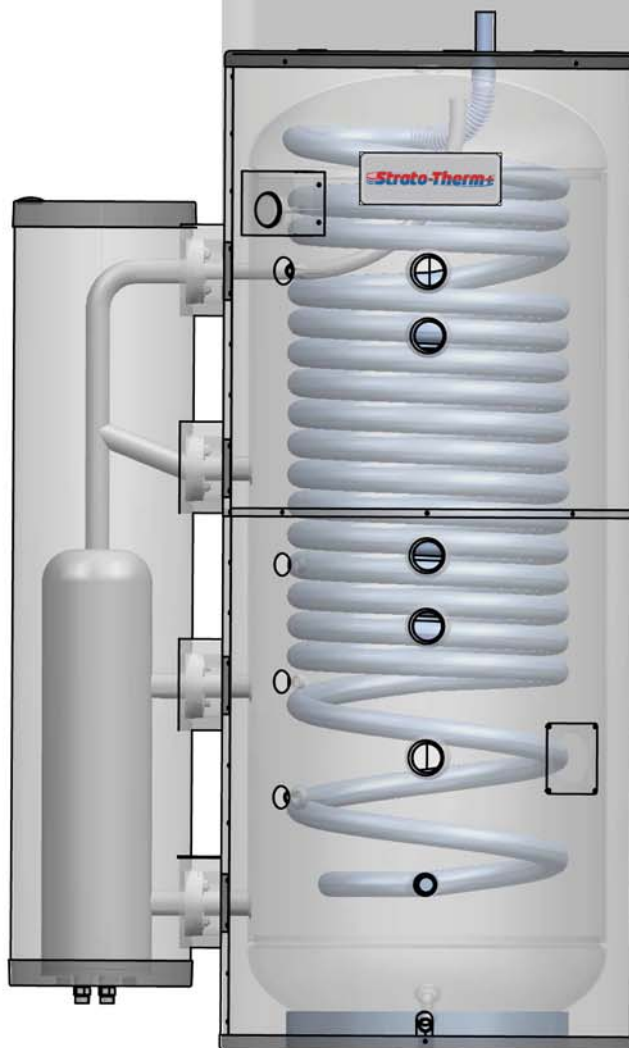


Strato-Therm⁺

Installation & Operation Manual

Models: STU150 - 940



IMG00044



LOW LEAD CONTENT



Lochinvar[®]

High Efficiency Water Heaters, Boilers and Pool Heaters

⚠ 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.

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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 Strato-Therm+ –

- 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.

The following chart details the relationship of water temperature and time with regard to scald injury and may be used as a guide in determining the safest water temperature for your applications.

APPROXIMATE TIME / TEMPERATURE RELATIONSHIPS IN SCALDS	
120°F	More than 5 minutes
125°F	1 1/2 to 2 minutes
130°F	About 30 seconds
135°F	About 10 seconds
140°F	Less than 5 seconds
145°F	Less than 3 seconds
150°F	About 1 1/2 seconds
155°F	About 1 second



Hot Water Can Scald!

- Water heated to temperatures for clothes washing, dish washing, and other sanitizing needs can scald and cause permanent injury.
- Children, elderly, and infirm or physically handicapped persons are more likely to be permanently injured by hot water. Never leave them unattended in a bathtub or shower. Never allow small children to use a hot water tap or draw their own bath.
- If anyone using hot water in the building fits the above description, or if state laws or local codes require certain water temperatures at hot water taps, you must take special precautions:
 - Use lowest possible temperature setting.
 - Install some type of tempering device, such as an automatic mixing valve, at hot water tap or water heater. Automatic mixing valve must be selected and installed according to valve manufacturer's recommendations and instructions.
- Water passing out of drain valves may be extremely hot. To avoid injury:
 - Make sure all connections are tight.
 - Direct water flow away from any person.

Protection Must Be Taken Against Excessive Temperature and Pressure!
--Installation of a Temperature & Pressure (T&P) relief valve is required.

1 General information

The Lochinvar Strato-Therm+ solar stratified tank (FIG. 1-1, page 5) is designed to use a solar collector system, in conjunction with a back-up heat source, to generate domestic hot water. This solar tank consists of a spherical heat exchanger attached to an unlined tank containing a corrugated 316L stainless steel coil. Tank components and specifications are detailed in FIG.'s 1-1 and 1-2 (pages 5 and 6), as well as Tables 1A - 1D.

Solar heated water is pumped through the spherical heat exchanger to heat the water in the tank. A backup heat source is used to maintain desired tank temperature in the event that solar heated water is not available. The tank may be used to heat domestic potable water which runs through the stainless steel coil. In addition to generating domestic hot water, this tank can have many other applications including indirect pool heating and space heating. Consult the factory if your specific application is not covered in this manual. The tank is not intended for use in gravity water heating applications.

Operating Restrictions:

- Maximum domestic hot water temperature is 194°F.
- Maximum boiler 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
Strato-Therm+
Tank Component Materials**

Component	Material
Tank	Steel SA414-G
Coil	316L Stainless Steel
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 Strato-Therm+ solar stratified tank components

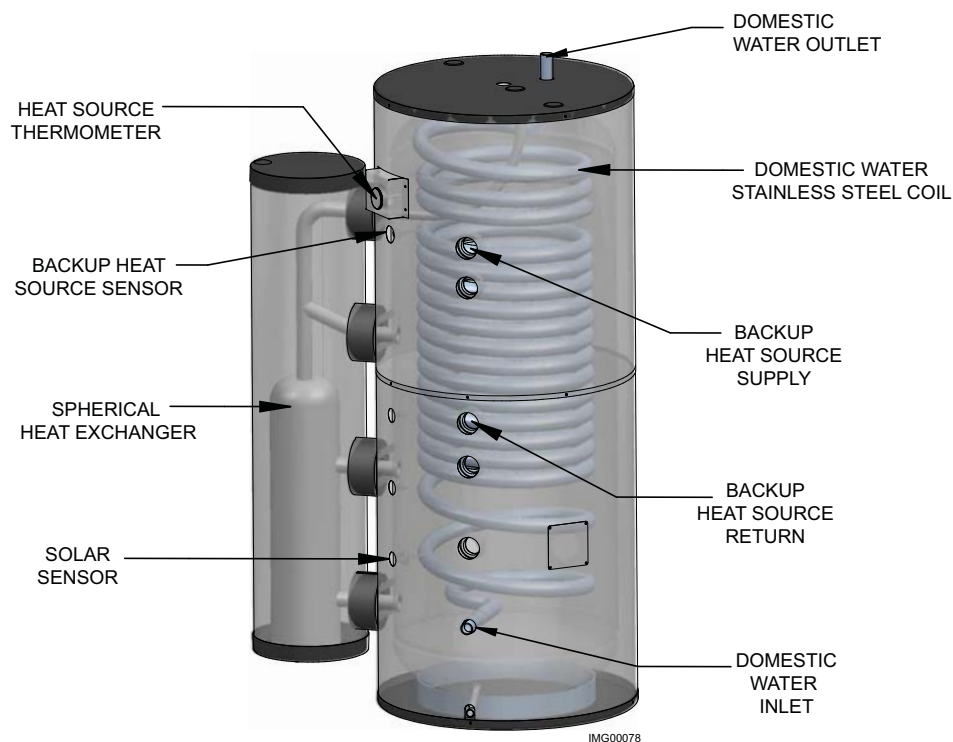


Table 1C
Strato-Therm+ Tank and Coil Specifications

Model	Tank Diameter (in.)	Jacket Diameter (in.)	Domestic Water Inlet/Outlet (NPT)	Boiler Supply/Return (NPT)	Stainless Steel Coil Length (ft.)	Stainless Steel Coil Surface Area (ft ²)	Tank Water Volume (gal.)	Domestic Water Volume (gal.)	Full Weight (lbs)
STU150	24	28	1"	2"	82	69	125	12.0	1715
STU200	28	32	1"	2"	98	83	175	14.5	2300
STU257	30	34	1"	2"	98	83	225	14.5	2875
STU350	36	40	1"	2"	98	83	325	14.5	3775
STU423	36	40	1"	2"	115	97	400	16.0	4650
STU504	42	46	1"	2"	121	103	475	17.0	5475
STU650	48	52	1"	2"	131	111	625	20.0	7050
STU752	48	52	1"	2"	131	111	725	20.0	8100
STU940	48	52	1"	2"	131	111	900	20.0	10000

