	0.09	0.30	0.61	1.01	1.50	2.06	2.70

Table 3B
Spherical Maximum Operating Conditions

	Copper Heat Exchanger	Tank
Temperature	230°F	230°F
Pressure	145 psi	125 psi

Table 3C
Spherical Heat Exchanger Pressure Drop Chart



3 Solar connections

Figure 3-1 *Solar System Piping*

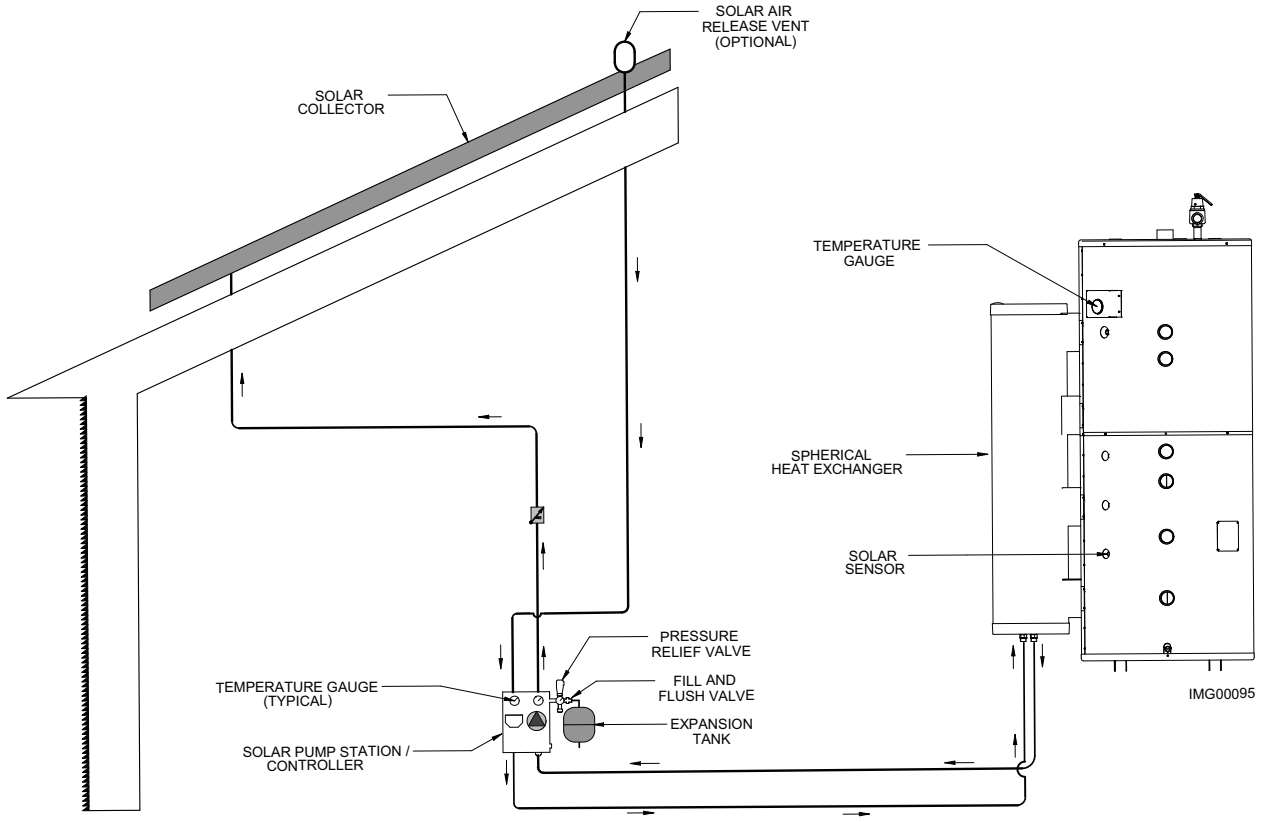
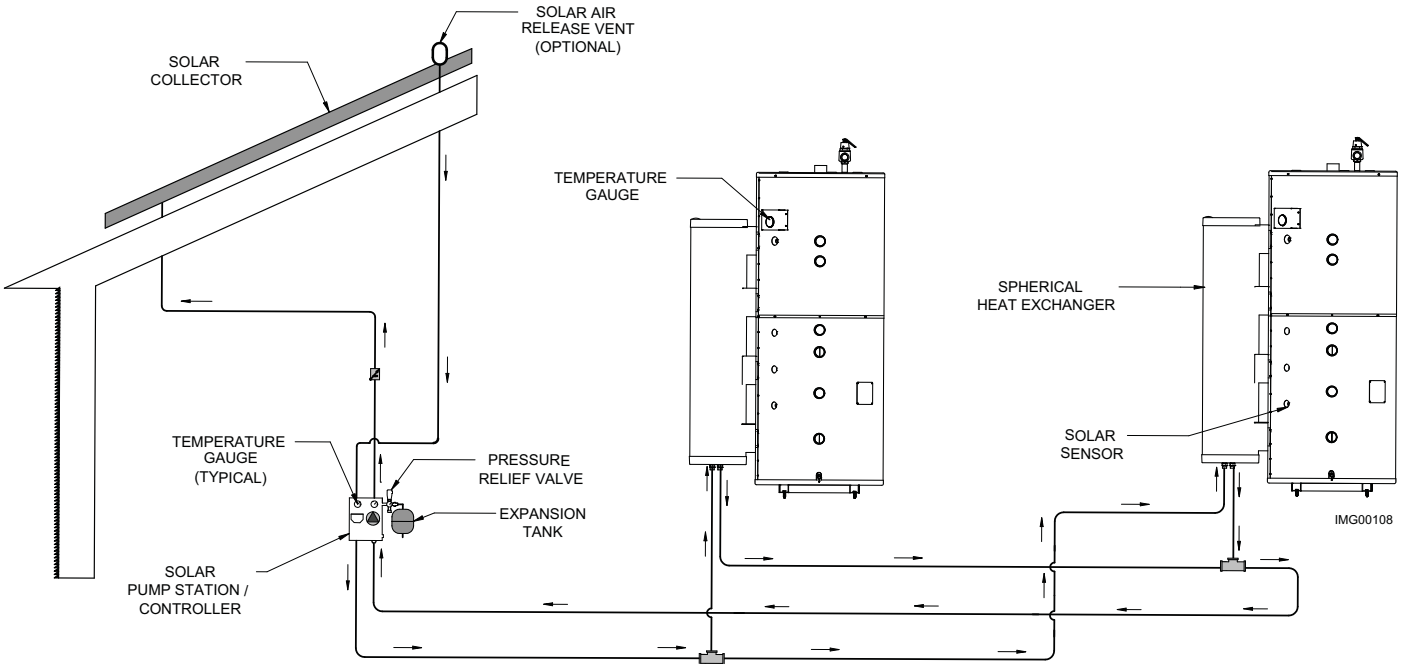


