DUAL HEAT EXCHANGER INDIRECT WATER HEATER

A Spanish language version of these instructions is available by contacting the manufacturer listed on the rating plate.
La version espanola de estas instruccions se puede obtener al escribirle a la fábrica cuyo nombre aparece in la placa de especificaciones.

INSTALLATION/OPERATING MANUAL

WITH PARTS LISTING AND TROUBLESHOOTING GUIDE

⚠ WARNING

To avoid damage or injury, there must be no materials stored against the water heater and proper care shall be taken to avoid unnecessary contact (especially by children) with the water heater.

- **Do not store or use gasoline or other flammable liquids in the vicinity of this water heater or any other appliance.**

For your family's comfort, safety, and convenience, we recommend this water heater be installed and serviced by a plumbing professional.

238-47346-00A REV 11/08

CONGRATULATIONS!

You have just purchased one of the finest water heaters on the market today!

This installation, operation, and instruction manual will explain in detail the installation and maintenance of your new water heater. We strongly recommend that you contact a plumbing professional for the installation of this water heater.

We require that you carefully read this manual, as well as the enclosed warranty, and refer to it if questions arise. If you have any specific questions concerning your warranty, please consult the plumbing professional from whom your water heater was purchased. For your records we recommend that you write the model, serial number and installation date of your water heater in the back of this manual.

This manual should be kept with the water heater.

We're committed to providing you with the finest water heater made.

SECTION I
IMPORTANT INFORMATION
-READ CAREFULLY-

The equipment must be installed in accordance with those installation regulations required in the area where the installation is to be made. These regulations must be carefully followed in all cases. Authorities having jurisdiction shall be consulted before installations are made.

All wiring on water heaters installed in the USA must be in accordance with the National Electrical Code, ANSI/NFPA 70, latest edition, and/or local regulations; or in Canada, installed in accordance with the Canadian Electrical Code, CSA C22.1, latest edition and/or local regulations.

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

DANGER

Indicates an imminently hazardous situation, which, if not avoided, will result in death, serious injury, or substantial property damage.

CAUTION

Indicates a potentially hazardous situation, which, if not avoided, may result in moderate, or minor injury or property damage.

WARNING

Indicates a potentially hazardous situation, which, if not avoided, could result in death, serious injury, or substantial property damage.

NOTICE

Indicates special instructions on installation, operation or maintenance, which are important but not related to personal injury hazards.

TABLE OF CONTENTS

I-	IMPORTANT INFORMATION…….…..	3
II-	SPECIFICATIONS…….	7
III-	GENERAL INFORMATION…….	9
IV-	PRE-INSTALLATION……	11
V-	WATER CONNECTIONS……..	13
	HEAT EXCHANGER SYSTEM CONNECTIONS……...	14
	Recommended System Combinations …….	14
	CONNECTIONS FOR SPACE HEATING…....……...	15
	CONNECTIONS FOR SOLAR HEATING……	
	Single Heat Exchanger Use…..…….	16
	Single Heat Exchanger Use – Drainback…….	17
	Dual Heat Exchanger Use……..…	18
	CONNECTIONS FOR GEOTHERMAL HEATING……	19
	CONNECTIONS FOR BOILER HEATING……..….	19
	Single Heat Exchanger Use……	19
	Dual Heat Exchanger Use – Parallel	20
	……	21
	Dual Heat Exchanger Use – Series……	
VI-	ELECTRICAL CONNECTIONS……..	22
VII-	OPERATING INSTRUCTIONS……	24
VIII-	MAINTENANCE…….	26
IX-	TROUBLESHOOTING GUIDE……	28
X-	PARTS LIST……	29
XI-	NOTES …….	31

⚠ DANGER

DO NOT store or use gasoline or other flammable, combustible, or corrosive vapors and/or liquids in the vicinity of this or any other appliance.

IF YOU SMELL GAS:

- **DO NOT try to light any appliance.**
- **DO NOT touch any electric switch; do not use any telephone in your building.**
- **Immediately call your gas supplier from a telephone in another building. Follow the gas supplier's instructions.**
- **If you cannot reach your gas supplier, call the fire department.**

DO NOT OPERATE THE APPLIANCE UNTIL THE LEAKAGE IS CORRECTED!

Liquefied petroleum gas/propane gas is heavier than air and will remain at floor level if there is a leak. Basements, crawl spaces, closets, and areas below ground level will serve as pockets for accumulation of leaking gas.

This water heater is supplied with adjustable thermostats to control water temperature. Hot water temperatures required for automatic dishwasher and laundry use can cause scald burns resulting in serious personal injury and/or death. The temperature at which injury occurs varies with the person's age and the time of exposure. The slower response time of disabled persons increases the hazards to them. *NEVER* allow small children to use a hot water tap or to draw their own bath water. *NEVER* leave a child or disabled person unattended in a bathtub or shower.

⚠ WARNING

Installation is not complete unless a properly sized/capacity pressure and temperature relief valve is installed into the side of the water heater. See the General Information section of this manual for details.

This water heater contains very hot water under high pressure. Do not unscrew any pipe fittings or attempt to disconnect any components of this water heater without positively assuring the water is cool and has no pressure. Always wear protective clothing and equipment when installing, starting up, or servicing this water heater to prevent scald injuries. Do not rely on the pressure and temperature gauges to determine the temperature and pressure of the water heater. This water heater contains components that become very hot. Do not touch any components unless they are cool.

Improper installation, adjustments, alteration, service or maintenance can cause property damage, personal injury or loss of life. Failure to follow all instructions in the proper order can cause personal injury or death. Read and understand all instructions, including all those contained in component manufacturer's manuals, which are provided with the appliance before installing, starting-up, operating, maintaining, or servicing this appliance. Keep this manual and literature in legible condition and posted near the appliance for reference by owner and service technician.

This water heater requires regular maintenance and service to operate safely. Follow the instructions contained in this manual.

Installation, maintenance, and service must be performed only by an experienced, skilled, and knowledgeable installer or service agency.

⚠ WARNING

It is the responsibility of the installing contractor to see that all controls are correctly installed and are operating properly when the installation is complete.

DO NOT operate the water heater with jumpered or absent controls or safety devices.

DO NOT tamper with or alter the water heater and/or controls.

DO NOT operate the water heater if any external part or control has been submerged in water. Immediately call a qualified service technician to inspect the appliance and to replace any part of the control system that was under water.

This water heater is suitable for installation on combustible flooring. DO NOT install this water heater on carpeting.

DO NOT operate this water heater without first being certain it is filled with water.

Flammable items, pressurized containers, or any other potential fire hazardous articles must never be placed on or adjacent to the heater. Containers of flammable gases should not be stored or used in the same room with this water heater.

Hydrogen gas can be produced in an operating water heater that has not had water drawn from the tank for a long period of time (generally two weeks or more). Hydrogen gas is extremely flammable. To prevent the possibility of injury under these conditions, it is recommended that a water faucet be opened for several minutes at the kitchen sink before you use any electrical appliance that is connected to the hot water system. If hydrogen is present, there will be unusual sounds such as air escaping through the pipes as hot water begins to flow. Do not smoke or have open flame near the faucet at the time it is open.

⚠ CAUTION

The maximum supply temperature to the heat exchangers must not exceed 250°F (*121°C*).

SECTION II
SPECIFICATIONS

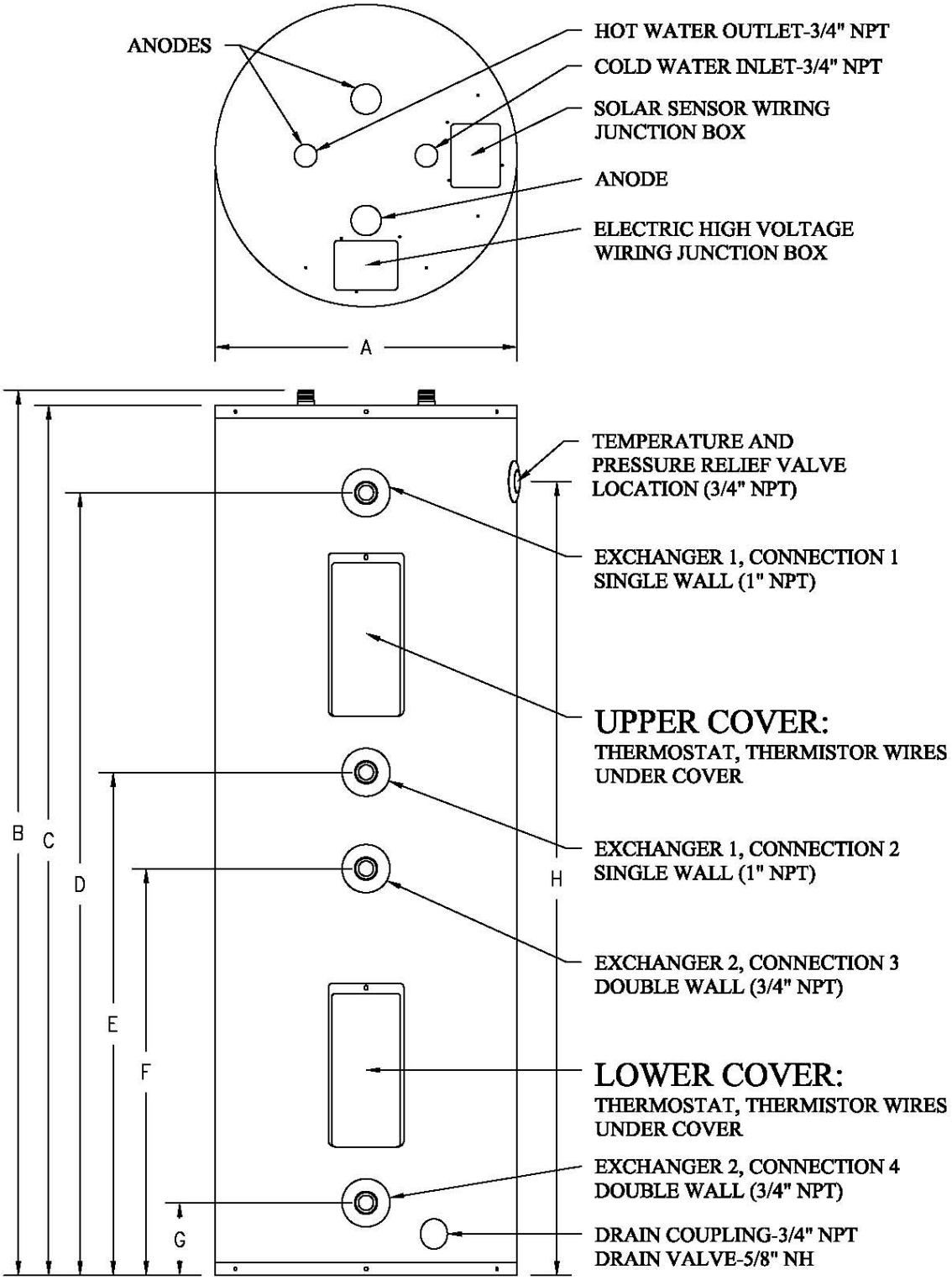

Figure 1 – Tank Layout

Table 1: Water Heater Dimension (Inches)