1 General information

Figure 1-2 Strato-Therm+ tapplings

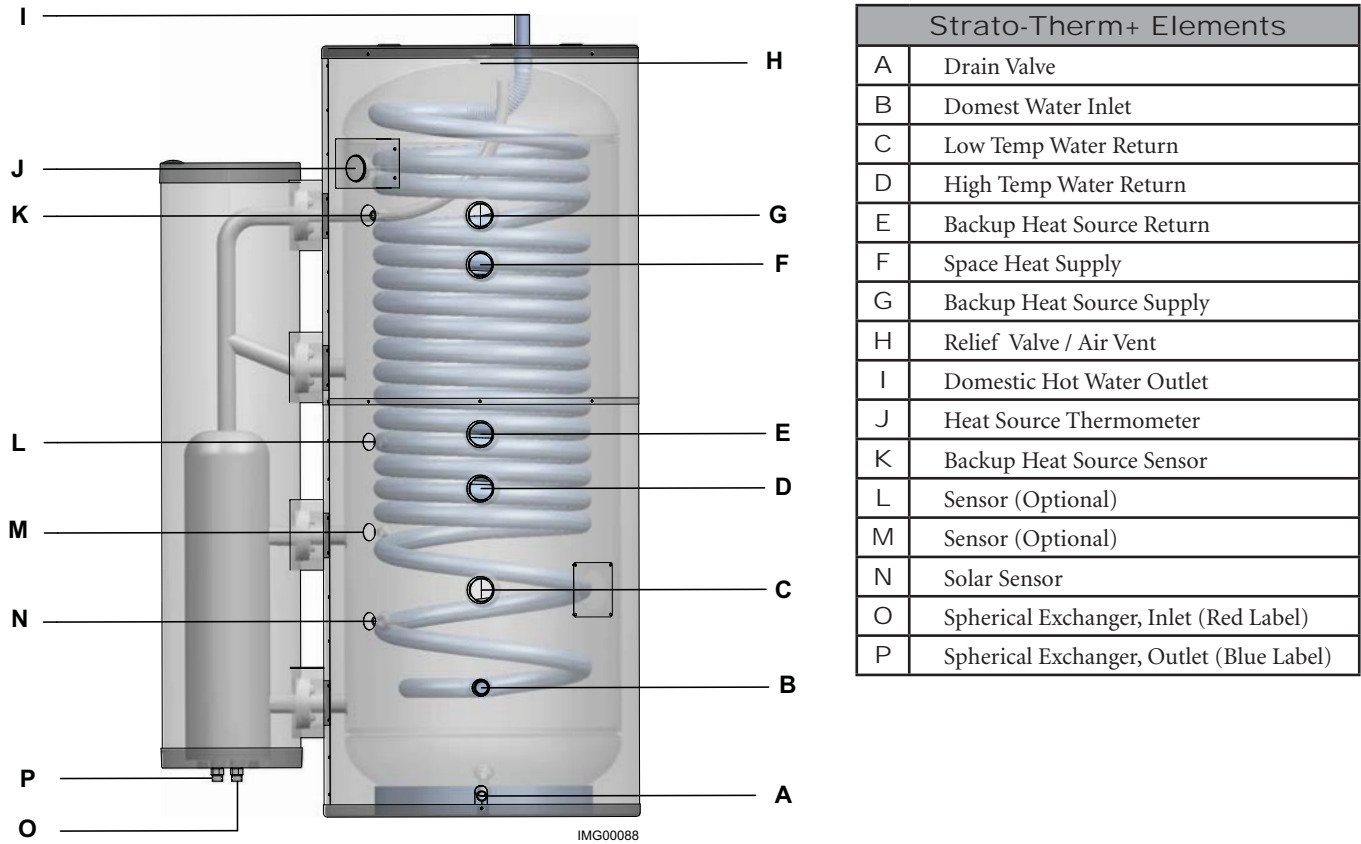


Table 1D
Tapping Measurements

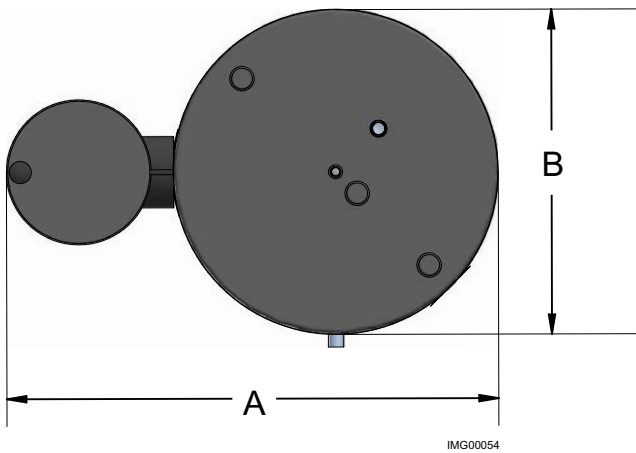
Model	A (in.)	B (in.)	C (in.)	D (in.)	E (in.)	F (in.)	G (in.)	H (in.)	I (in.)	O (in.)	P (in.)
STU150	2 1/4	12 1/4	21 1/4	28 3/4	33	50 3/4	55 1/4	71	76 3/4	3 1/2	3 1/2
STU200	3 1/2	12 3/4	22 3/4	33	38 1/2	55 1/4	59 1/2	76	80 1/4	4 1/4	4 1/4
STU257	2 1/4	17	34 1/2	42 1/2	49	63 1/2	67 3/4	87	92 3/4	8 1/2	8 1/2
STU350	3 1/4	18 3/4	37	46 1/2	53	62	66 1/4	87 1/4	92 1/4	10	10
STU423	3 1/4	18 1/2	40 1/4	52	58 1/4	76 1/2	80 3/4	100	105 1/4	10	10
STU504	2 1/2	19 1/2	33 1/2	42 1/4	49	60 1/4	64 3/4	87	92 1/2	11 1/2	11 1/2
STU650	2	21 1/2	36 3/4	44 1/2	51	61 1/4	65 3/4	88	94	13 1/2	13 1/2
STU752	2	22	38 1/4	50	57 1/2	70 3/4	75	100	105 3/4	10 1/2	10 1/2
STU940	2	22	49	63	70 1/2	89	93 1/2	124	130	13 1/2	13 1/2

1 General information *(continued)*

Spherical heat exchanger

The Strato-Therm+ 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 hot water and space 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.)
STU150	SHX40000	44 1/2	28
STU200	SHX40000	48 1/4	32
STU257	SHX40001	50 1/4	34
STU350	SHX40001	56 1/4	40
STU423	SHX40002	56 1/4	40
STU504	SHX40002	62 1/4	46
STU650	SHX40003	71 1/4	52
STU752	SHX40003	71 1/4	52
STU940	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. Ensure that the domestic water supply to the stainless steelcoil has physical and chemical characteristics that fall within the limits shown in Table 2A. Where questions exist as to the composition of the water on the job site, a qualified water treatment expert should be consulted.

CAUTION

Water with characteristics outside the limits shown in Table 2A may severely shorten the life of the domestic water coil due to corrosion. Damage in such cases is not covered under warranty.

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

Table 2A
Water Chemistry Requirements

Domestic potable water must have characteristics falling within the following limits:

Characteristic	Min.	Max.
pH	6.5	9.5
Chloride (PPM)	--	200

Locating the Tank

1. Choose a location for the Strato-Therm+ centralized to the piping system. You must also locate the Strato-Therm+ where it will not be exposed to freezing temperatures. Additionally, you will need to place the appliance so that the controls, drain, and inlet/outlets are easily accessible. This appliance must not be installed outdoors, as it is certified as an indoor appliance, and must also 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 appliance 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 water heater should always be located in an area with a floor drain or installed in a drain pan suitable for water heaters. 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 Strato-Therm+ tank. 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 are connected with supply and return piping that is insulated to minimize heat losses (FIG. 3-1, page 10). The system is equipped with over-temperature and over-pressure devices that prevent unsafe operating conditions. When multiple heat exchangers 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 Strato-Therm+ 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.

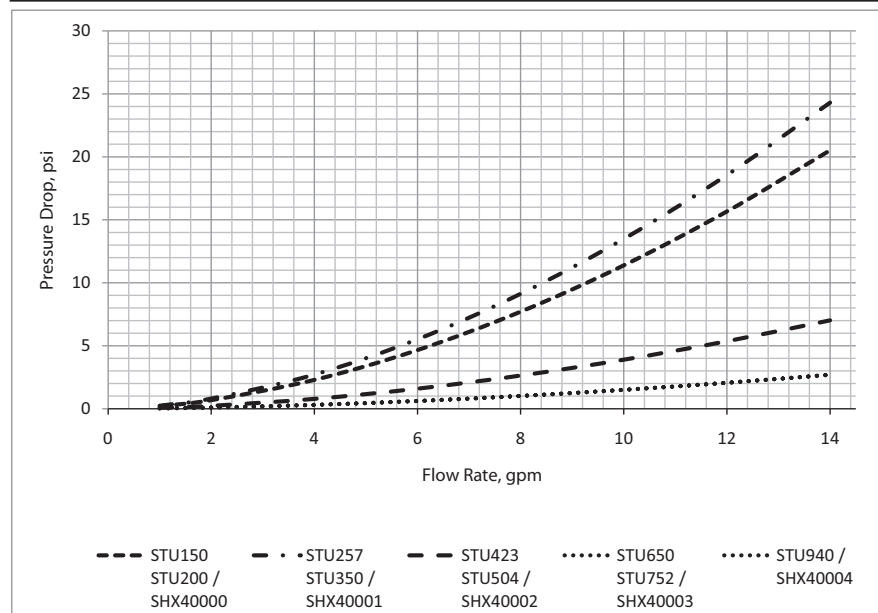
Table 3A
Spherical Heat Exchanger
Pressure Drop Values

MODEL	SPHERICAL MODEL	PRESSURE DROP PSI)							
		1 GPM	2 GPM	4 GPM	6 GPM	8 GPM	10 GPM	12 GPM	14 GPM
STU150	SHX40000	0.20	0.68	2.29	4.66	7.71	11.39	15.67	20.52
STU200									
STU257	SHX40001	0.24	0.81	2.71	5.52	9.13	13.49	18.56	24.31
STU350									
STU423	SHX40002	0.07	0.23	0.78	1.59	2.64	3.90	5.36	7.02
STU504									
STU650	SHX40003	0.03	0.09	0.30	0.61	1.01	1.50	2.06	2.70
STU752									
STU940	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