Figure 3-2 *Solar System Piping with Multiple Heat Exchangers*



NOTICE Please note that these illustrations are meant to show system piping concept only, the installer is responsible for all equipment and detailing required by local codes.

4 Hydronic piping

Basic hydronic piping

Depending upon the application, there are many different piping arrangements that can be applied to the Thermal-Stor buffer tank. A pressure relief valve must be installed on each boiler and each buffer tank as regulations require. Installation and commissioning must always be carried out by a licensed and experienced contractor. It is the responsibility of the installer to comply with all building and installation codes in effect.

Hydronic heating zoned with circulators

FIG. 4-2 on page 14 shows typical space heating piping for a Thermal-Stor tank. The functions of some of the illustrated components are as follows:

- Shut-off valves (recommended) - Used to isolate the tank for servicing.
- Backflow Preventer (required by some codes) - Used to prevent water from backing out into the piping in the event that inlet water pressure drops.
- Expansion Tank (required for thermal expansion) - Tank absorbs the increased volume caused by heating water.

Refer to the expansion tank manufacturer's instructions for proper sizing and use.

NOTICE If a valve is used between an expansion tank and the tank inlet, the installer must ensure that the valve is open.

- Circulation Pump (recommended) - Used to circulate and maintain hot water within the piping system.
- Check Valve (required by some codes) - Used to allow water to flow in only one direction, preventing back-flow.
- Drain (required) - Used to drain the tank for inspection or servicing.
- Mixing valve (required for domestic water) - Used to mix hot water with cold water to ensure constant, safe outlet temperatures.
- Unions (optional) - Used to disconnect the tank in the unlikely event that this is necessary for service.

NOTICE Be sure to field-install plugs or caps on any tank tappings that are not in use.

Thermal-Stor domestic water heating

When paired with an indirect water heater or a heat exchanger (FIG. 4-3, page 15) the Thermal-Stor buffer tank can be used to heat domestic water. The hottest water is taken from the auxiliary heat supply and piped to the indirect heater where it is used to heat domestic potable water. The water is returned to the high temperature return tapping so the hottest water will be available for domestic heating while preserving tank stratification. Other hydronic heating applications will be piped into the low temperature or auxiliary returns.

Domestic hot water priority

Domestic Hot Water (DHW) priority allows a boiler to be used for both space and domestic water heating by turning off the boiler output for space heating when there is a call for domestic hot water. Outdoor reset is required with the use of DHW priority in order to regulate water temperature and satisfy heating load. During calls for DHW, the outdoor reset control will turn off the circulation pump and raise the boiler water temperature to a minimum of 180°F (FIG. 4-5, page 17).