MODEL	A	B	C	D	E	F	G	H
55-Gal.	22	60	59-1/4	56	37-1/2	27-1/2	5-3/8	53
70-Gal.	24	60	59-1/4	56	37-1/2	27-1/2	5-3/8	53

110-Gal.	**28 1/4**	**63-1/4**	**62-1/2**	**57-3/4**	**39-1/4**	**27-1/2**	**5-3/8**	**55-3/4**

Table 2: Water Heater Capacities

MODEL	Tank Capacity (Gal)	Coil Volume* (Gal)	Coil Heat Transfer Area* (Sq Ft)	Approximate Dry Weight (Lbs)	Approximate Wet Weight (Lbs)
55-Gal.	55	2.7	14.2	282	702
70-Gal.	70	2.7	14.2	313	843
110-Gal.	110	2.7	14.2	442	1,277

***Note: Both upper and lower heat exchanger coils are identical in coil volume and heat transfer area.**

Heat Exchanger Flow Specifications

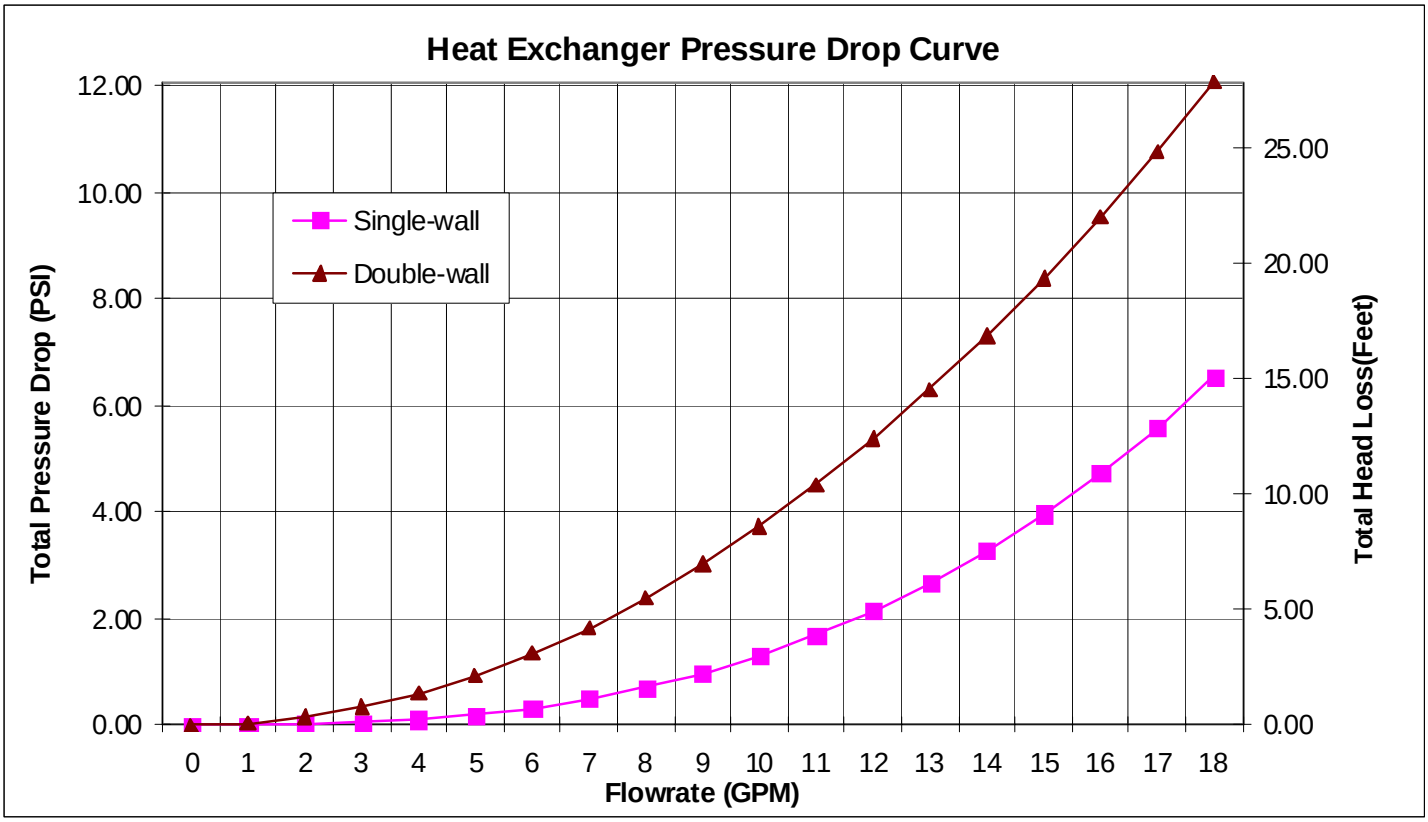

Figure 2 –Heat Exchanger Pressure Drop Chart

SECTION III
GENERAL INFORMATION

FEATURES
This water heater contains the following features:

HEAT EXCHANGER – The heat exchangers (coils) are made of porcelain coated carbon steel tubing and female fittings. If a confirmed leak occurs, contact the plumbing professional who installed the water heater or the manufacturer listed on the rating plate, for additional guidance.

DOUBLE-WALL HEAT EXCHANGER –The lower heat exchanger (Heat Exchanger 2) is a double-wall heat exchanger and has a slight gap between the two tubes that makes up the heat exchanger coil. The ¾" female fittings provide an atmospheric vent for any fluid that enters the gap between the tubes.

SINGLE-WALL HEAT EXCHANGER – The upper heat exchanger (Heat Exchanger 1) is a single-wall heat exchanger with 1" female fittings. Water heaters with single-wall heat exchangers meet the Uniform Plumbing Code for installation in all potable water systems provided that:

- The heat transfer medium (including additives) is practically non-toxic, having toxicity rating of class of 1 as listed in Clinical Toxicology of Commercial Products.
- The heat transfer medium pressure is limited to maximum 30 psig by approved relief valve.
- The heat transfer medium is potable water or contains only substances that are recognized as safe by the U.S. Food and Drug Administration (FDA).
- The pressure of the heat transfer medium is maintained less than the normal minimum operating pressure of the potable water system.
- The equipment is permanently labeled to indicate that only additives recognized as safe by the FDA shall be used in the heat transfer medium.

SENSOR WIRES FOR SOLAR THERMISTOR CONNECTIONS – Twisted wires are provided under the covers. These wires have been provided as a means for connecting thermistors to a solar controller. **NOTICE: Neither a solar controller nor thermistors are provided with the indirect water heater and must be purchased separately.** In a solar application, the thermistor wires can connect a thermistor for temperature comparison with the solar collector temperature to determine if an appropriate temperature difference for heat transfer is available.

MIXING DEVICE – An ASSE approved temperature mixing device is supplied with the water heater. In solar heating systems, heat may transfer into the water heater above the temperature limits considered safe for immediate use. This may create the potential for scald injury. To protect against such injury, you must install the supplied ASSE approved mixing valve (a device to limit the temperature of water to protect against scald injury via mixing hot and cold water supply) or equivalent in the water system. This valve will reduce point of discharge temperature in branch supply lines. Refer to the instructions supplied with the mixing device for installation procedures and device specifications.

⚠ CAUTION

This water heater must NOT be operated without the mixing device installed.

SACRIFICIAL ANODES — Three sacrificial anode rods have been installed in the tank head to extend tank life. The anode rods should be inspected annually to determine the amount of sacrificial decay and replaced when necessary to prolong tank life. The permanent removal of these anodes, for any reason, will nullify the warranty. Water conditions in your area will influence the time interval for inspection and replacement of the anode rods. The use of a water softener may increase the speed of anode consumption. More frequent inspection of the anodes are needed when using softened (or phosphate treated) water. Contact the plumbing professional who installed the water heater or the manufacturer, listed on the rating plate, for anode replacement information.

TEMPERATURE AND PRESSURE RELIEF VALVE

⚠ WARNING

Keep clear of the combination temperature and pressure relief valve discharge line outlet. The discharge may be hot enough to cause scald injury. The water is under pressure and may splash.
For protection against excessive temperatures and pressure, install temperature and pressure protective equipment required by local codes, but not less than a combination temperature and pressure relief valve certified by a nationally recognized testing laboratory that maintains periodic inspection of production of listed equipment or materials as meeting the requirements of the Standard for *Relief Valves and Automatic Gas Shutoff Devices for Hot Water Supply Systems, ANSI Z21.22* and the Standard *CAN1-4.4 Temperature, Pressure, Temperature and Pressure Relief Valves and Vacuum Relief Valves.* The combination temperature and pressure relief valve must be marked with a maximum set pressure not to exceed the maximum working pressure of the water heater. The combination temperature and pressure relief valve must also have an hourly rated temperature steam BTU discharge capacity not less than the hourly rating of the water heater/storage unit. The supplied combination temperature and pressure relief valve, when properly installed and unrestricted, will discharge the maximum input produced by a 250°F (*121*°C) collector supply temperature. For solar installations, a lower collector supply temperature will reduce the input required to be discharged in the event of excessive potable water temperatures.

Install the combination temperature and pressure relief valve into the opening provided and marked for this purpose on the water heater/storage unit.

Some models may already be equipped or supplied with a combination temperature and pressure relief valve. Verify that the combination temperature and pressure relief valve complies with local codes. If the combination temperature and pressure relief valve does not comply with local codes, replace it with one that does.

Install a discharge line so that water discharged from the combination temperature and pressure relief valve will exit within six (6) inches above, or any distance below the structural floor and cannot contact any live electrical part. The discharge line is to be installed to allow for complete drainage of both the temperature and pressure relief valve and the discharge line. The discharge opening must not be subjected to blockage or freezing. **DO NOT** thread, plug, or cap the discharge line. It is recommended that a minimum clearance of four (4) inches be provided on the side of the water heater/storage unit for servicing and maintenance of the combination temperature and pressure relief valve

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Do not place a valve between the combination temperature and pressure relief valve and the tank!

SECTION IV
PRE-INSTALLATION

UNPACKING

INSPECT SHIPMENT carefully for any signs of damage. If damage is noted, do not install the product. Contact the shipper or manufacturer listed on the rating plate. All equipment is carefully manufactured, inspected, and packed. Our responsibility ceases upon delivery of the packaged water heater to the carrier in good condition.
NOTE: Any claims for damage or shortage in shipment must be filed immediately against the carrier by the consignee.

This water heater MUST be installed indoors out of the wind and weather.

⚠ CAUTION

This water heater must be located in an area where leakage of the tank, water line connections, or the temperature and pressure relief valve will not result in damage to the area adjacent to the water heater/storage unit or to lower floors of the structure. When such locations cannot be avoided, a suitable drain pan must be installed under the water heater/storage unit. The drain pan depth must be suitable for draining and collecting water. The drain pan can be purchased from your plumbing professional. The drain pan must be piped to an adequate drain. The piping must be at least ¾ inch in diameter and pitched for proper drainage.