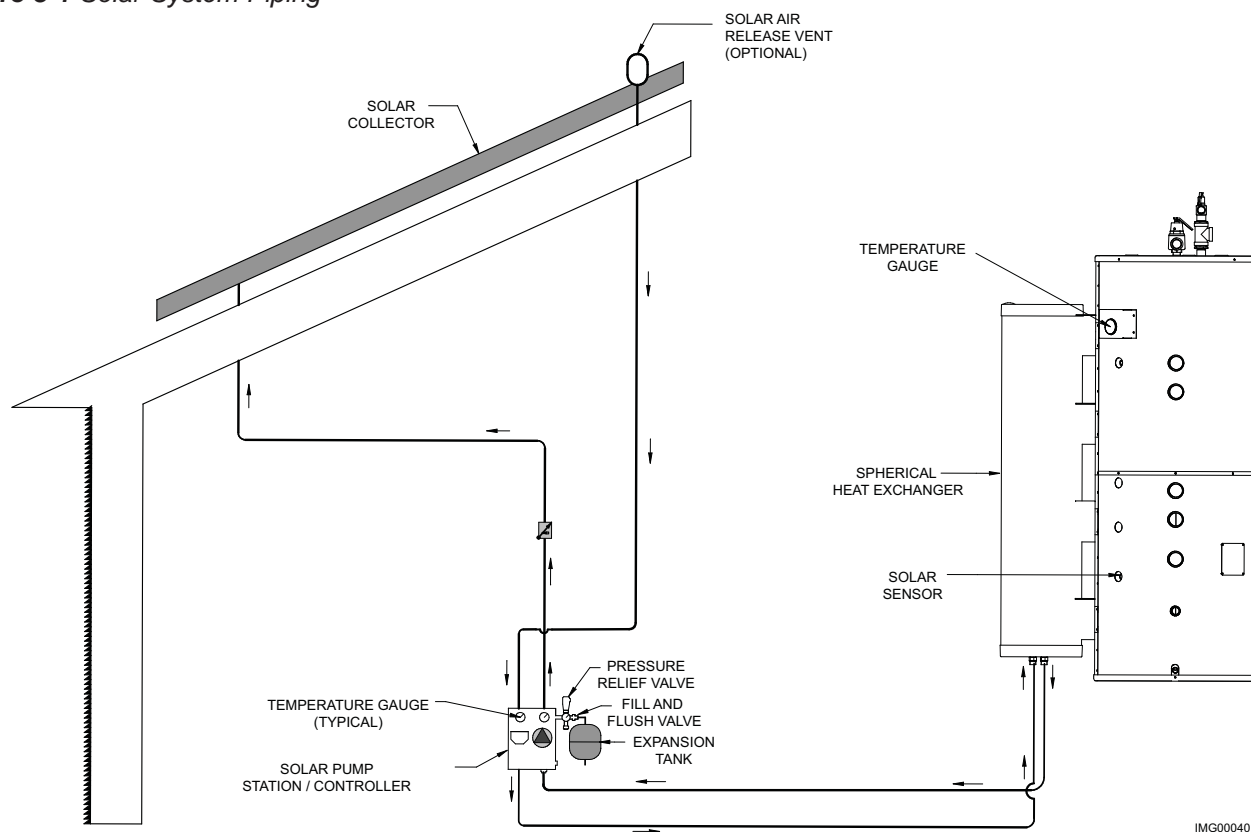
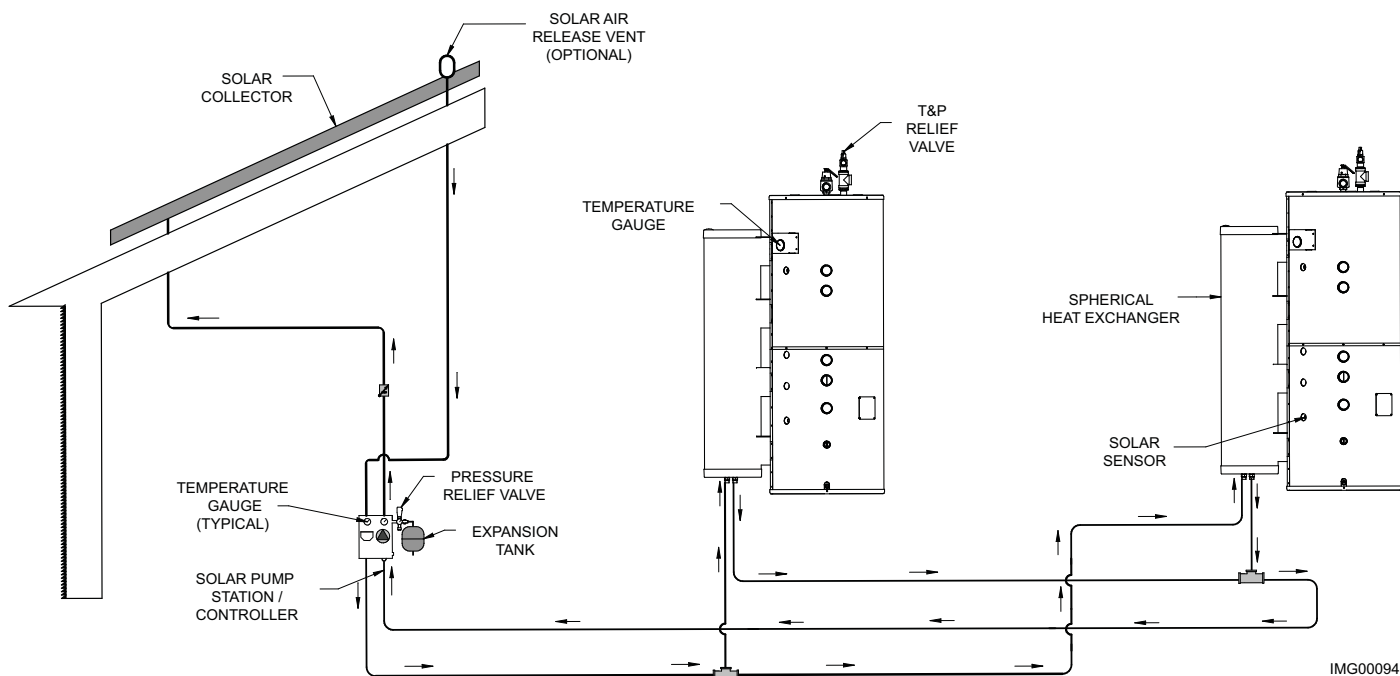


Figure 3-2 Solar System Piping with Multiple Heat Exchangers



4 Domestic side piping

Basic domestic piping

Figure 4-4 on page 17 shows typical domestic water and space heating piping for a Strato-Therm+ tank. The stainless steel coil requires properly sized piping and a properly sized pump to maintain adequate domestic hot water delivery. Refer to Tables 4D and 4E on page 14 and 15 for domestic coil pressure drop. The functions of the components shown are as follows:

- a. Shut-off valves (recommended) - Used to isolate the appliance for servicing.
- b. Backflow Preventer (required by some codes) - Used to prevent water from backing out of the indirect coil and into the main potable water supply in the event that inlet water pressure drops.
- c. Expansion Tank (required for thermal expansion) - Tank absorbs the increased volume caused by heating water.

Use an expansion tank designed for use on domestic water systems. Refer to the expansion tank manufacturer's instructions for proper sizing and use.

NOTICE

If an expansion tank is used, do not put any valves between the expansion tank and tank inlet.

- d. Shock Arrestor (required by some codes) - Used to allow water to accelerate or decelerate without a sudden change in pressure.
- e. Circulation Pump (recommended) - Used to circulate and maintain hot water within the piping system.
- f. Check Valve (required by some codes) - Used to allow water to flow in only one direction, preventing back-flow.
- g. Drain (required) - Used to drain the tank for inspection or servicing.
- h. Mixing valve (required) - Used to mix hot water with cold water to ensure constant, safe outlet temperatures.
- i. 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.

Domestic water piping for distant fixtures

In some cases the furthest fixture may be located far from the tank. This may result in an unacceptable delay before hot water reaches these distant fixtures. Even if all the fixtures are located relatively close to the tank, it may be desired that hot water be instantly available to all fixtures.

To prevent delays, return circulation piping with a check valve that allows flow to the domestic hot water outlet. This should be installed on each branch circuit at the farthest fixture or device, so that hot water is supplied upon demand. Traditional recirculation piping is illustrated in FIG. 4-1, page 12.

Because hot water is always circulating in the hot water branch, the entire branch should be insulated to prevent excessive heat loss.

When a hot water recirculation system is used there are two piping arrangements that can be applied to the Strato-Therm+. The first arrangement is for use in systems with up to 2 gal/min circulation and requires the purchase of a recirculation lance assembly (FIG. 4-5, page 18). The second arrangement is for use in systems with greater than 2 gal/min circulation that require higher performance and temperature (FIG. 4-6, page 18).

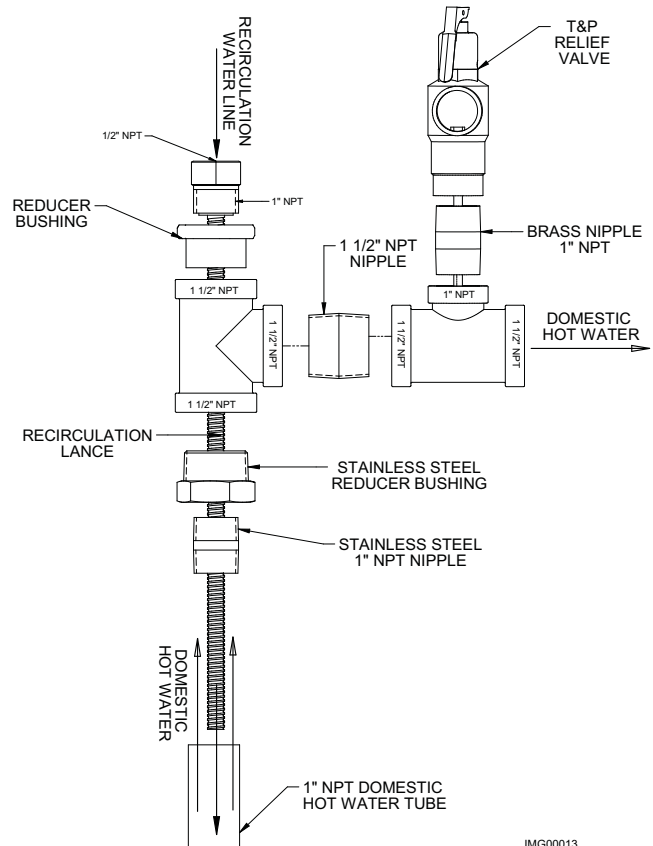
4 Domestic side piping

Recirculation lance

Recirculation systems with up to 2 gal/min circulation require the use of a recirculation lance assembly (TUB30000) (FIG. 4-1). The lance is a stainless steel tube that is inserted directly into the hot water connection of the tank and into the stainless steel coil. As part of a continuous, slow-moving loop, warm water is circulated directly back into the coil, via the lance, maintaining tank stratification. Reference FIG. 4-5 on page 18 for typical recirculation lance piping.