High output piping

When a large amount of hot water is required for hydronic heating, there are several different piping alternatives. When hydraulic separation is desired, multiple boilers coupled with a buffer tank can provide adequate water for both space and domestic water heating (FIG. 4-4, page 16).

Multiple Thermal-Stor tanks can also be piped together if there is a continuous demand for heating water. This is typically done in the reverse-return arrangement. This method uses more piping than direct-return systems, but the temperature and boiler flow are more balanced throughout each tank. To ensure even charging and discharging of each tank, it is recommended that only tanks of the same size are placed in the same manifold. It is recommended that each tank be equipped with its own isolation valves, unions and drains, so that one tank may be removed from the system if necessary. It is only necessary to use one backup heat source sensor for control (FIG. 4-6, page 17).

CAUTION Piping must be balanced. Failure to balance piping could result in uneven flow and improper operation.

4 Hydronic piping

Relief Valves

⚠ WARNING

For protection against excessive pressure, install temperature and pressure protective equipment required by local codes. A relief valve must be certified by a nationally recognized testing laboratory that maintains periodic inspection of listed equipment or materials. The equipment and materials must meet the requirements for Relief Valves and Automatic Gas Shutoff Devices for Hot Water Supply Systems, ANSI Z21.22, as well as the standard CAN1-4.4, Temperature, Pressure, Temperature and Pressure Relief Valves and Vacuum Relief Valves. The relief valve shall be marked with a maximum set pressure, not to exceed the maximum working pressure of the appliance. It shall also have an hourly rated discharge capacity not less than the Btu output of the heat source.

Pressure only relief valves (POV)

A pressure relief valve should be installed in the connection provided on the top of the tank containing hydronic water. It is imperative that the relief valve be correctly installed because it also serves as an air vent. Do Not place any valve between the relief valve and the opening provided. To prevent water damage, the discharge from the relief valve should be piped to a suitable floor drain for disposal when relief occurs Do Not install reducing coupling or other restrictions in the discharge line. The discharge line should allow complete drainage of the valve and line. The POV should be sized in accordance with the maximum working pressure of the tanks, and the Btu output of the backup heat source.

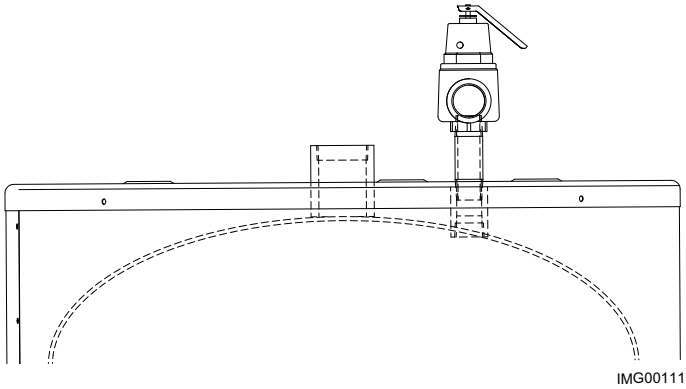
It is recommended to have a relief valve sized in accordance with ASME Boiler and Pressure Vessel Code, Section IV "Heating Boilers". ASME states in Section VIII, Division 1, paragraph UG-125 (a), "All pressure vessels within the scope of this division, irrespective of size or pressure, shall be provided with pressure relief devices in accordance with the requirements of UG-125 through UG-137."

NOTICE

Verify that the relief valve complies with local codes. If the relief valve does not comply with local codes, replace it with one that does. Follow the installation instructions in this section.

Do not place a valve between the relief valve and the tank.

Figure 4-1 *Relief valve*



Standard Installation

Relief Valve Discharge Piping

Relief valve discharge piping **MUST** be:

- Made of material serviceable for a temperature of 250°F or greater
- Directed so that hot water flows away from all persons
- Directed to a suitable place for disposal
- Installed so as to allow complete draining of the relief valve and discharge line
- Terminated within 6" of the floor

Relief valve discharge piping **MUST NOT** be:

- Excessively long. Using more than two (2) elbows or 15 feet of piping can reduce discharge capacity
- Directly connected to a drain (Refer to local codes)
- Subject to freezing

⚠ WARNING

Do not install any valve between the relief valve and its connection or on the relief valve discharge piping. Improper placement and piping of relief valve can cause severe personal injury, death or substantial property damage.

⚠ CAUTION

The relief valve is not intended for constant duty, such as relief of pressure due to repeated normal system expansion. Correct this condition by installing a properly sized expansion tank in a domestic water system. Refer to the expansion tank manufacturer's installation instructions for proper sizing.

⚠ WARNING

Failure to install and maintain a new, listed and properly sized relief valve will relieve the manufacturer from any claim which might result from excessive temperature and pressure.

4 Hydronic piping *(continued)*

Anti-scald mixing valves

Anti-scald valves used with water heaters are also called tempering valves or mixing valves. An anti-scald valve mixes cold water with the outgoing hot water to assure that hot water reaching a building fixture is at the correct temperature. A mixing valve is required when the Thermal-Stor is used to generate domestic hot water.