Component Location

Clearance from Combustible Materials			
Top	Sides	Front	Rear
0”	0”	0”	0”

Table 3 – Combustible Material Clearances

Recommended Service Clearances			
Non-Piping Side	Front (Heat Exchangers)	Rear	T & P Relief Valve Side
4”	16”	0”	6”

Table 4 – Service Clearances

1. **Heater Location –** For fastest delivery of hot water, place the indirect water heater closest to the points of use.

Additional Recommended Components

1. **Shut-off Valves –** Allows isolation of water heater from domestic water system and the connected heating system during service.
2. **Unions –** Allows water heater movement during service if adequate clearance cannot be provided.
3. **Thermal Expansion Tank –** If the water heater is installed in a closed water supply system, such as one having a back-flow preventer in the cold water line, provide thermal expansion control. Contact the water supplier or local plumbing inspector for additional information.

MOVE THE WATER HEATER TO A PERMANENT POSITION BY SLIDING OR WALKING.

⚠ CAUTION

Do not drop water heater. Do not bump water heater jacket against floor.

NOTICE

For California installation this water heater must be braced, anchored, or strapped to avoid falling or moving during an earthquake. See instructions for correct installation procedures. Instructions may be obtained from California Office of the State Architect, 400 P Street, Sacramento, CA 95814.

SOLAR WATER HEATING FUNDAMENTALS

The solar heating system puts the most amount of heat into the storage tank when the internal heat exchanger is located in cold water. This allows the collector temperature to be lower and still transfer heat into the storage tank. As a rule, solar installations will use the lower or both heat exchangers. This will allow for the greatest solar fraction possible.

When hot water is taken from the top of the tank, cool water is delivered to the tank bottom by means of a diptube. The amount of heat transferred into the tank due to solar heating is variable. The more heat stored in the tank through solar heating, the lower the operating costs. The mixing device must be installed to ensure that if higher temperatures are achieved, safe water temperature delivery occurs. It is recommended that storage tank temperatures are not allowed above 185°F.

GEOTHERMAL WATER HEATING FUNDAMENTALS

The use of an internal heat exchanger in the water heater can be used in a closed-loop geothermal heating system without a desuperheater installed in the geothermal heat pump unit. The desuperheater is a heat exchanger attachment that allows potable water from the water heater to flow through the geothermal unit. In an open-loop geothermal application, the desuperheater must be installed. In geothermal water heating, the heat available is considered supplemental due to the lower than typically desired temperatures achieved.

The maximum amount of heat available for the water heater in a geothermal application is in the summer months as the unit is attempting to discharge gained heat. It should be noted that no heat is available for the water heater in periods where the geothermal unit is not running as no fluid is flowing.

SECTION V
WATER CONNECTIONS

INSTALL TEMPERATURE AND PRESSURE RELIEF VALVE (if not factory installed)

⚠ WARNING

FAILURE TO INSTALL AND MAINTAIN A NEW, LISTED TEMPERATURE AND PRESSURE RELIEF VALVE WILL RELEASE THE MANUFACTURER FROM ANY CLAIM WHICH MIGHT RESULT FROM EXCESSIVE TEMPERATURE AND PRESSURES.

Hydrogen gas can be produced in an operating water heater that has not had water drawn from the tank for a long period of time. HYDROGEN GAS IS EXTREMELY FLAMMABLE. To prevent the possibility of injury under these conditions, we recommend the hot water faucet be opened for several minutes at the kitchen sink before you use any electrical appliance that is connected to the hot water system. If hydrogen is present, there will be an unusual sound such as air escaping through the pipes as hot water begins to flow. Do not smoke or have open flame near the faucet at the time it is open.

Keep clear of the temperature and pressure relief valve discharge line outlet. The discharge may be hot enough to cause scald injury. The water is under pressure and may splash.

Keep clear of the temperature and pressure relief valve discharge line outlet. The discharge may be hot enough to cause scald injury. The water is under pressure and may splash.

Temperature and pressure relief valve discharge piping must be piped near the floor to eliminate potential of severe burns. Do not pipe in any area where freezing could occur. Do not install any shut-off valves, plugs or caps to the temperature and pressure relief valve or piping.

⚠ CAUTION

If sweat fittings are to be used, DO NOT apply heat to the nipples on top of the water heater. Sweat the tubing to the adapter before fitting the adapter to the water connections. It is imperative that heat is not applied to the nipples containing a plastic liner.

INSTRUCTIONS FOR POTABLE CONNECTIONS

1. BEFORE PROCEEDING WITH THE INSTALLATION, CLOSE THE MAIN WATER SUPPLY VALVE. After shutting off the main water supply, open a faucet to relieve the water line pressure to prevent any water from leaking out of the pipes while making the water connections to the water heater. After the pressure has been relieved, close the faucet. The COLD water inlet and HOT water outlet are identified on the top of the water heater. Install the mixing device supplied with the indirect water heater, following the installation instructions included with the mixing device. Make the proper plumbing connections between the mixing device on the water heater and the plumbing system to the house. Install a shut-off valve in the cold water supply line.
2. If this water heater is installed in a closed water supply system, such as one having a back-flow preventer in the cold water supply, provisions must be made to control thermal expansion. DO NOT operate this water heater in a closed system without provisions for controlling thermal expansion. Warranties do not cover damages from thermal expansions such as pressure bulges and/or deformities. A properly sized expansion tank will alleviate most problems. Your water supplier or local plumbing inspector should be contacted on how to control this situation.
3. After installation of the water lines, open the main water supply valve and fill the water heater. While the water heater is filling, open several hot water faucets to allow air to escape from the water system. When steady streams of water flow through the faucets, close them and check all water connections for possible leaks.
4. **NEVER OPERATE THE WATER HEATER WITHOUT FIRST BEING CERTAIN THAT IT IS FILLED WITH WATER.**

HEAT EXCHANGER SYSTEM CONNECTIONS

The two heat exchangers located inside the tank may be connected to a variety of different heating systems. As a result, both upper and lower control locations contain a surface mounted thermostat with a high temperature cut-out device and wiring for a thermistor. The surface mounted thermostat is for applications such as a boiler where a specific temperature is desired to control a circulator. The thermistor wiring is for applications such as solar where a thermistor is connected and used in a solar controller. A solar controller compares the thermistor temperature to the solar collector temperature and determines if a sufficient temperature differential exists to transfer heat into the water storage tank.

Since multiple heating systems may be applied to the heat exchangers, separate and combined configurations will be provided as guidelines. When only one exchanger is shown, the other will be covered in the section appropriated to that heating system. In all cases, a qualified installer must design the system to ensure proper and safe operation.

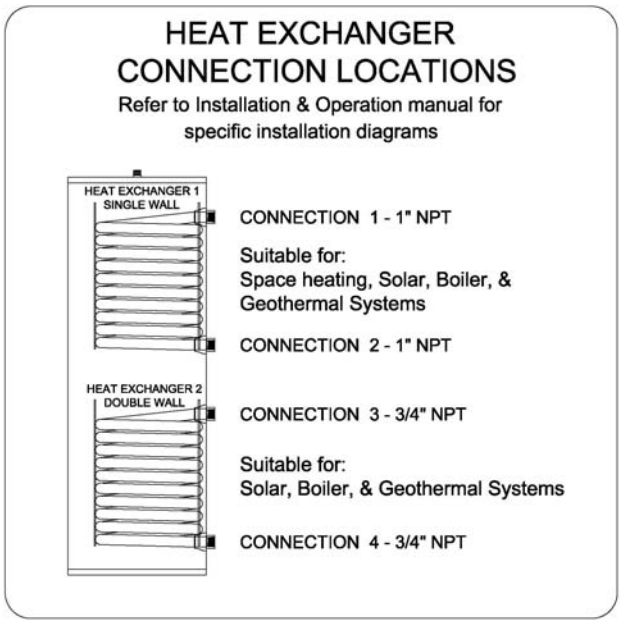


Figure 3 – Heat Exchanger System Capabilities

Recommended System Combinations

Space Heating System – when space heating is used with this water heater, that system should only be connected to the upper heat exchanger, Heat Exchanger 1. As water is heated, it rises to the top of the tank. By using the upper heat exchanger for space heating, the hottest water is applied and the best space heating is available.

Solar Heating System – when solar heating is used with this water heater, that system should be connected to the lower heat exchanger, Heat Exchanger 2. The exception to this rule is when both heat exchangers are to be used for maximum heat transfer capability. The lower heat exchanger is used to maximize the transfer of solar heat into the tank as the cold water is delivered into the tank bottom.

Geothermal Heating System – when geothermal heating is used with this water heater, that system should follow the Solar Heating System guidelines as indicated above. If geothermal and solar heating is desired in the same heater, geothermal is recommended to be connected to Heat Exchanger 2 and solar is recommended to be connected to Heat Exchanger 1. This is a result of Geothermal heating attaining only supplemental temperature limits while solar can attain higher temperatures.

Boiler Heating System – when boiler heating is used, that system can be connected in any heat exchanger configuration, Heat Exchanger 1, 2 or both. If used in combination with a space heating, solar or geothermal system, the general rules for heat exchanger use in those systems must take precedence.

FILLING THE HEAT EXCHANGER SYSTEM WITH HEAT TRANSFER FLUID

1. Refer to the appropriate diagram for general piping schematics. Verify that a full port ball valve is located between a drain and the cold water supply. This must be established such that when the full port ball valve is closed, water will flow in the same direction as it will when operation. This is important for systems that include check valves. A shorter distance between the drain and the cold water supply is beneficial.
2. Close the full port ball valve and open the drain valve. Make sure that an appropriate drain hose is connected and securely applied to a location that the overflowing fluid can be dumped into.
3. Fill the heat exchanger system with water or a propylene glycol/water mix.
4. When the water or propylene glycol/water mix is flowing from the drain, slowly close the drain.
5. With the drain closed, open the full port ball valve to allow the water or propylene/glycol mix to fill the remaining pipe volume.
6. Activate the space heating circulator(s), verifying circulator flow and direction. Purge all air from the heat exchanger system piping.
7. Check system for leaks. Repair as necessary.
   a. In a closed loop system, check for leaks when flow is stopped and the operating pressure is maintained.

CONNECTIONS FOR SPACE HEATING

When a space heating system is used, connect the upper heat exchanger (heat exchanger 1) as shown in Figure 4. Due to each system being independent of each other, the lower system's connection to heat exchanger 2 is not shown. The space heating connection designated as CONNECTION 1 should be piped to the space heating supply piping. The use of shut-off valves and unions are recommended for future service convenience. The use of an air separator and vent is necessary to eliminate air in the system. Pipe and fittings between the space heating system and water heater must be ¾" diameter or larger. The water heater connection designated as CONNECTION 2 should be piped to the space heating return piping.