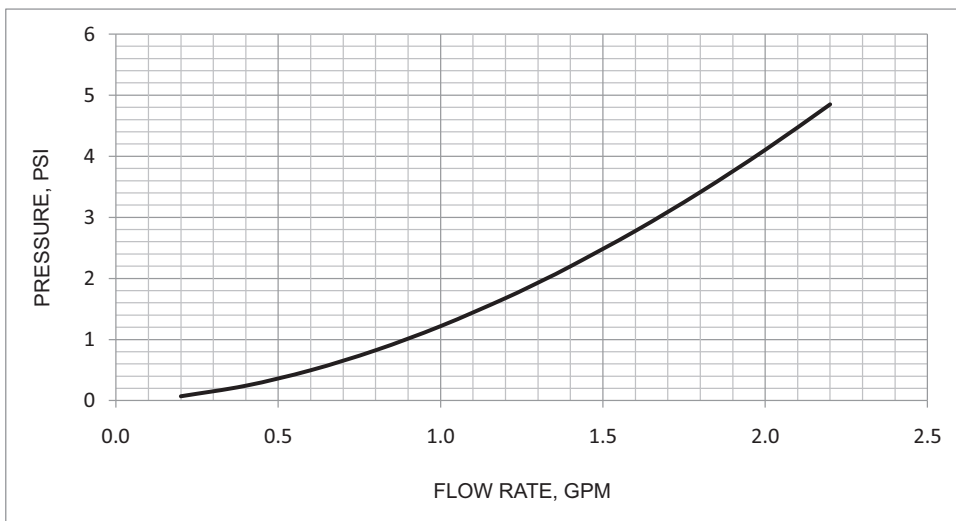
Table 4A Recirculation Lance Pressure Drop Values	
Flow Rate (gpm)	Pressure Drop (psi)
0.2	0.07
0.4	0.25
0.6	0.5
0.8	0.83
1	1.22
1.2	1.68
1.32	1.98
1.4	2.2
1.6	2.78
1.8	3.41
2	4.11
2.2	4.85

Figure 4-1 Recirculation lance assembly



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Table 4B
Recirculation Lance Pressure Drop Chart



4 Domestic side piping *(continued)*

Direct piping to cold water inlet

When a re-circulation lance is not used, it is acceptable to connect a building recirculation loop directly to the cold water inlet of the Strato-Therm+ when flows are greater than 2 gal/min returning to the tank. This method of building recirculation will use the entire indirect coil to heat the recirculation loop. See Figure 4-6 on page 18 for typical piping arrangement.

Multiple tank domestic water piping

Multiple tank installations must be done in the reverse-return arrangement. This helps maintain the same flow and pressure drop through the coil of each tank. Because the pressure drop through tank coils varies from size to size, it is recommended not to mix tanks with different coil sizes within the same zone. Multiple tank domestic piping is illustrated in FIG. 4-7 on page 19.

When high volume supply of hot water at a constant outlet temperature is required, the Strato-Therm+ can be paired with a large capacity storage tank (FIG. 4-8, page 19). In this configuration the Strato-Therm+ will be able to meet high demands with its instantaneous delivery rate. An Aquastat control is used to control the water temperature between the two tanks with a circulation pump. If a building recirculation system is installed, the return water is brought back to the storage tank so as not to disturb the stratification of the Strato-Therm+.

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.

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. Anti-scald mixing valve piping is illustrated in FIG.'s 4-4 thru 4-8, pages 17 - 19. 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

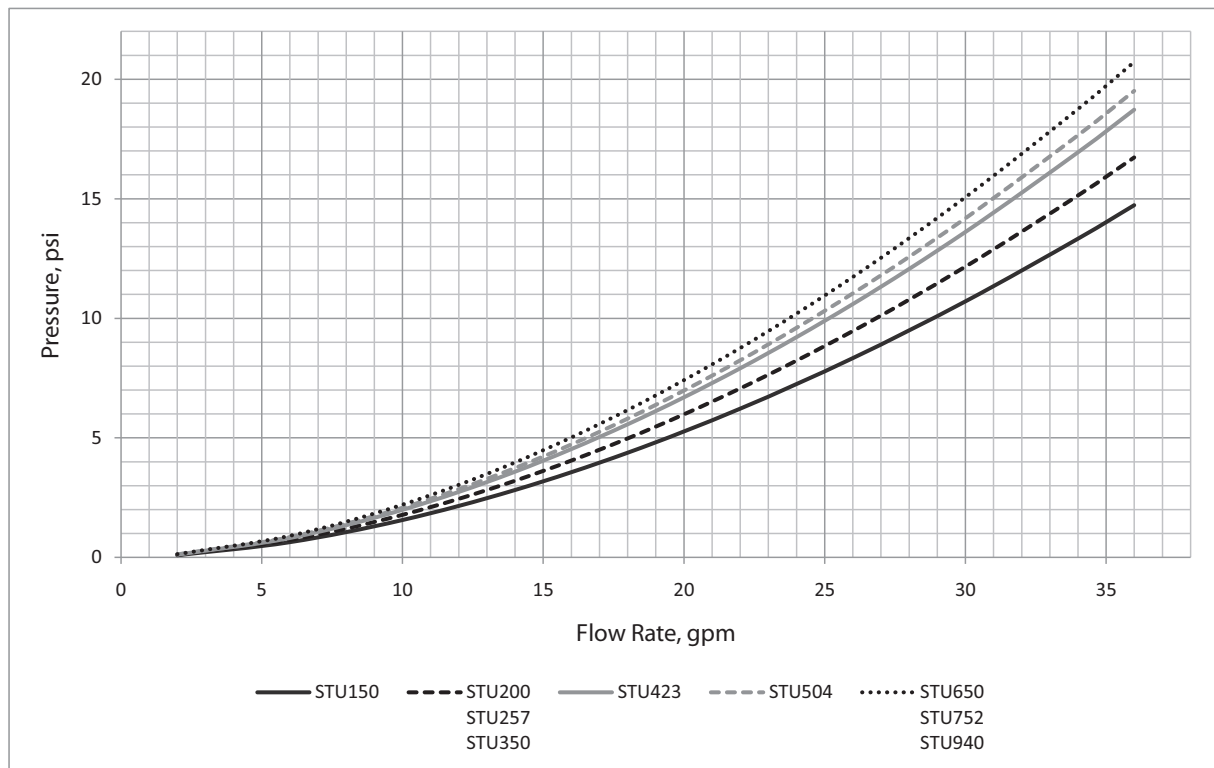
An anti-scald mixing valve does not eliminate the risk of scalding.

- * 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 Domestic side piping

Table 4C Domestic Coil Pressure Drop Values										
MODEL	PRESSURE DROP (PSI)									
	2 GPM	6 GPM	10 GPM	14 GPM	18 GPM	22 GPM	26 GPM	30 GPM	34 GPM	36 GPM
STU150	0.1	0.6	1.6	2.8	4.4	6.2	8.3	10.7	13.3	14.7
STU200 STU257 STU350	0.1	0.7	1.8	3.2	5.0	7.1	9.5	12.2	15.1	16.7
STU423	0.1	0.8	2.0	3.6	5.6	7.9	10.6	13.6	16.9	18.7
STU504	0.1	0.8	2.1	3.7	5.8	8.2	11.0	14.2	17.7	19.5
STU650 STU752 STU940	0.1	0.9	2.2	4.0	6.2	8.8	11.7	15.1	18.7	20.7

**Table 4D
Domestic Coil Pressure Drop Chart**



4 Domestic side piping *(continued)*

Temperature & Pressure (T&P) Relief Valve

⚠ WARNING

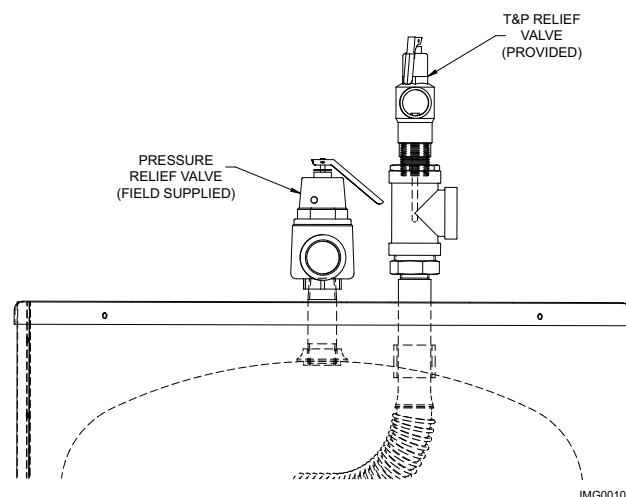
For protection against excessive temperatures and pressure, install temperature and pressure protective equipment required by local codes. A T&P relief valve must be certified by a nationally recognized testing laboratory that maintains periodic inspection of listed equipment or materials. The equipment 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 combination T&P relief valve shall be marked with a maximum set pressure, not to exceed the maximum working pressure of the water heater. It shall also have an hourly rated discharge capacity not less than shown in Table 4E.