NOTICE ASSE1017 and ASSE1070 certified mixing valves are required.

The temperature of water going to the fixtures may be more carefully controlled through the use of a thermostatic mixing valve. This device blends a controlled amount of cold water with the hot water leaving the tank so that water at a more constant temperature exits the mixing valve. Always consult the mixing valve manufacturer's instructions and guidelines for correct piping and usage.

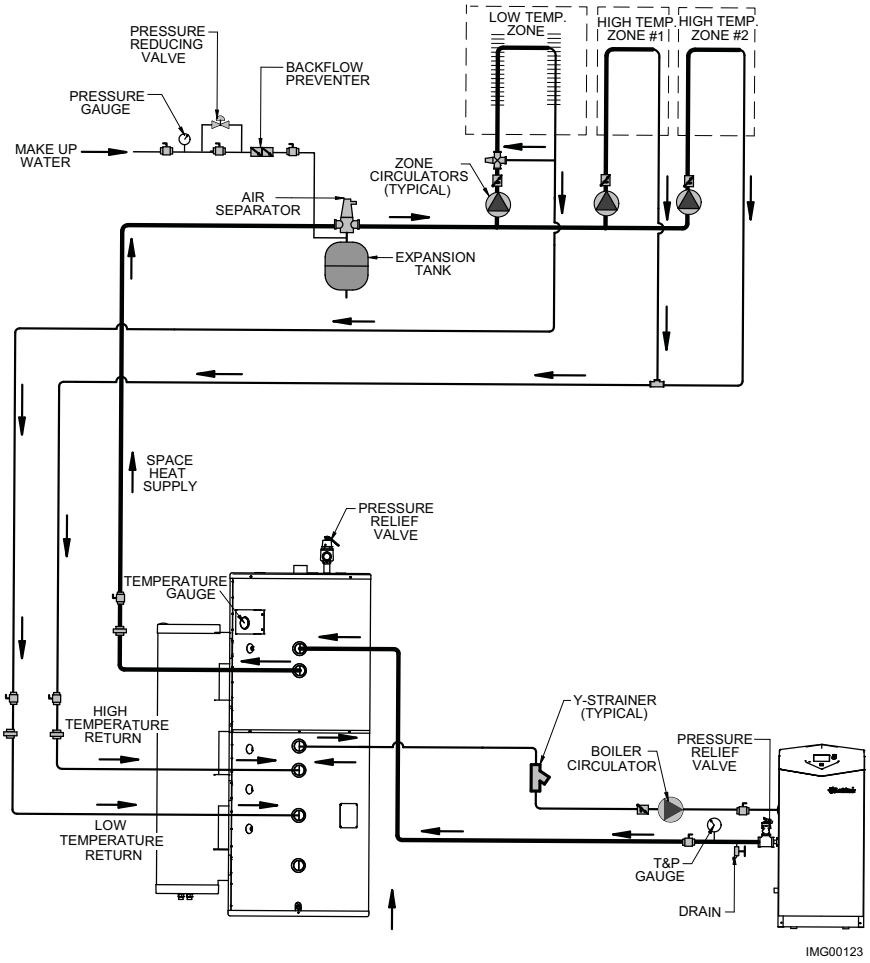
⚠ WARNING Hot water can scald! To avoid scalding potential, mixing valves must be selected and installed according to valve manufacturer's instructions and recommendations. Mixing valves should be installed by a licensed contractor.

⚠ WARNING An anti-scald mixing valve does not eliminate the risk of scalding.

- Feel water before bathing or showering.
- If anti-scald or anti-chill protection is required, use devices specifically designed for such service. Install these devices in accordance with their manufacturer's instructions.