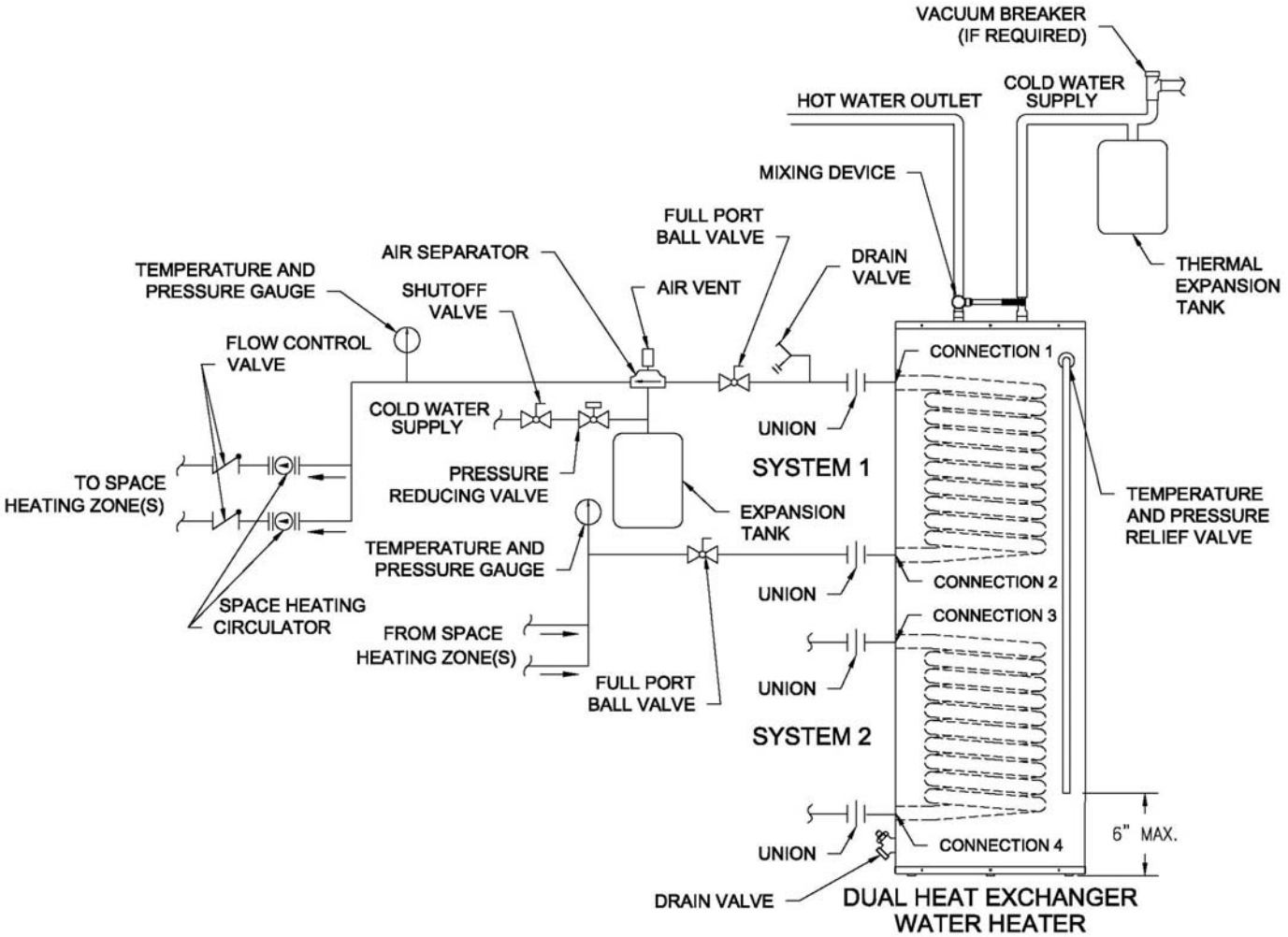


Figure 4 – Space Heating Piping in Closed-loop Installation for Single Heat Exchanger (SYSTEM 1)

CONNECTIONS FOR SOLAR HEATING

FILL SOLAR COLLECTOR SYSTEM

1. Fill solar heating system appropriately with water or a propylene glycol/water mix.
2. Verify circulator flow and direction. In a closed loop system, purge all air from the collector/water heater piping.
3. Check system for leaks. Repair as necessary.
   a. In a closed loop system, check for leaks when flow is stopped and the operating pressure is maintained.

Single Heat Exchanger Use

When multiple systems are used with closed loop solar heating, connect the lower heat exchanger (heat exchanger 2) as shown in Figure 5. Due to each system being independent of each other, the upper system's connection to heat exchanger 1 is not shown. The dual indirect water heater connection designated as CONNECTION 3 should be piped to the solar collector supply piping. Mount the circulator making sure the flow arrow points away from the water heater. The use of shut-off valves and unions are recommended for future service convenience. The use of an air separator and vent is required to eliminate air in the system. Pipe and fittings between the solar collector and solar water heater must be ¾" diameter or larger. The solar water heater connection designated as CONNECTION 4 should be piped to the solar collector return piping.

When a single heat exchanger is used in solar heating it is recommended that the lower heat exchanger be used for maximum solar collector efficiency and the best solar fraction. In generic terms, solar fraction is a ratio of the amount of hot water supplied by solar heating in respect to the amount of hot water used.

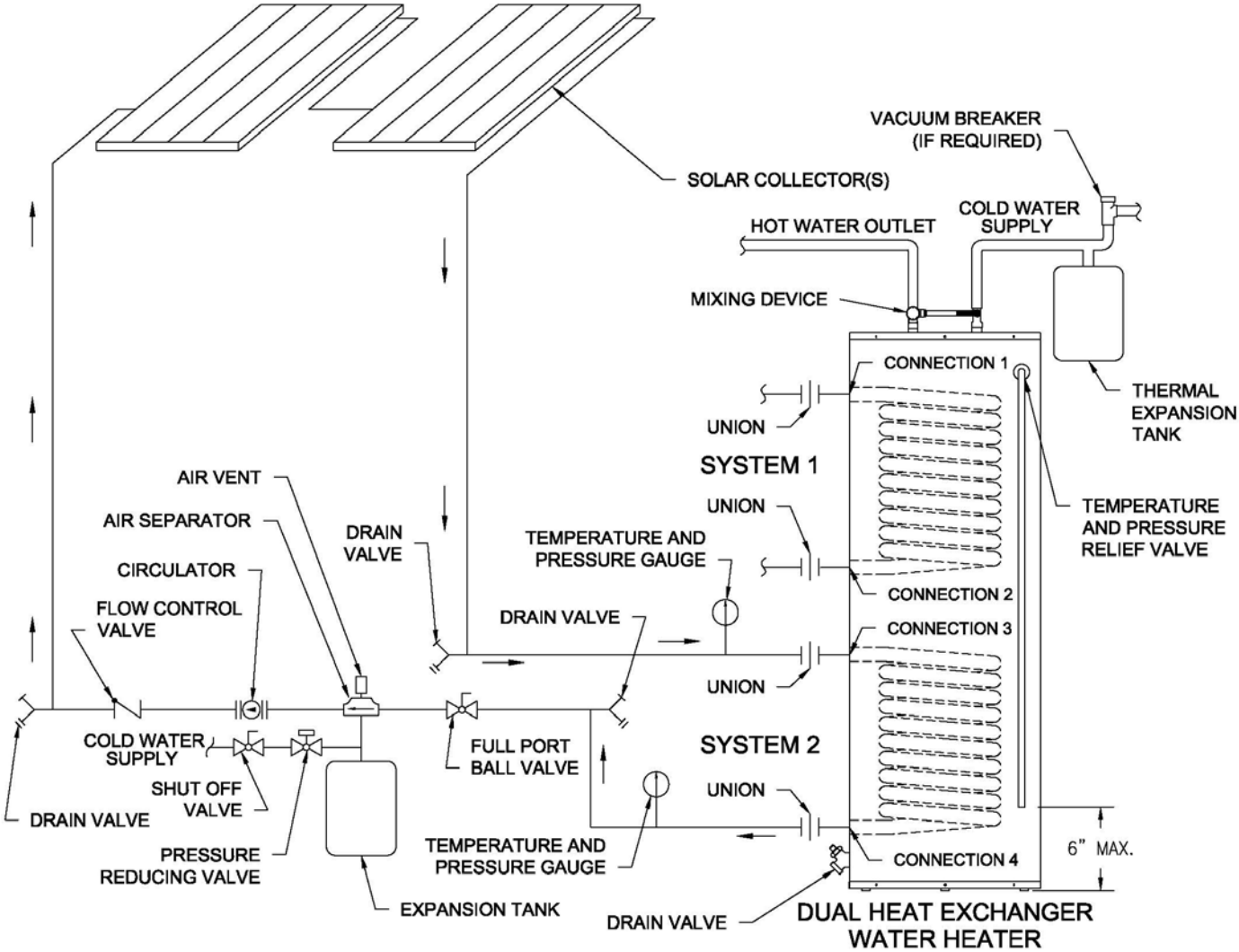


Figure 5 – Solar Collector Piping in Closed-loop Installation for Single Heat Exchanger (SYSTEM 2)

⚠ CAUTION

Maximum solar collector water supply temperature to the solar heat exchanger must not exceed 250°F (*121°C*).

DRAINBACK APPLICATION

For a drainback solar heating system, refer to Figure 6. The dual indirect water heater connection designated as CONNECTION 3 should be piped to the solar collector supply piping. Mount the pump making sure the flow arrow points away from the water heater. The use of shut-off valves and unions are recommended for future service convenience. Pipe and fittings between the solar collector and dual indirect water heater must be ¾" diameter or larger. The piping or drainback tank must have a site glass located at a level above the circulator and water heater. The drainback tank and water level should be located in a controlled temperature location. The drainback tank should be at the highest point below the collectors possible to reduce the amount of head necessary to pump the fluid into the collectors. It is imperative that no check valves are in the solar system and that all piping is oriented to allow fluid to drain back into the tank.

When a single heat exchanger is used in solar heating it is recommended that the lower heat exchanger be used for maximum solar collector efficiency and the best solar fraction. In generic terms, solar fraction is a ratio of the amount of hot water supplied by solar heating in respect to the amount of hot water used.