The T&P relief valve is installed in the vertical position and mounted in the outlet of the indirect coil as shown in FIG. 4-2. Do not place a valve between the relief valve and the coil. To prevent water damage, the discharge from the relief valve shall be piped to a suitable floor drain for proper drainage when relief occurs. Do not install reducing couplings or other restrictions in the discharge line. The discharge line shall allow complete drainage of the valve and line. Relief valves should be manually operated at least once per year.

Pressure Only (POV) Relief Valve

A connection is provided for a pressure relief valve on the top of the tank. The tank containing the hydronic water shall have a pressure only relief valve in addition to the T&P relief valve installed in the stainless steel coil. The POV should be sized in accordance with the maximum working pressure of the tank 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."

Figure 4-2 Relief valve



NOTICE

Verify that the combination temperature and pressure relief valve complies with local codes. If the combination T&P 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 combination T&P relief valve and the tank.

Table 4E
Minimum Domestic Coil Relief Valve

Model	ASME Btu/hr	Pressure psi	Lochinvar Part No.
STU150 - STU940	2,610,000	125	RLV20015

4 Domestic side piping

Standard Installation

- Connect a factory-supplied straight tee, reducing bushing and close nipple to the coil opening provided. Install the T&P relief valve vertically (FIG. 4-3). Install a field-supplied POV into the nipple provided.

T&P Relief Valve and POV 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 T&P 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.

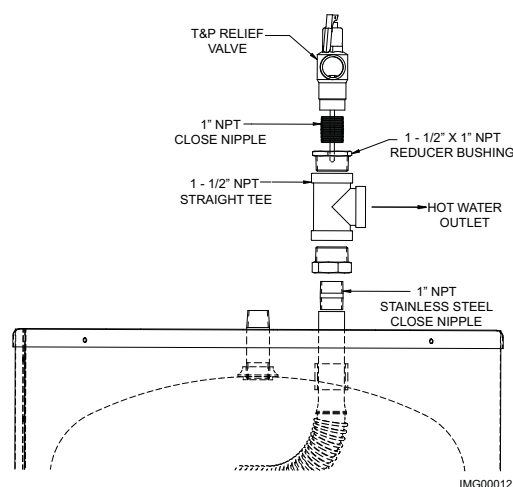
⚠ CAUTION

The T&P relief valve or POV 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

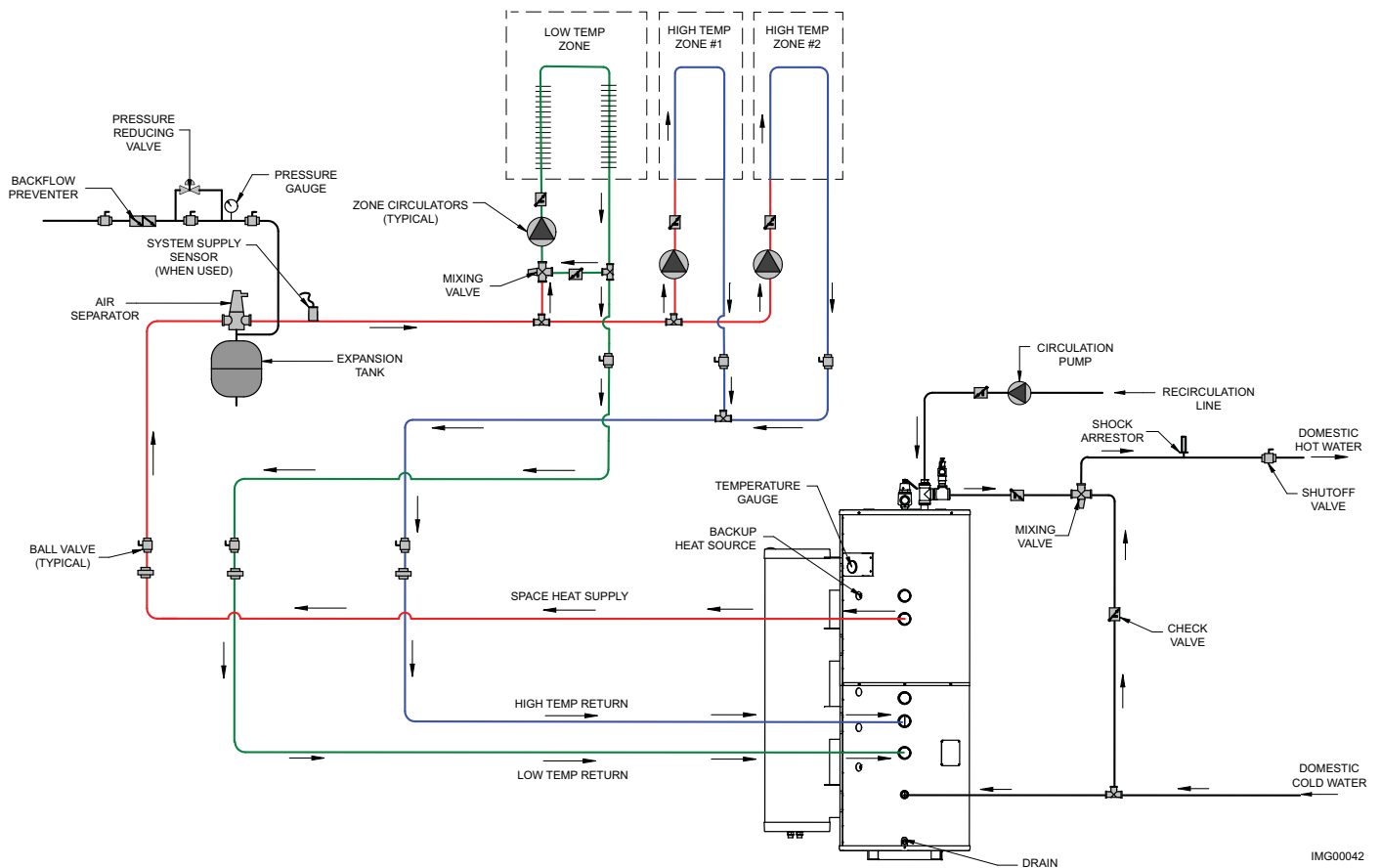
Failure to install and maintain a new, listed and properly sized relief valve will relieve the manufacturer from any claim which might result from excessive temperature and pressure.

Figure 4-3 Relief valve Assembly



4 Domestic side piping *(continued)*

Figure 4-4 Domestic Piping with Hydronic Heating



IMG00042

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 Domestic side piping

Figure 4-5 Recirculation Lance Piping: Flow Up to 2 gal/min

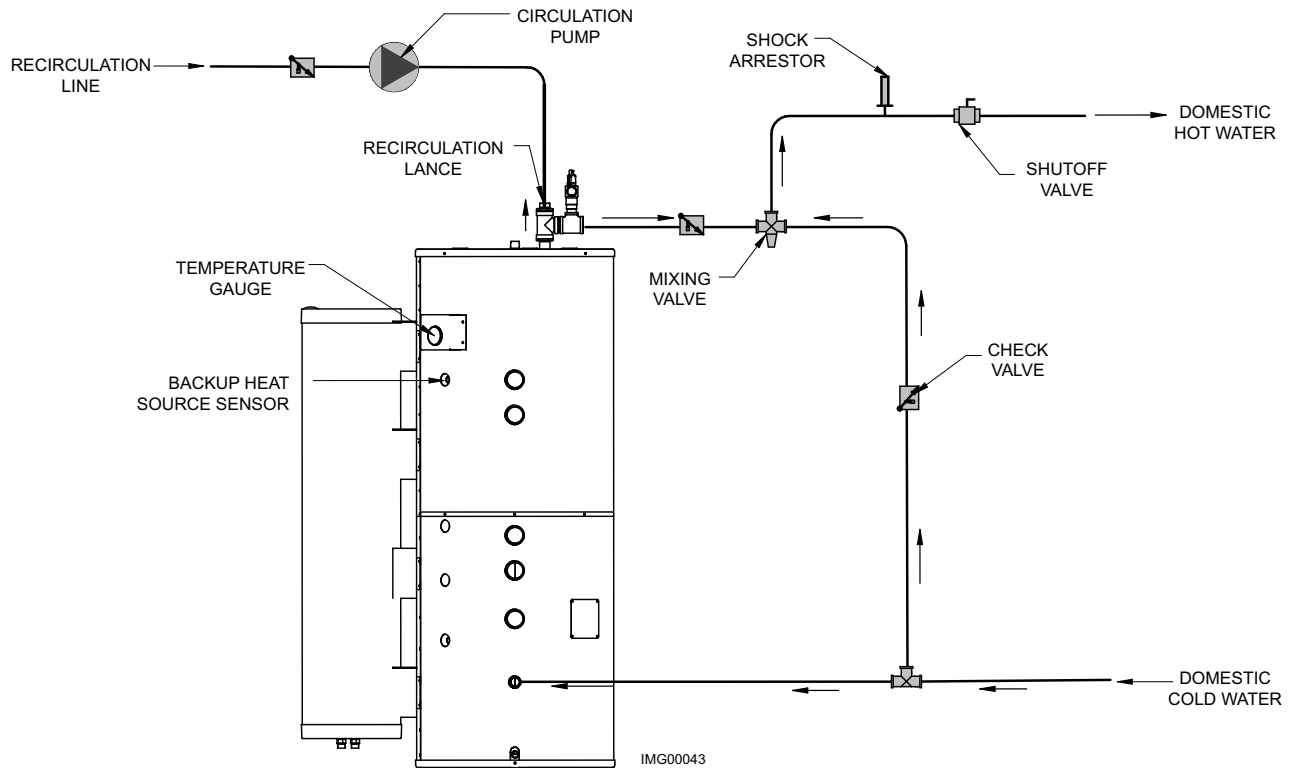
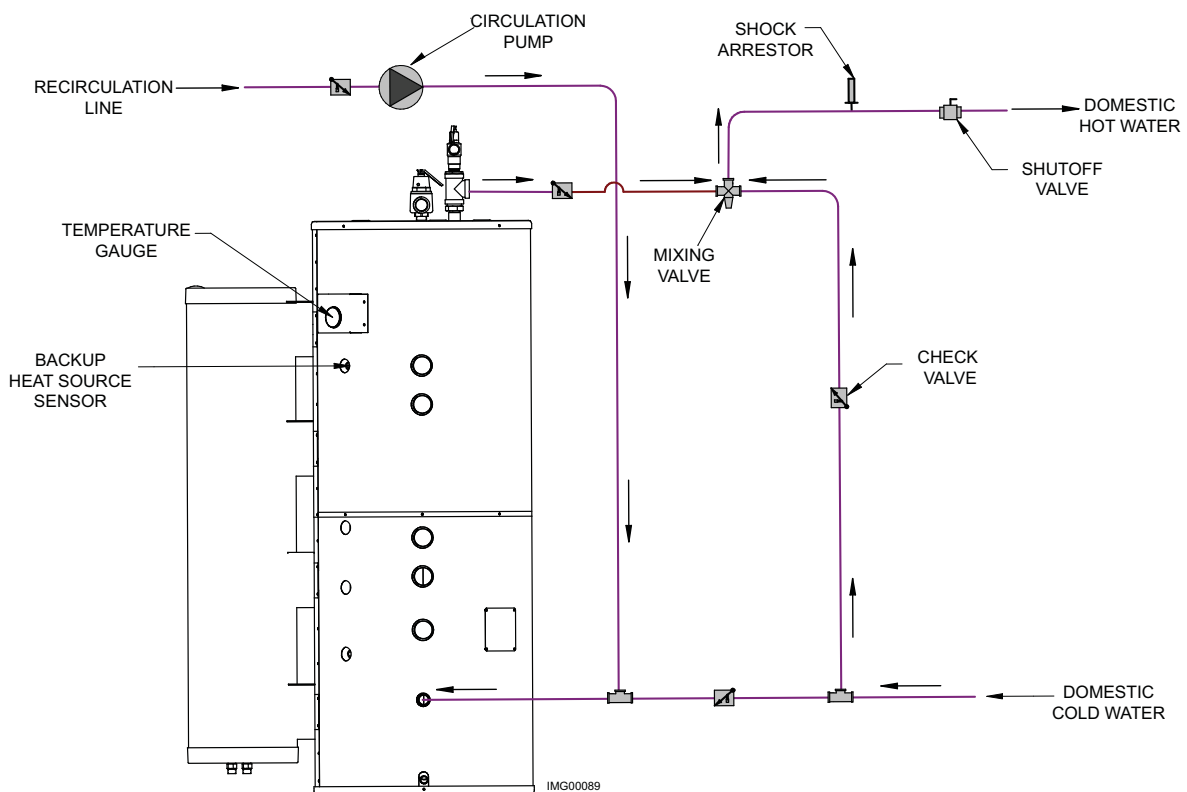