4 Hydronic piping

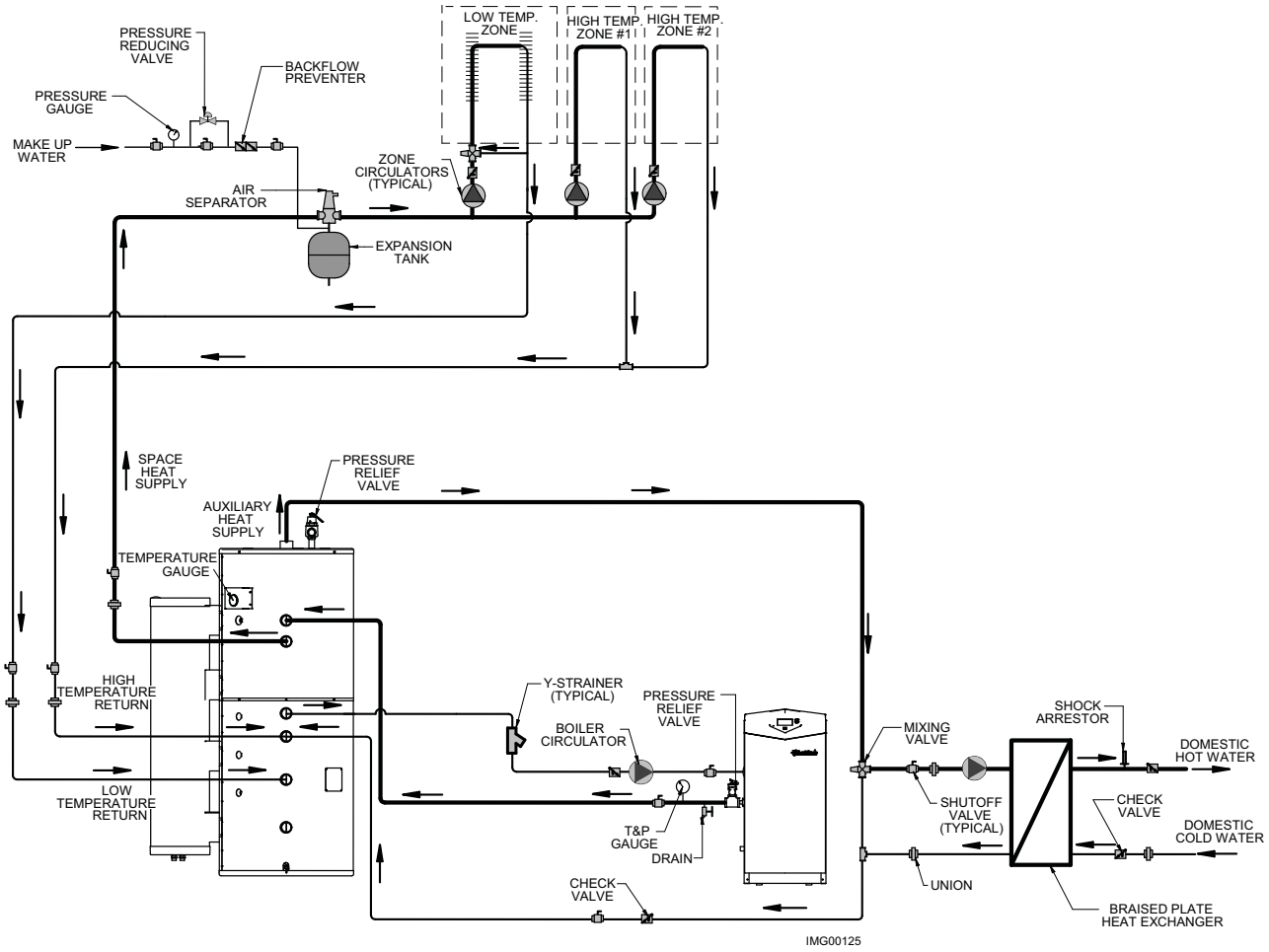
Figure 4-2 *Piping with Hydronic Heating*



NOTICE Please note that these illustrations are meant to show system piping concept only, the installer is responsible for all equipment and detailing required by local codes.