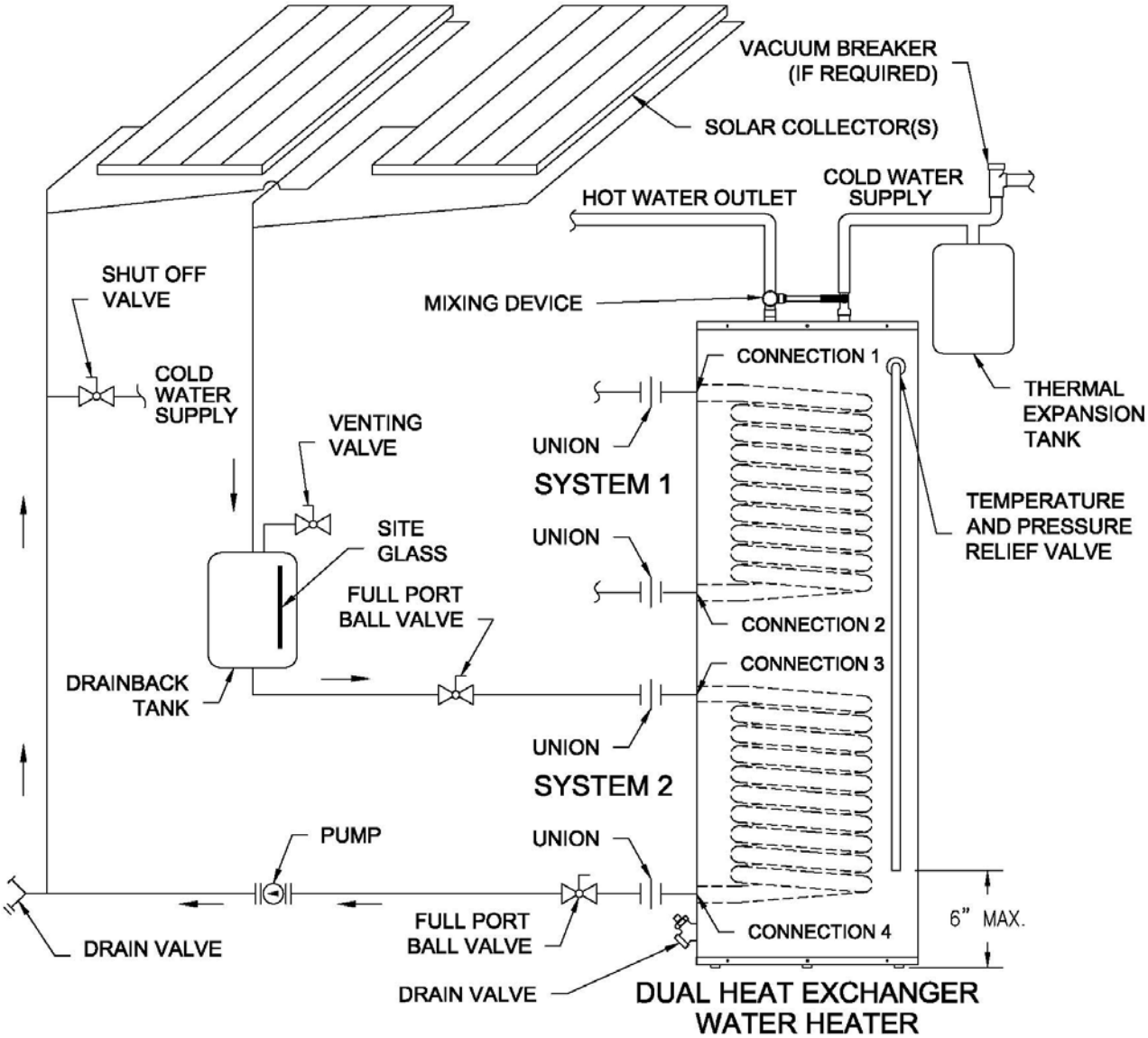


Figure 6 – Solar Collector Piping in Drainback Installation for Single Heat Exchanger (SYSTEM 2)

Dual Heat Exchanger Use

When both heat exchangers are used with closed loop solar heating, make connections as shown in Figure 7. The solar water heater connection designated as CONNECTION 1 according to Figure 3 should be piped to the solar collector supply piping. Mount the circulator making sure the flow arrow points away from the water heater. The use of shut-off valves and unions are recommended for future service convenience. The use of an air separator and vent is required to eliminate air in the system. Pipe and fittings between the solar collector and solar water heater must be ¾" diameter or larger. Provide an appropriate connection from CONNECTION 2 to CONNECTION 3 as shown. The solar water heater connection designated as CONNECTION 4 according to Figure 3 should be piped to the solar collector return piping.

When both heat exchangers are used in solar heating it is recommended that the CONNECTION 1 is piped to the solar collector supply piping to allow for the maximum amount of heat to be transferred in the upper portion of the water heater. The heat that is not transferred in the upper heat exchanger can be transferred through the lower heat exchanger. This allows maximum hot water deliverability, maximum solar collector efficiency and the best solar fraction. In generic terms, solar fraction is a ratio of the amount of hot water supplied by solar heating in respect to the amount of hot water used.

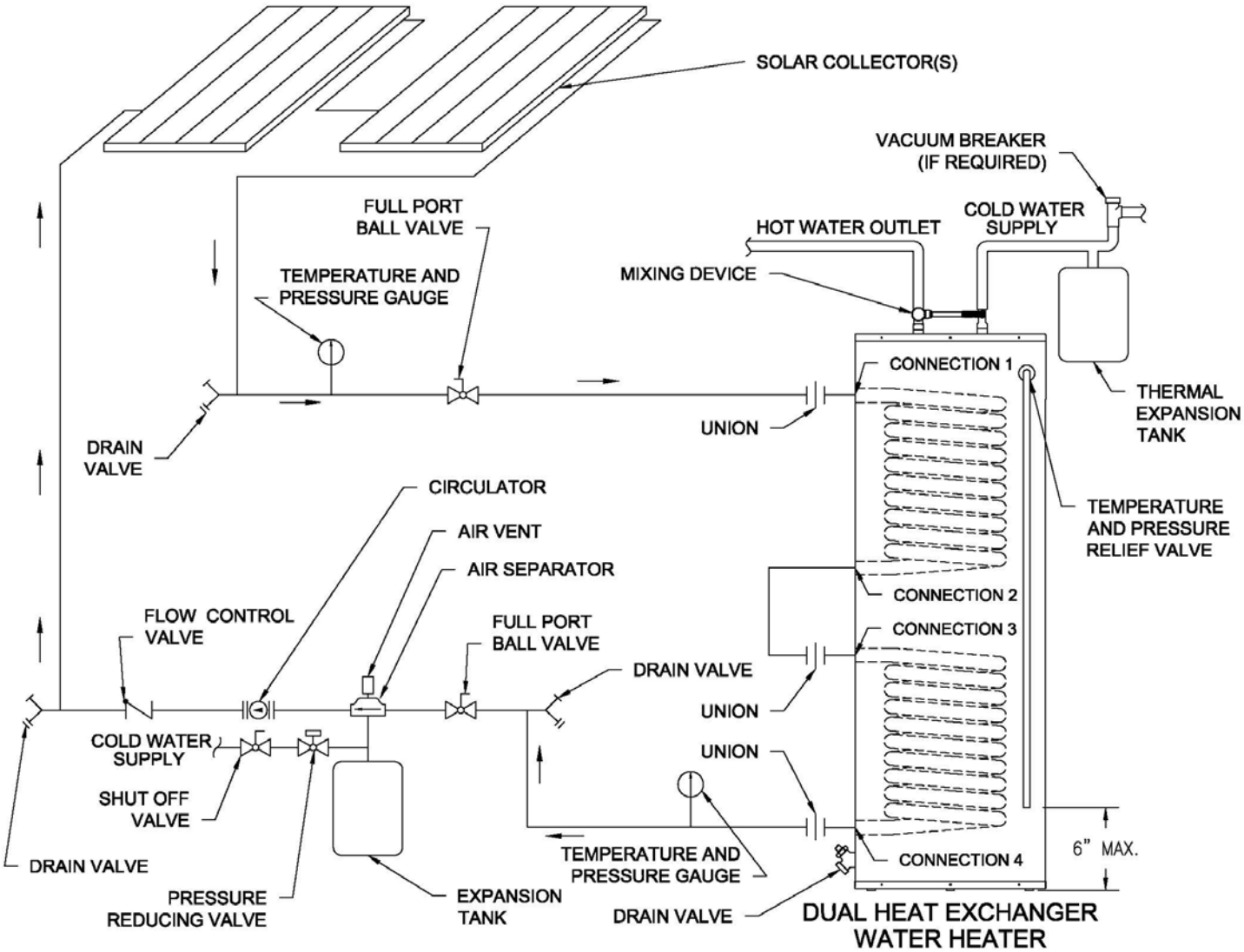


Figure 7 – Solar Collector Piping in Closed-loop Installation for Both Heat Exchangers

CONNECTIONS FOR GEOTHERMAL HEATING

Follow the instructions for solar heating connections for either single or dual heat exchanger use. Refer to the Recommended System Combinations in Section V, Water Connections, for information regarding which heat exchanger to use when multiple heating systems are connected to the indirect water heater.

CONNECTIONS FOR BOILER HEATING

FILL BOILER SYSTEM

1) On new boiler installations, do not purge the boiler or space heating system through the water heater. During any boiler or space heating system flushing, cleaning, or purging, the water heater should be isolated to avoid possible attack on the carbon steel coil by chemical additives.
2) Purge air from boiler/water heater piping.
3) Check system for leaks. Repair as necessary.

Single Heat Exchanger Use

1. For a boiler heating system that utilizes a single heat exchanger, refer to Figure 8. Due to each system being independent of each other, the upper system's connection to heat exchanger 1 is not shown. The indirect water heater connection designated as CONNECTION 3 should be piped to the boiler supply piping. Mount the circulator making sure the flow arrow points toward the water heater. The use of shut-off valves and unions are recommended for future service convenience. The use of an air separator and vent is required to eliminate air in the system. Pipe and fittings between the boiler and indirect-fired water heater must be ¾" diameter or larger. The indirect water heater connection designated as CONNECTION 4 according to Figure 8 should be piped to the boiler return piping.

If the upper heat exchanger is to be used to heat the potable water, the system connections are the same, but with CONNECTION 1 taking the place of CONNECTION 3 and CONNECTION 2 taking the place of CONNECTION 4.