Figure 4-6 Recirculation Piping: Flow Over 2 gal/min



4 Domestic side piping *(continued)*

Figure 4-7 Multiple Tank Domestic Piping

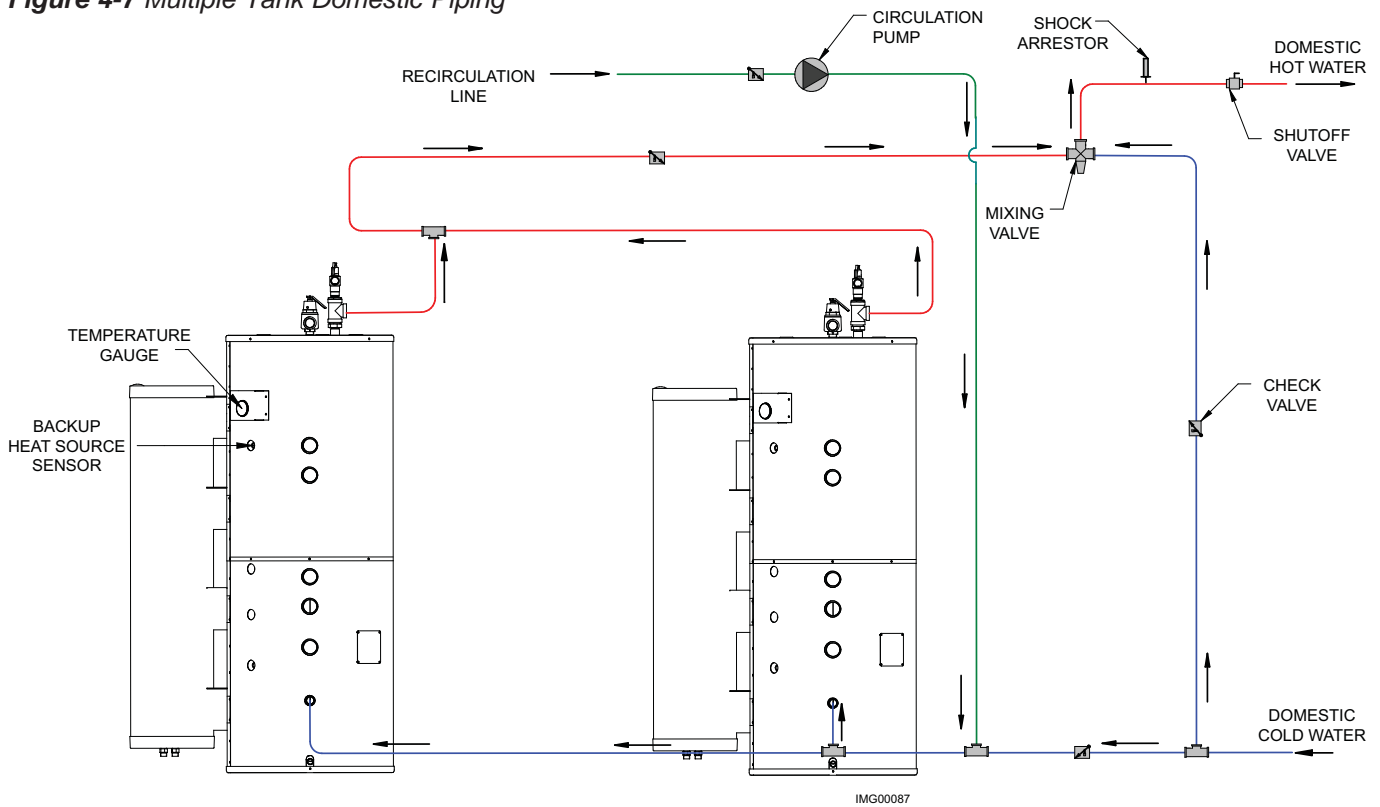
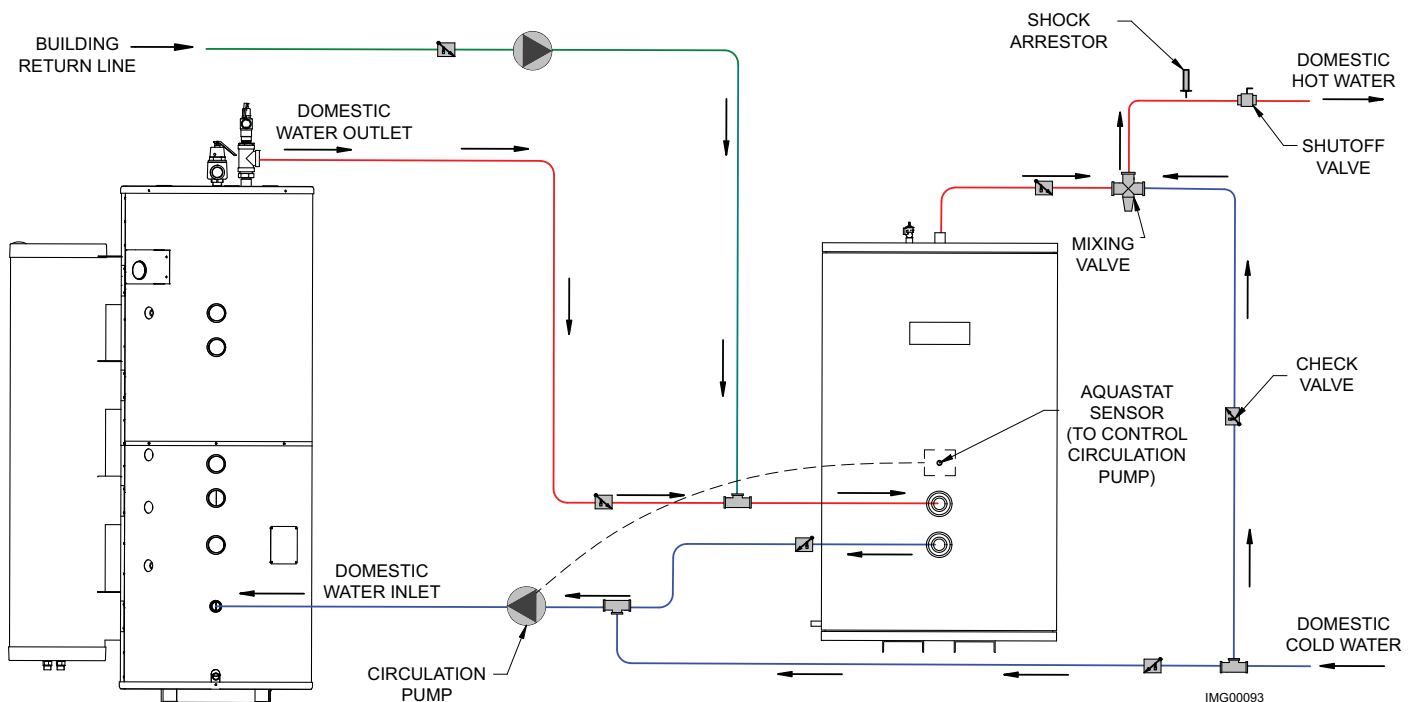


Figure 4-8 Domestic Piping with Storage Tank



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.