4 Hydronic piping *(continued)*

Figure 4-3 *Domestic Indirect Water Heating*

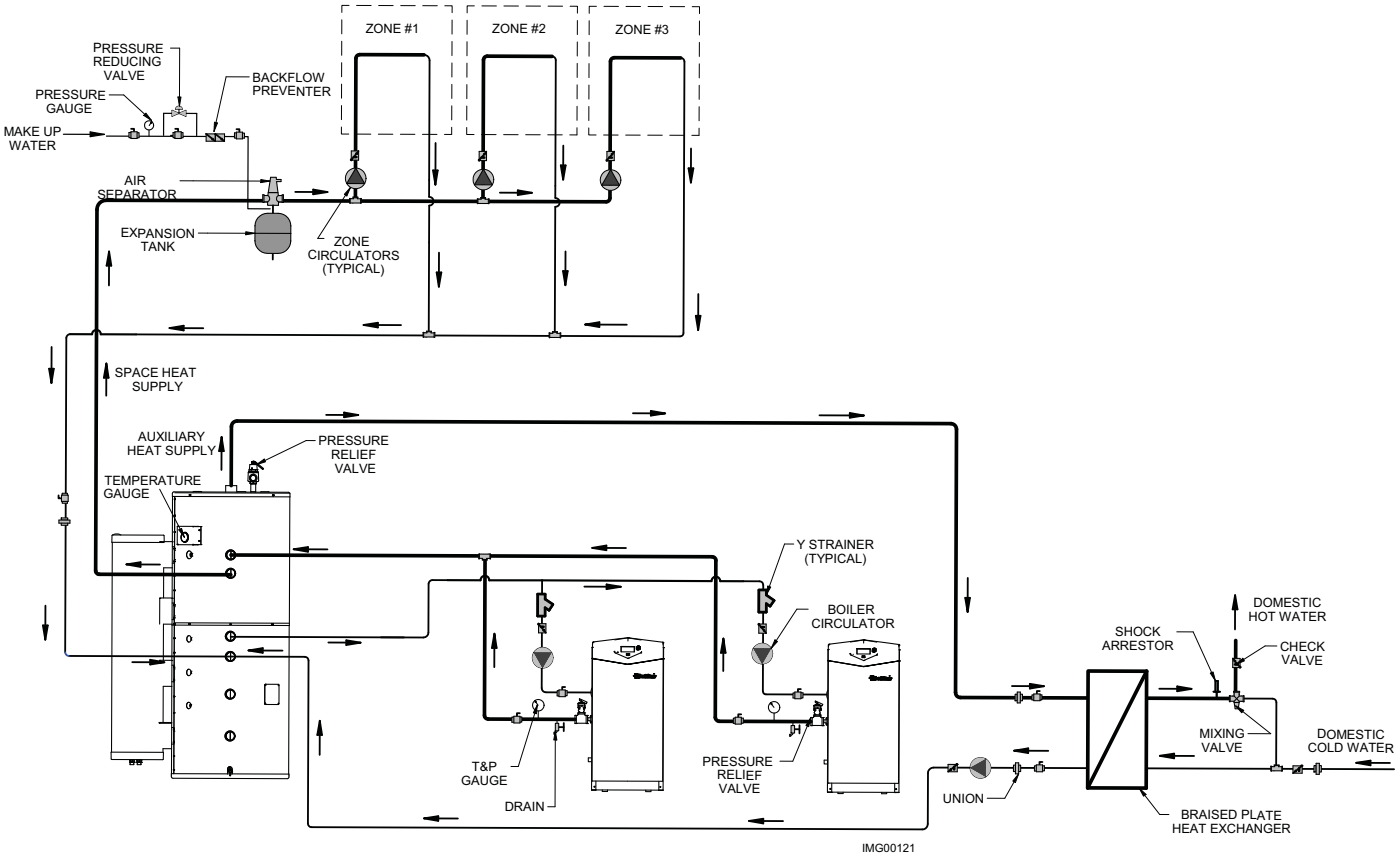


WARNING Boiler must be sized to meet all space heating and domestic hot water loads simultaneously. Failure to properly size the heat source can cause operational issues.

NOTICE Please note that these illustrations are meant to show system piping concept only, the installer is responsible for all equipment and detailing required by local codes.

4 Hydronic piping

Figure 4-4 *Multiple Boiler Piping - Single Temperature*



WARNING Boiler must be sized to meet all space heating and domestic hot water loads simultaneously. Failure to properly size the heat source can cause operational issues.

NOTICE Please note that these illustrations are meant to show system piping concept only, the installer is responsible for all equipment and detailing required by local codes.