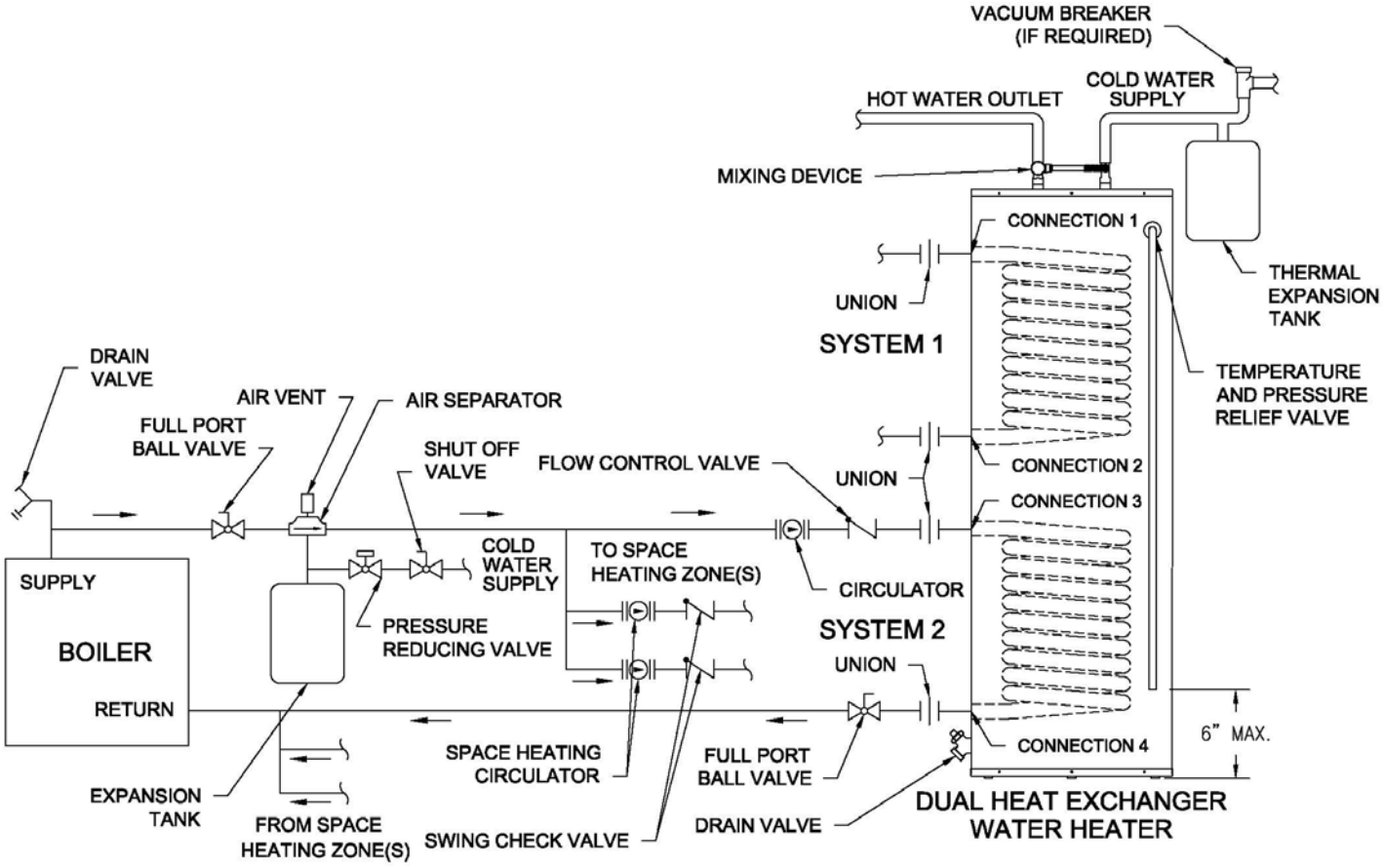


Figure 8 – Boiler Piping in Closed-loop Installation for Single Heat Exchanger

Dual Heat Exchanger Use - Parallel

When both heat exchangers are used with a boiler, make connections as shown in Figure 9. The dual indirect water heater connections designated as CONNECTION 1 and CONNECTION 3 should be piped to the boiler supply piping. Mount the circulators making sure the flow arrows points toward the water heater. The use of shut-off valves and unions are required for future service convenience. The use of an air separator and vent is required to eliminate air in the system. Pipe and fittings between the boiler and dual indirect water heater must be ¾" diameter or larger. The dual indirect water heater connections designated as CONNECTION 2 and CONNECTION 4 according to Figure 9 should be piped to the boiler return piping.

When both heat exchangers are used in a boiler heating system it is recommended that CONNECTION 1 and CONNECTION 3 are piped to the boiler supply to allow for the maximum amount of heat to be transferred in the dual indirect water heater if needed. When a typical draws occurs, the lower circulator can be activated. When a significant draw occurs, both circulators can be activated, supplying each heat exchanger with boiler supply water. This allows for maximum hot water deliverability and the greatest efficiency.

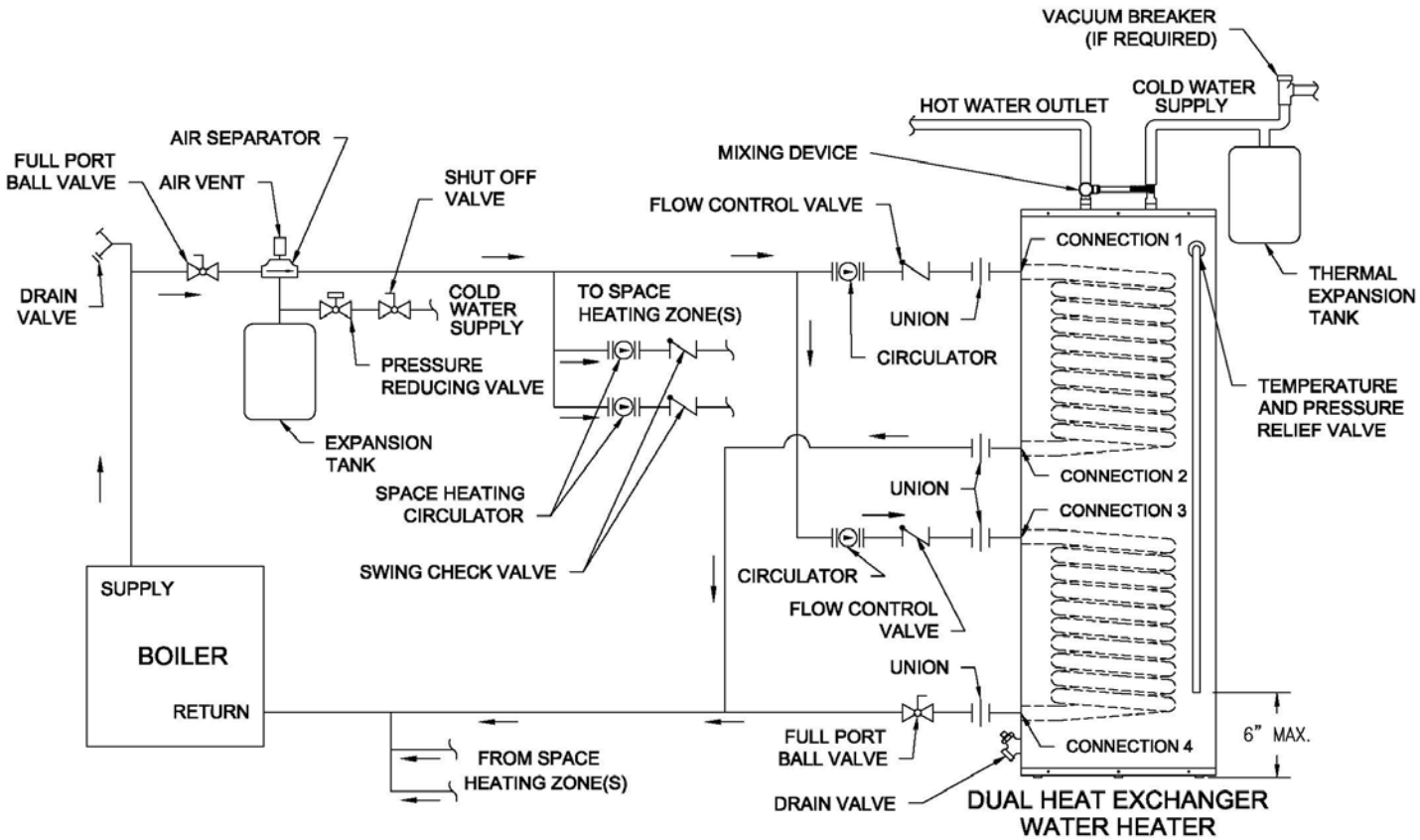


Figure 9 – Boiler Piping Installation for Both Heat Exchangers using Both Thermostats

Dual Heat Exchanger Use - Series

An alternate installation when both heat exchangers are used with a boiler, is to make connections as shown in Figure 10. The dual indirect water heater connection designated as CONNECTION 1 should be piped to the boiler supply piping. Mount the circulator making sure the flow arrow points toward the water heater. The use of shut-off valves and unions are required for future service convenience. The use of an air separator and vent is required to eliminate air in the system. Pipe and fittings between the boiler and dual indirect water heater must be ¾" diameter or larger. CONNECTION 2 should be plumbed to CONNECTION 3 as shown. The dual indirect water heater connections designated as CONNECTION 4 according to Figure 10 should be piped to the boiler return piping.

When both heat exchangers are used in a boiler heating system and is connected as shown in Figure 10, the lower thermostat must be used to activate the circulator.

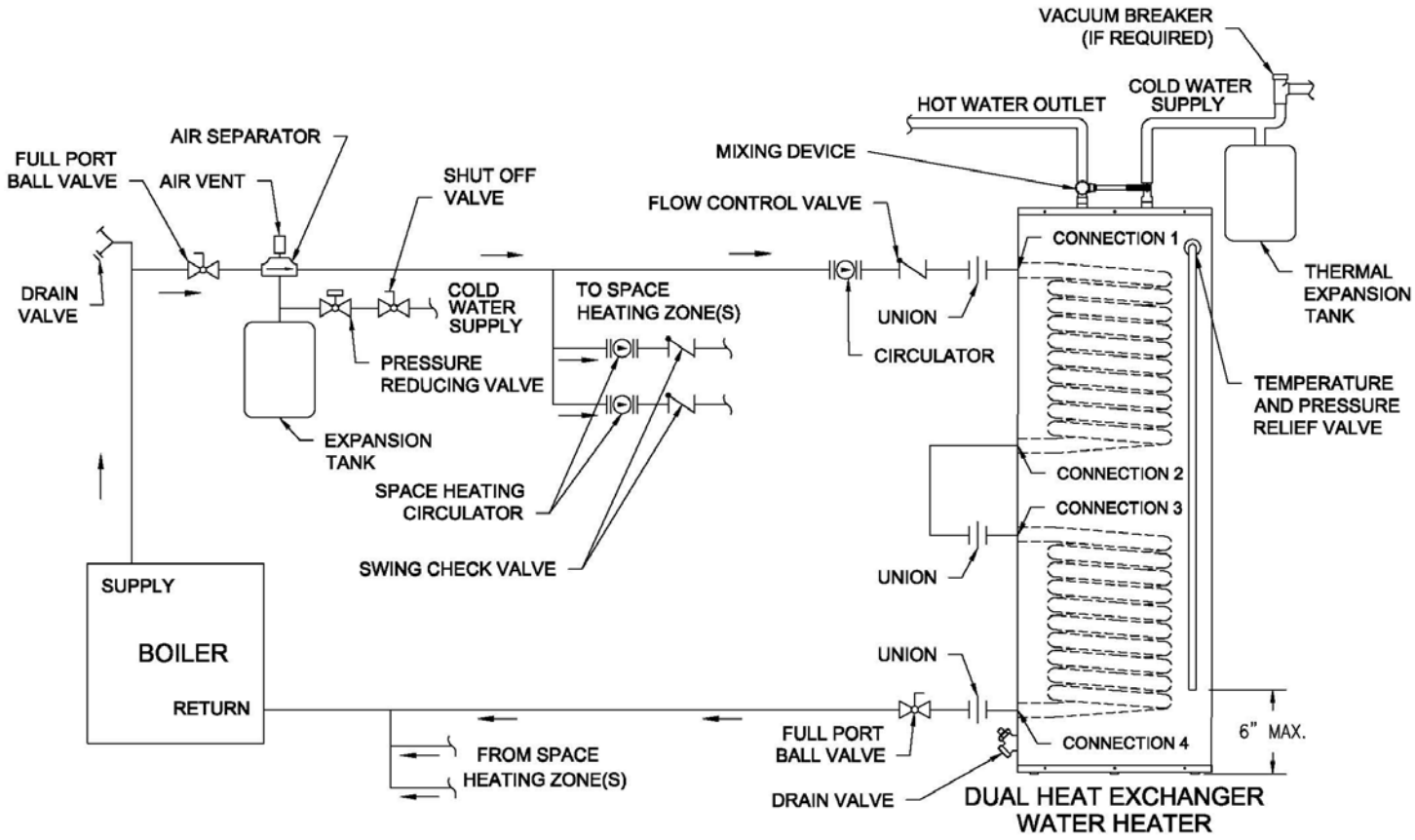


Figure 10 – Boiler Piping Installation for Both Heat Exchangers using the Lower Thermostat

SECTION VI
ELECTRICAL CONNECTIONS

Install electric wiring in accordance with the National Electric, ANSI/NFPA 70, or in Canada the CSA C22.1 Electric Code, latest editions.