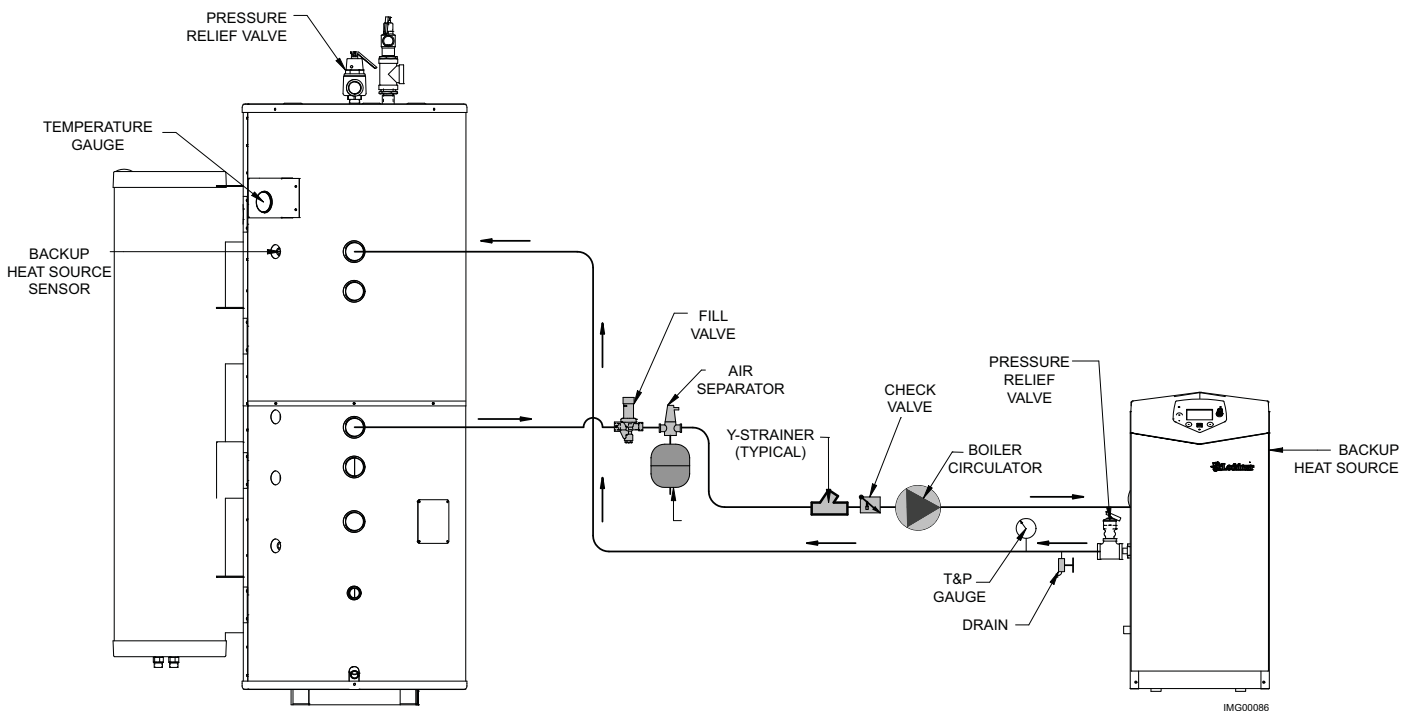
5 Boiler side piping

Figures 5-1 and 5-2 show typical boiler piping for single and multi-tank situations. A pressure relief valve must be installed on each boiler and each tank, as regulations require. The tank pressure relief valve should be sized to meet the working pressure of the tank according to local codes.

Multiple tank connections (boiler side)

Boiler piping works most efficiently when it is done in the reverse-return application. This method uses more piping than direct return systems, but the pressure drop 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.

Figure 5-1 Backup Heat Source Connection

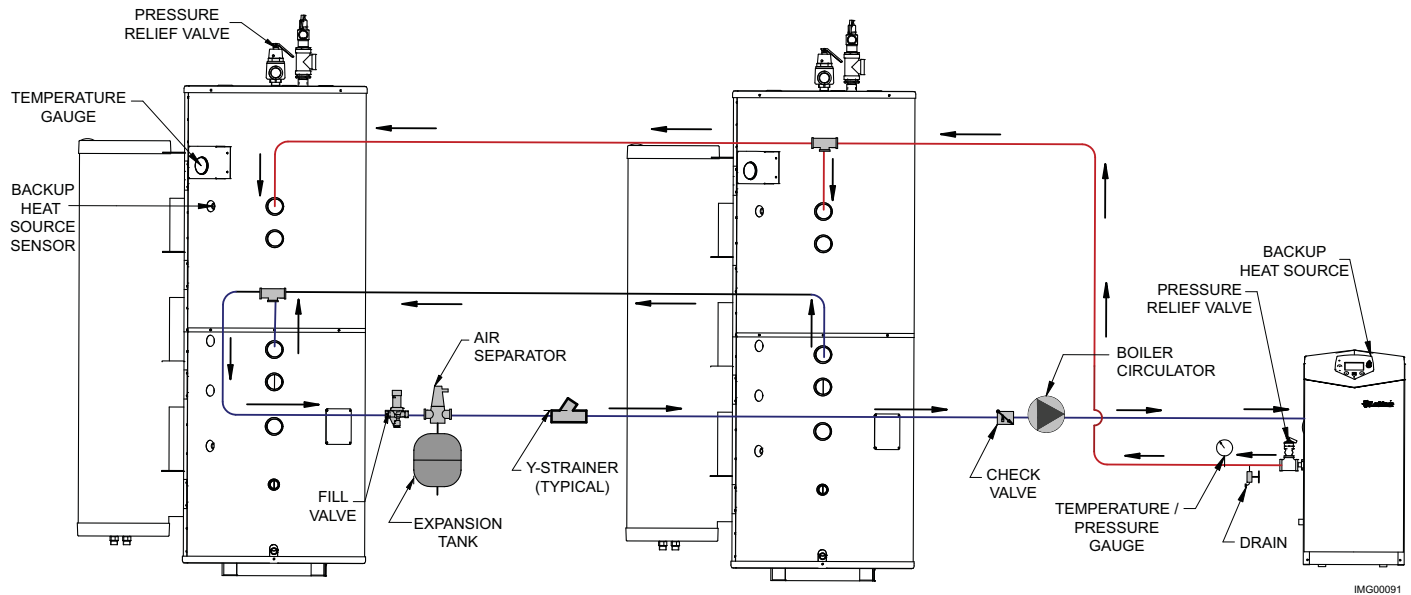


NOTICE

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 Boiler side piping *(continued)*

Figure 5-2 Multiple Tank Backup Heat Source Connection



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.

6 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 Strato-Therm+ tank and indirect coil thoroughly before leaving the installation. This is particularly important if the Strato-Therm+ 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 Strato-Therm+ 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 a water treatment system 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 T&P relief valve at least once a year. This will release some hot water.

WARNING

Before operating a 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.

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

Move operating lever to open position for a few seconds and then move it back, allowing it to snap closed. After the T&P 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 T&P relief valve. If the T&P relief valve weeps periodically, it may be due to thermal expansion. Do not plug the T&P 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 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.

6 Startup and maintenance *(continued)*

- ❑ 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 coil if it will be off and exposed to freezing temperatures. Freezing water will expand and damage the water heater.

- If the tank, spherical heat exchanger and heat source water contain sufficient antifreeze, then only the domestic coil water needs to be drained.
- If the tank, spherical heat exchanger and heat source water do not contain sufficient antifreeze, they must be drained in addition to domestic water.

If antifreeze is used in the heat source water, check the concentration. Heat source water (including additives) must be practically 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.



Hot Water Can Scald!

- Water heated to temperatures for clothes washing, dish washing, and other sanitizing needs can scald and cause permanent injury.
- Children, elderly, and infirm or physically handicapped persons are more likely to be permanently injured by hot water. Never leave them unattended in a bathtub or shower. Never allow small children to use a hot water tap or draw their own bath.
- If anyone using hot water in the building fits the above description, or if state laws or local codes require certain water temperatures at hot water taps, you must take special precautions:
 - Use lowest possible temperature setting.
 - Install some type of tempering device, such as an automatic mixing valve, at hot water tap or water heater. Automatic mixing valve must be selected and installed according to valve manufacturer's recommendations and instructions.
- Water passing out of drain valves may be extremely hot. To avoid injury:
 - Make sure all connections are tight.
 - Direct water flow away from any person.

Protection Must Be Taken Against Excessive Temperature and Pressure!
 --Installation of a Temperature & Pressure (T&P) relief valve is required.