4 Hydronic piping *(continued)*

Figure 4-5 *DHW Priority Piping - Multiple Temperature Space Heating*

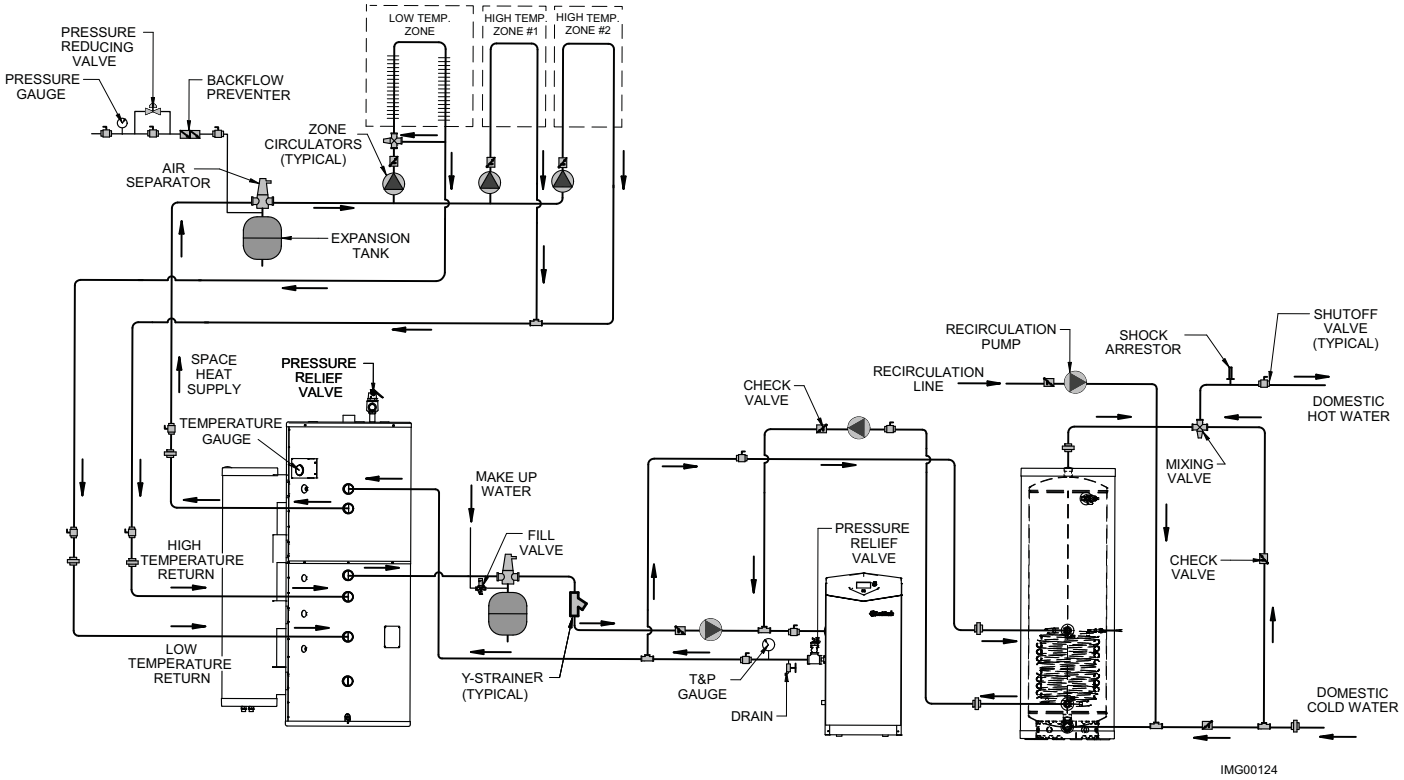
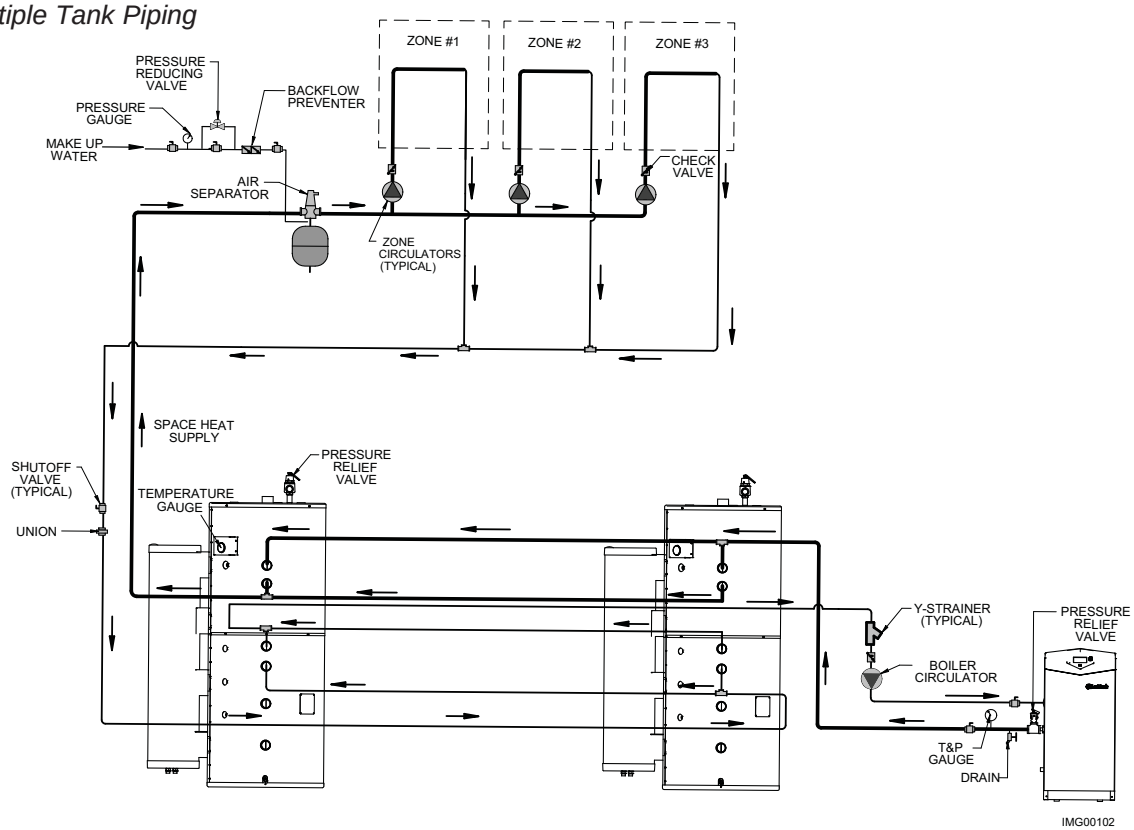


Figure 4-6 *Multiple Tank Piping*



WARNING Boiler must be sized to meet all space heating and domestic hot water loads simultaneously. Failure to properly size the heat source can cause operational issues.