⚠ DANGER

Positively assure all electrical connections are unpowered before attempting installation or service of electrical components or connections of the water heater or building. Lock out all electrical boxes with padlock once power is turned off.

⚠ WARNING

When installed, the water heater must be electrically grounded in accordance with local codes or, in the absence of local codes, with the National Electrical Code, ANSI/NFPA 70, or in Canada the CSA C22.1 Electric Code, latest editions.

Failure to properly wire electrical connections to the water heater may result in serious physical harm.

Electrical power may be from more than one source. Make sure all power is off before attempting any electrical work.

CONNECT THERMOSTATS FOR BOILER OPERATION

Before any electrical connections are made, be sure that the water heater is full of water and that the valve in the cold water supply line is open. The dual indirect water heater is supplied with thermostats that incorporate manual reset temperature-limiting devices. Please refer to the TROUBLESHOOTING GUIDE section for manual reset operation. Both upper and lower thermostats incorporate a manual adjustable temperature indicator to change the potable water temperature setting. Refer to WATER TEMPERATURE ADJUSTMENT in the OPERATING INSTRUCTIONS section for proper instruction in adjusting water temperature. Turn off all power related to the heating system before proceeding with the electrical connections. Any and all wiring shall be sized and installed to satisfy the voltage and amperage used. The water heater must be well grounded. A green ground screw is provided at the electrical connection point for connecting a ground wire. All wiring shall be done in accordance with all applicable local and state codes.

⚠ WARNING

Water heaters are heat-producing appliances. To avoid damage or injury there must be no materials stored against the water heater, and proper care must be taken to avoid unnecessary contact (especially by children) with the water heater.
UNDER NO CIRCUMSTANCES SHALL FLAMMABLE MATERIALS, SUCH AS GASOLINE OR PAINT THINNER BE USED OR STORED IN THE VICINITY OF THE WATER HEATER OR IN ANY LOCATION FROM WHICH FUMES COULD REACH THE WATER HEATER.

Installation or service of this water heater requires ability equivalent to that of a licensed tradesman in the field involved. Plumbing and electrical work are required.

CONNECT THERMISTORS FOR SOLAR OPERATION

Sensor wires are provided for connection to the solar controller in a separate junction box located on top of the water heater. The brown twisted wires provide thermistor wiring from the controller to the lower heat exchanger. The orange twisted wires provide thermistor wiring from the solar controller to the upper heat exchanger location.

NOTICE

A solar control and thermistors are not supplied with this water heater. The Tekmar 156, when installed according to manufacturer's instructions, is an acceptable controller. Other solar controller manufacturers such as Steca and Resol provide controllers appropriate for use with this water heater.
Thermistors are not included with the water heater. Thermistors must be purchased with the solar controller to ensure capability with the selected control. Contact the solar controller manufacturer for details.

Refer to Figure 11 for connecting the thermistor(s) and pressing it against the tank. This figure illustrates the opening under the upper and lower control cover.

1. Positively assure all electrical connections are unpowered whenever removing the control covers.
2. Strip the twisted wire ends and use wire nuts to securely connect the thermistor wires.
3. With a flat blade screwdriver or similar tool to be used as a lever, gently pry the sensor plate away slightly from the water heater tank.
4. Slide the thermistor between the sensor plate and the water heater tank as shown.
    a. The tank thermistor(s) should be inserted as shown in the upright position.
5. Verify that the sensor plate provides enough pressure to hold the thermistor in place.
6. Return power to the water heater once the covers are in place.

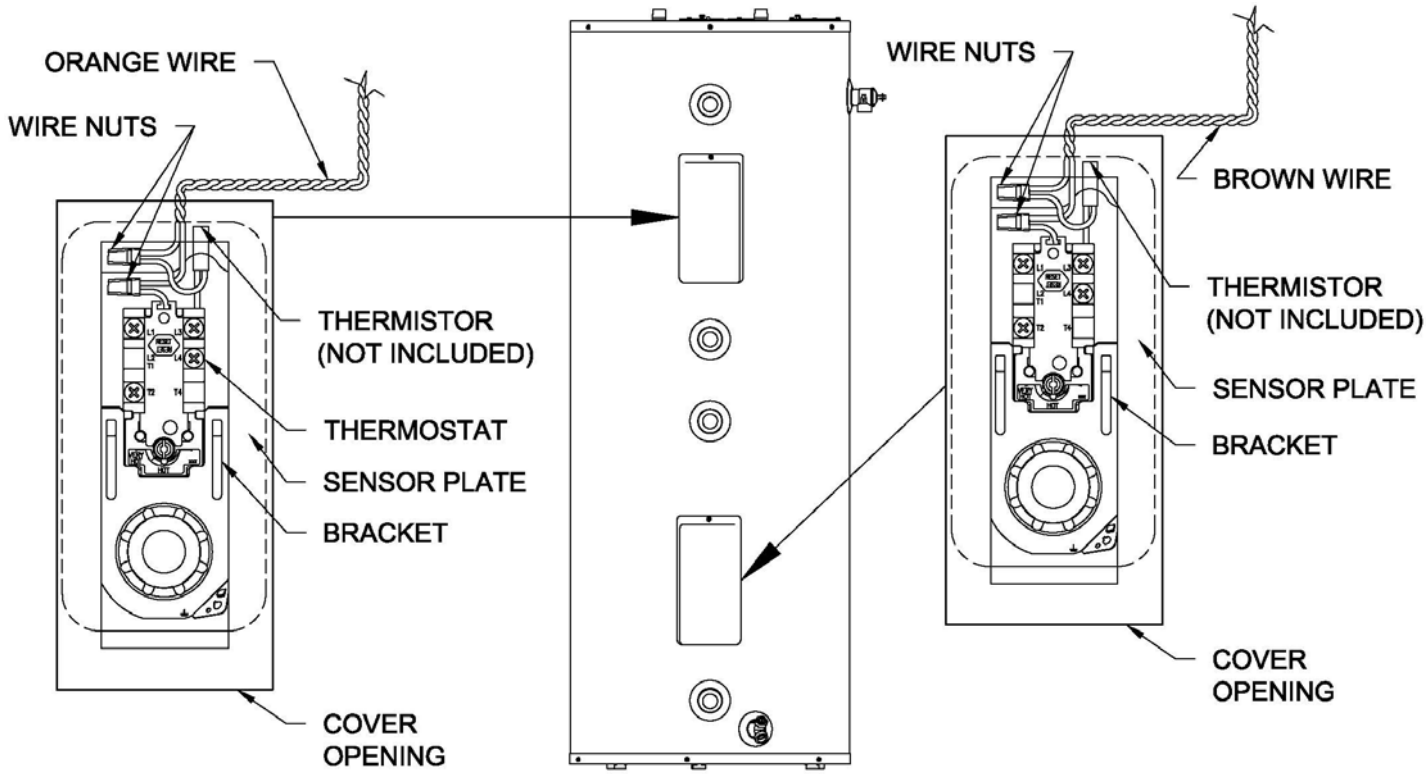


Figure 11 – Wiring and Placement for the Solar Control Thermistors

SECTION VII
OPERATING INSTRUCTIONS

SYSTEM START-UP
Follow the appropriate installation instructions to place the heating system or space heating system in operation. Ensure that fluid flow operation is established in the heat exchanger for the installed system.

WATER TEMPERATURE ADJUSTMENT
Table 5 details the approximate 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.

⚠ WARNING

SCALDING

This water heater can deliver scalding temperature water at any faucet in the system. Be careful whenever using hot water to avoid scalding injury. By setting the thermostat on this water heater to obtain an increased water temperature, you may create the potential for scald injury. To protect against injury, you should install an ASSE approved mixing valve (a device to limit the temperature of water to protect against scald injury via mixing hot and cold water supply) in the water system. This valve will reduce point of discharge temperature in branch supply lines. This water heater was shipped with an ASSE approved mixing valve. Install this valve according to the directions in the mixing device container. DO NOT OPERATE THIS WATER HEATER A MIXING DEVICE. If this water heater was shipped without a mixing device, contact the manufacturer.

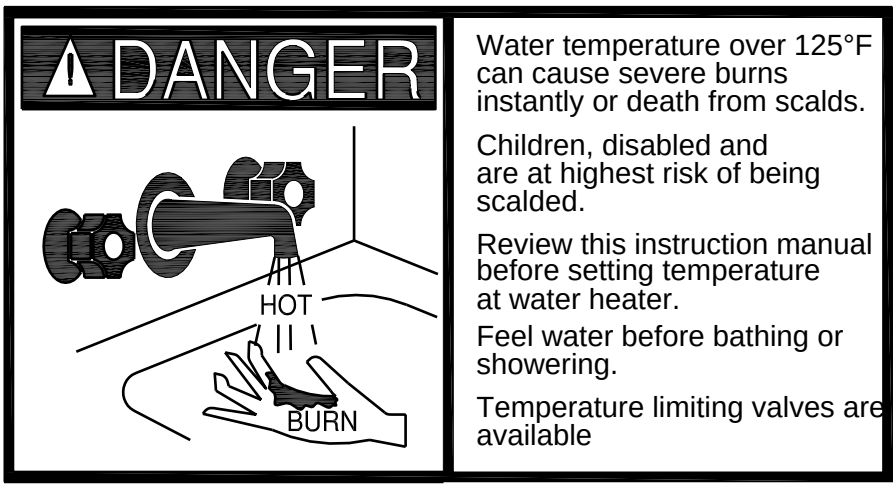


Figure 12 – Scald Warning

APPROXIMATE TIME/TEMPERATURE RELATIONSHIPS IN SCALDS	
120°F	More than 5 minutes
125°F	1 ½ 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 ½ seconds
155°F	About 1 second

Table 5 – Scald Relationships

SEQUENCE OF HEATING OPERATIONS –SPACE HEATING
1) The space heating zone control senses a need for heat.
   a) The zone control activates the appropriate space heating circulator to begin circulating heated fluid through the zone and deactivates the circulator when the desired temperature is achieved.

SEQUENCE OF HEATING OPERATIONS -SOLAR BACKUP
1. The solar controller senses a large enough temperature difference between the tank and the solar collector to transfer heat into the tank.
   a. The solar controller activates a circulator/pump to flow fluid through the heat exchanger and solar collector, transferring heat into the storage tank until the temperature difference is significantly reduced.