7 Performance data

Table 7A First Hour Ratings at Maximum Coil Capacity						
	180°F Boiler Input				140°F Boiler Input	
	140°F Mixed DHW		115°F Mixed DHW		115°F Mixed DHW	
Model	Max. Capacity Flow Rate (gpm)	First Hour Rating gal/hr	Max. Capacity Flow Rate (gpm)	First Hour Rating gal/hr	Max. Capacity Flow Rate (gpm)	First Hour Rating gal/hr
STU150	16	1035	23	1516	15	997
STU200	19	1244	27	1774	18	1125
STU257	19	1365	27	1965	18	1250
STU350	19	1550	27	2223	18	1395
STU423	27	1690	36	2451	26	1600
STU504	28	1816	36	2569	27	1783
STU650	31	2036	36	2737	28	1952
STU752	31	2042	36	2869	28	1983
STU940	31	2072	36	3011	28	2032

Table 7B Standby Heat Loss	
Model	Heat Loss °F/hr
STU150	0.61
STU200	0.52
STU257	0.44
STU350	0.39
STU423	0.31
STU504	0.30
STU650	0.27
STU752	0.25
STU940	0.23

7 Performance data *(continued)*

Table 7C Maximum Coil Capacity 180°F Boiler Input, 115°F DHW										
Boiler Heat Input - Btu/hr										
Flow Rate		Tank Size								
gpm	gal/hr	150	200	257	350	423	504	650	752	940
2	120	84,592	84,592	84,592	84,592	84,592*	84,592*	84,592*	84,592*	84,592*
3	180	89,569	89,569	89,569	89,569	89,569*	89,569*	89,569*	89,569*	89,569*
4	240	119,425	119,425	119,425	119,425	119,425*	119,425*	119,425*	119,425*	119,425*
5	300	149,281	149,281	149,281	149,281	149,281*	149,281*	149,281*	149,281*	149,281*
6	360	179,137	179,137	179,137	179,137	179,137*	179,137*	179,137*	179,137*	179,137*
7	420	208,993	208,993	208,993	208,993	208,993*	208,993*	208,993*	208,993*	208,993*
8	480	238,849	238,849	238,849	238,849	238,849*	238,849*	238,849*	238,849*	238,849*
9	540	268,706	268,706	268,706	268,706	268,706*	268,706*	268,706*	268,706*	268,706*
10	600	298,562	298,562	298,562	298,562	298,562*	298,562*	298,562*	298,562*	298,562*
11	660	328,418	328,418	328,418	328,418	328,418*	328,418*	328,418*	328,418*	328,418*
12	720	358,274	358,274	358,274	358,274	358,274*	358,274*	358,274*	358,274*	358,274*
13	780	388,130	388,130	388,130	388,130	388,130*	388,130*	388,130*	388,130*	388,130*
14	840	417,986	417,986	417,986	417,986	417,986*	417,986*	417,986*	417,986*	417,986*
15	900	447,843	447,843	447,843	447,843	447,843*	447,843*	447,843*	447,843*	447,843*
16	960	477,699	477,699	477,699	477,699	477,699*	477,699*	477,699*	477,699*	477,699*
17	1020	507,555	507,555	507,555	507,555	507,555*	507,555*	507,555*	507,555*	507,555*
18	1080	537,411	537,411	537,411	537,411	537,411*	537,411*	537,411*	537,411*	537,411*
19	1140	567,267	567,267	567,267	567,267	567,267*	567,267*	567,267*	567,267*	567,267*
20	1200	597,123	597,123	597,123	597,123	597,123*	597,123*	597,123*	597,123*	597,123*
21	1260	626,980	626,980	626,980	626,980	626,980*	626,980*	626,980*	626,980*	626,980*
22	1320	656,836	656,836	656,836	656,836	656,836*	656,836*	656,836*	656,836*	656,836*
23	1380	686,692	686,692	686,692	686,692	686,692*	686,692*	686,692*	686,692*	686,692*
24	1440		716,548	716,548	716,548	716,548*	716,548*	716,548*	716,548*	716,548*
25	1500		746,404	746,404	746,404	746,404*	746,404*	746,404*	746,404*	746,404*
26	1560		776,260	776,260	776,260	776,260*	776,260*	776,260*	776,260*	776,260*
27	1620		806,117	806,117	806,117	806,117*	806,117*	806,117*	806,117*	806,117*
28	1680					835,973*	835,973*	835,973*	835,973*	835,973*
29	1740					865,829*	865,829*	865,829*	865,829*	865,829*
30	1800					895,685*	895,685*	895,685*	895,685*	895,685*
31	1860					925,541*	925,541*	925,541*	925,541*	925,541*
32	1920					955,397*	955,397*	955,397*	955,397*	955,397*
33	1980					985,254*	985,254*	985,254*	985,254*	985,254*
34	2040					1,015,110*	1,015,110*	1,015,110*	1,015,110*	1,015,110*
35	2100					1,044,966*	1,044,966*	1,044,966*	1,044,966*	1,044,966*
36	2160					1,074,822*	1,074,822*	1,074,822*	1,074,822*	1,074,822*

* Denotes value based on use of a mixing valve.

NOTE: - Values based on 55°F domestic cold water input
 - Values obtained using boiler heat input only
 - Maximum coil threshold was set at 36 gpm

7 Performance data

Table 7D
Maximum Coil Capacity 180°F Boiler Input, 140°F DHW

Flow Rate		Boiler Heat Input - Btu/hr								
		Tank Size								
gpm	gal/hr	150	200	257	350	423	504	650	752	940
2	120	84,389	84,389	84,389	84,389	84,389	84,389	84,389	84,389	84,389
3	180	126,583	126,583	126,583	126,583	126,583	126,583	126,583	126,583	126,583
4	240	168,778	168,778	168,778	168,778	168,778	168,778	168,778	168,778	168,778
5	300	210,972	210,972	210,972	210,972	210,972	210,972	210,972	210,972	210,972
6	360	253,167	253,167	253,167	253,167	253,167	253,167	253,167	253,167	253,167
7	420	295,361	295,361	295,361	295,361	295,361	295,361	295,361	295,361	295,361
8	480	337,556	337,556	337,556	337,556	337,556	337,556	337,556	337,556	337,556
9	540	379,750	379,750	379,750	379,750	379,750	379,750	379,750	379,750	379,750
10	600	421,944	421,944	421,944	421,944	421,944	421,944	421,944	421,944	421,944
11	660	464,139	464,139	464,139	464,139	464,139	464,139	464,139	464,139	464,139
12	720	506,333	506,333	506,333	506,333	506,333	506,333	506,333	506,333	506,333
13	780	548,528	548,528	548,528	548,528	548,528	548,528	548,528	548,528	548,528
14	840	590,722	590,722	590,722	590,722	590,722	590,722	590,722	590,722	590,722
15	900	632,917	632,917	632,917	632,917	632,917	632,917	632,917	632,917	632,917
16	960	675,111	675,111	675,111	675,111	675,111	675,111	675,111	675,111	675,111
17	1020		717,306	717,306	717,306	717,306	719,036	719,036	719,036	719,036
18	1080		759,500	759,500	759,500	759,500	761,332	761,332	761,332	761,332
19	1140		801,694	801,694	801,694	801,694	803,629	803,629	803,629	803,629
20	1200					843,889	843,889	843,889	843,889	843,889
21	1260					886,083	886,083	886,083	886,083	886,083
22	1320					928,278	928,278	928,278	928,278	928,278
23	1380					970,472	970,472	970,472	970,472	970,472
24	1440					1,012,667	1,012,667	1,012,667	1,012,667	1,012,667
25	1500					1,054,861	1,054,861	1,054,861	1,054,861	1,054,861
26	1560					1,097,055	1,097,055	1,097,055	1,097,055	1,097,055
27	1620					1,139,250	1,139,250	1,139,250	1,139,250	1,139,250
28	1680						1,181,444	1,181,444	1,181,444	1,181,444
29	1740							1,223,639	1,223,639	1,223,639
30	1800							1,265,833	1,265,833	1,265,833
31	1860							1,308,028	1,308,028	1,308,028

NOTE: - Values based on 55°F domestic cold water input
 - Values obtained using boiler heat input only

7 Performance data *(continued)*

Table 7E Maximum Coil Capacity 140°F Boiler Input, 115°F DHW										
Boiler Heat Input - Btu/hr										
Flow Rate		Tank Size								
gpm	gal/hr	150	200	257	350	423	504	650	752	940
2	120	84,592	84,592	84,592	84,592	84,592	84,592	84,592	84,592	84,592
3	180	89,569	89,569	89,569	89,569	89,569	89,569	89,569	89,569	89,569
4	240	119,425	119,425	119,425	119,425	119,425	119,425	119,425	119,425	119,425
5	300	149,281	149,281	149,281	149,281	149,281	149,281	149,281	149,281	149,281
6	360	179,137	179,137	179,137	179,137	179,137	179,137	179,137	179,137	179,137
7	420	208,993	208,993	208,993	208,993	208,993	208,993	208,993	208,993	208,993
8	480	238,849	238,849	238,849	238,849	238,849	238,849	238,849	238,849	238,849
9	540	268,706	268,706	268,706	268,706	268,706	268,706	268,706	268,706	268,706
10	600	298,562	298,562	298,562	298,562	298,562	298,562	298,562	298,562	298,562
11	660	328,418	328,418	328,418	328,418	328,418	328,418	328,418	328,418	328,418
12	720	358,274	358,274	358,274	358,274	358,274	358,274	358,274	358,274	358,274
13	780	388,130	388,130	388,130	388,130	388,130	388,130	388,130	388,130	388,130
14	840	417,986	417,986	417,986	417,986	417,986	417,986	417,986	417,986	417,986
15	900	447,843	447,843	447,843	447,843	447,843	447,843	447,843	447,843	447,843
16	960		477,699	477,699	477,699	477,699	477,699	477,699	477,699	477,699
17	1020		507,555	507,555	507,555	507,555	507,555	507,555	507,555	507,555
18	1080		537,411	537,411	537,411	537,411	537,411	537,411	537,411	537,411
19	1140					567,267	567,267	567,267	567,267	567,267
20	1200					597,123	597,123	597,123	597,123	597,123
21	1260					626,980	626,980	626,980	626,980	626,980
22	1320					656,836	656,836	656,836	656,836	656,836
23	1380					686,692	686,692	686,692	686,692	686,692
24	1440					716,548	716,548	716,548	716,548	716,548
25	1500					746,404	746,404	746,404	746,404	746,404
26	1560					776,260	776,260	776,260	776,260	776,260
27	1620						806,117	806,117	806,117	806,117
28	1680							835,973	835,973	835,973

NOTE: - Values based on 55°F domestic cold water input
 - Values obtained using boiler heat input only