NOTICE Please note that these illustrations are meant to show system piping concept only, the installer is responsible for all equipment and detailing required by local codes.

5 Startup and maintenance

System startup

1. Make sure the system is free of leaks and that air is purged from the system.

CAUTION Fix any leaks found before proceeding further. Leakage from the heat source and solar piping can result in severe damage to the system.

2. Many soldering fluxes contain Zinc Chloride which can cause severe corrosion damage to stainless steel. After completing all domestic water connections, flush the Thermal-Stor tank thoroughly before leaving the installation. This is particularly important if the Thermal-Stor will be unused for an extended period of time after installation. Flush the storage tank by drawing at least three times its volume from the tank.

3. Make sure that each zone valve or circulator operates when, and only when, its thermostat calls for heat. Let each zone operate long enough to purge any remaining air from the system.

   Refer to the heat source and solar Installation and Operation Manuals for additional start-up information.

Maintenance Schedule

The Lochinvar Thermal-Stor solar tank is an extremely simple device and as such requires very little maintenance. There are, however, several items which should be inspected on an annual or as needed basis to ensure a reliable supply of hot water:

- Ensure that the boiler and solar water piping are free of leaks.
- If there is an oil lubricated circulator in the system, make sure it is lubricated as called for by the circulator manufacturer.
- Make sure that the heat source is maintained in accordance with the manufacturer's instructions.
- If antifreeze is required to keep the water chemistry within the parameters shown in Table 2A (see Section 2 - Pre-Installation), make sure that this system is properly maintained.

Annual service by a qualified service technician should include the following:

- ❑ Any procedure required by local codes.
- ❑ Verify system pressure. Air venting procedure may require adding water to bring boiler system up to pressure, typically 12 psig minimum.
- ❑ Manually operate relief valve at least once a year. This will release some hot water.

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

Move operating lever to open position for a few seconds and then move it back, allowing it to snap closed. After the relief valve is operated, if it continues to release water, close the cold water inlet to the water heater immediately. Follow the draining instructions, and replace the relief valve. If the relief valve weeps periodically, it may be due to thermal expansion. Do not plug the relief valve or discharge piping. In this case, ensure that the expansion tank is properly sized and charged to the appropriate pressure.

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

- ❑ Verify that expansion tank pressure is equal to system pressure.

5 Startup and maintenance

- ❑ Follow instructions on circulator to oil, if required.
- ❑ Check mixing valve, valves, pipes, and fittings for leaks.
- ❑ Check function of the field-installed controls and valves. See component manufacturer's instructions.
- ❑ Review owner's maintenance responsibilities and their frequencies, including any not listed in the following section.

Owner monthly maintenance to include:

- ❑ Visually check valves, pipes, and fittings for leaks. Call a qualified service technician to repair leaks.

Winterizing the system

Drain the tank and spherical heat exchanger if the appliance will be off and exposed to freezing temperatures. Freezing water will expand and damage the appliance.

- If the tank, spherical heat exchanger and heat source water contain sufficient antifreeze, then the tank does not need to be drained.

If antifreeze is used in the heat source water, check the concentration. Heat source water (including additives) must be non-toxic, having a toxicity rating or class of 1, as listed in the "Clinical Toxicology of Commercial Products". A maximum 50/50 mixture of inhibited propylene glycol is recommended. Follow the antifreeze manufacturer's instructions.

⚠ WARNING Do not use automotive, ethylene glycol or petroleum-based antifreeze. Do not use any undiluted antifreeze. This can cause severe personal injury, death, or substantial property damage.

To drain/flush the system

1. Turn OFF main electrical power to the tank, solar collectors and any other heat source connected to the tank.
2. Turn OFF the main manual gas shutoff for any heat source connected to the tank.
3. Turn OFF electrical power to the circulating pump (if used).
4. Close off the boiler or heat source inlet connection.
5. Ensure that the drain (located on the bottom of the tank) is routed to a floor drain with adequate capacity to allow the tank to be flushed.
6. Open the drain valve and allow the incoming cold water "Boiler Return" to flush the soft sediment out of the bottom of the storage tank.

⚠ CAUTION Hot water will be released under pressure. Avoid contact with hot discharge water to prevent the risk of severe scald injury.

7. Observe the color of the water initially discharged from the tank drain. This water will generally be milky or slightly discolored by the sediment discharge. Allow the drain to run until the water runs clear.
8. Close the drain valve on the tank.
9. Open the hot water relief/air valve on the top of the tank.
10. Turn ON main electrical power for the heat source, solar collectors, tank and circulating pump.
11. Turn ON gas supply to the heat source(s).
12. Observe heat source and solar piping to ensure that all components are functioning properly.

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