SEQUENCE OF HEATING OPERATIONS -BOILER BACKUP

1. The boiler senses through the surface mounted thermostat that the indirect water heater needs heat.
   a. The circulator begins flowing water through the heat exchanger and the boiler turns on. The circulator continues to flow water through the exchanger until the temperature in the tank satisfies the surface mounted thermostat.

⚠ CAUTION

Before adjusting the thermostat, turn off all power supplied to the dual heat exchanger indirect water heater.

The minimum potable water temperature can be changed by adjusting the thermostat. Before any work is done on the water heater, disconnect all power to the water heater and heat source (solar collector) by opening the switch(s) at the main electrical circuit breaker or fuse box. Remove the cover and fold the insulation outward away from the control. Adjust the thermostat dial using a screwdriver until the minimum acceptable temperature is achieved. The thermostat has been factory preset to 120°F *(49°C)*. **Remember that lower temperature settings are more energy efficient.** Rotate the temperature dial **clockwise** ↻ to increase water temperature. Rotate the thermostat dial **counter-clockwise** ↺ to decrease the temperature setting. Replace the insulation making sure that the control is well covered and that the plastic terminal shield has not been displaced. Replace the access panel. The water heater is now ready for operation and the main switch can be closed.

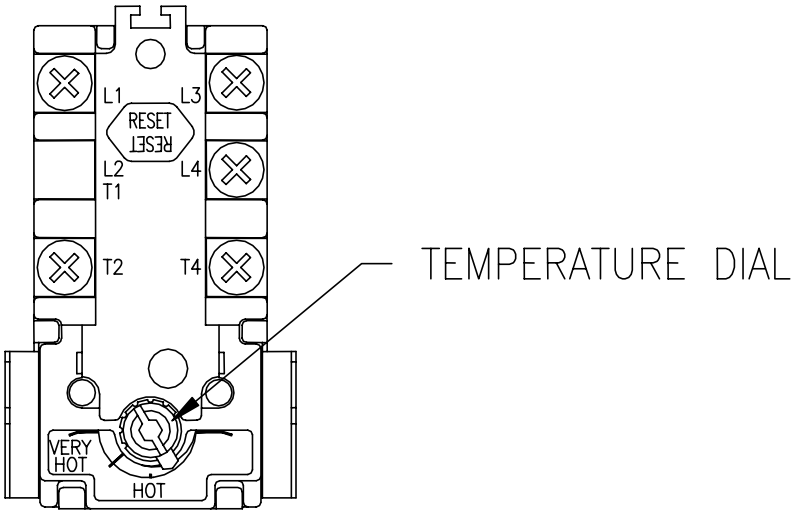


Figure 13 – Thermostat

After the water heater completes a heat-up cycle, check the water temperature at a faucet. Allow enough water to flow to ensure that the faucet water temperature reflects the discharge temperature. Adjust the water heater's or mixing device's temperature setting as necessary.

Adjusting to a lower tank temperature setting will not immediately affect water temperature. Draw sufficient water or allow the water heater to remain idle until a heat-up cycle is initiated. After the heater's heat-up cycle is complete, check the water temperature at a faucet to determine if further adjustment is necessary.

Adjusting to a higher tank temperature may not immediately affect water temperature. If a heat-up cycle begins, allow the heat-up cycle to complete before checking the water temperature. If a heat-up cycle does not begin, draw sufficient water or allow the water heater to remain idle until a heat-up cycle is initiated. After the heater's heat-up cycle is complete, check the water temperature at a faucet to determine if further adjustment is necessary.

SECTION VIII
MAINTENANCE

This indirect water heater is intended to provide a service life of many years. Components that require service, however, may be subject to failure. Failure to use the correct procedures or parts in these circumstances may make the water heater unsafe.
The owner should arrange to have the following inspections and simple maintenance procedure performed by qualified service personnel at the frequencies suggested.

1. ***System and Domestic Water Piping (Annual) -*** Check all piping for signs of leakage at joints, unions, and shut-off valves. Repair as needed.

2. ***Temperature-Pressure Relief Valve (Annual) -*** The temperature-pressure relief valve should be checked to ensure that it is in operating condition. To check the relief valve, lift the lever at the end of the valve several times. The valve should seat properly and operate freely. If water does not flow, remove and inspect for obstructions or corrosion. Replace with a new valve of the recommended capacity as necessary. Do not attempt to repair the valve, as this could result in improper operation and a tank explosion. In areas with poor water conditions, it may be necessary to inspect the temperature-pressure relief valve more often than once a year.

⚠ CAUTION

Before manually operating the valve, make sure that a drain line has been attached to the valve to direct the discharge to an open drain. Failure to take this precaution could mean contact with extremely hot water discharging from the valve during this checking operation.

If the temperature–pressure relief valve on the heater discharges periodically or continuously, it may be due to thermal expansion of water in a closed water supply system, or it may be due to a faulty relief valve.
Thermal expansion is the normal response of water when it is heated. In a closed system, thermal expansion will cause the system pressure to build until the relief valve actuation pressure is equaled. Then the relief valve will open, allowing some water to escape, slightly lowering the pressure. Contact your water supplier or local plumbing inspector on how to control this situation.

ABOVE ALL, DO NOT PLUG THE TEMPERATURE AND PRESSURE RELIEF VALVE. THIS IS NOT A SOLUTION AND CAN CREATE A HAZARDOUS SITUATION.

3. Anode Inspection and Replacement - This water heater is equipped with multiple sacrificial anodes. Anodes protect the glass-lined tank from corrosion by sacrificing themselves through electrolysis. When the anode material is consumed, there is no more protection and tank corrosion accelerates.
Inspection of the anodes every year allows you to identify spent anodes and replace. Replace the anodes when its diameter is 3/8 of an inch, or every other year, which ever is first. Aggressive, very hot and softened water causes rapid consumption of the anode, requiring frequent inspections. Anodes are available from your distributor or from the manufacturer.

<u>To inspect or replace an anode:</u>

The anodes on this water heater are easily accessible from the top of the heater making replacement simple and quick.

a. Turn the water heater and, if applicable, solar controller or circulator electricity off. Flow water until the discharge is cool or allow enough time for the potable water to cool naturally. Connect a hose to the drain valve. Locate the hose's discharge in an area where any remaining hot water will not cause any damage or injury.
b. Open the drain valve to flush any sediment out of the bottom to the heater.
c. Shut off the cold water supply. Make sure all hot water fixtures and circulating pumps are turned off.
d. Wait for water flow from the hose to stop. Remove the anode using a socket of the appropriate size. Do not use an impact wrench.
e. Inspect and replace the anode as required. Use pipe tape or sealant when reinstalling the anode.
f. Close the drain valve. Open a hot water fixture to allow air to escape. Open the cold water supply to the heater and allow the tank to fill.
g. Check your anode and drain valve for leaks.
h. Turn the water heater and, if applicable, solar controller or circulator electricity on.

4. ***Sediment (Annual, but harsh water quality may dictate more frequent service) -*** Depending on water conditions, a varying amount of sediment may collect in the tank. Levels requiring service are indicated by a small temperature difference in the supply and return lines (See also "Scale" below). Repeated flushing usually clears such material. As a preventive measure, water should be drawn from the tank at the drain valve until it runs clear.

5. ***Scale (Annual) -*** Hard water may cause scale to build-up on the outside of the heat exchanger coil. A water softener will prevent this problem (See also "Sediment" above). Symptoms would be reduced recovery capacity. Repeated flushing should resolve the problem.

6. ***Circulator -***The circulator manufacturer may have a recommended maintenance procedure. Refer to the installation and operation manual that was received with the circulator.

If in a Solar Heating System

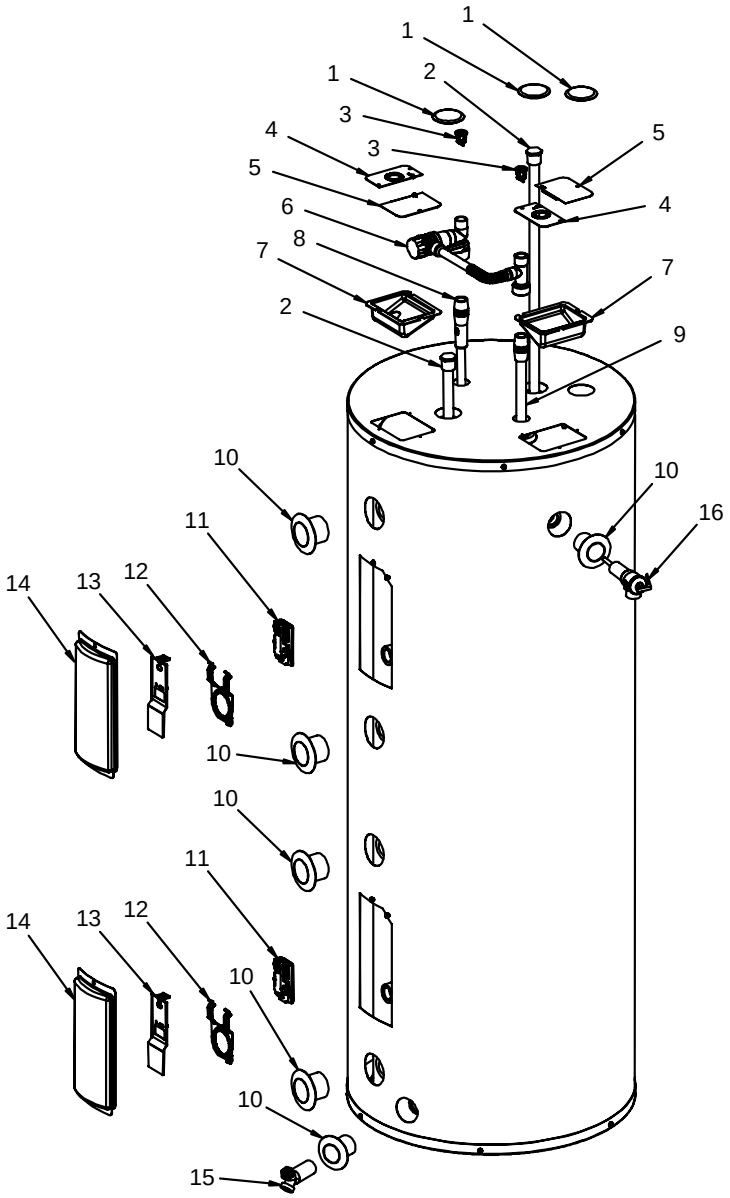
7. ***Solar Controller -***The solar controller manufacturer may have a recommended maintenance procedure. Refer to the installation and operation manual that was received with the solar controller.

8. ***Solar Collector Panels -*** The solar collector panel manufacturer may have a recommended maintenance procedure. Refer to the installation and operation manual that was received with the solar collector panels.

SECTION IX
TROUBLESHOOTING GUIDE

PROBLEM	CAUSE	SOLUTION
No hot water at faucet	ECO on thermostat tripped	Determine why ECO trip occurred in system. Correct or replace as necessary. Depress red "RESET" button on thermostat
	Improper thermostat setting or calibration	Adjust tank thermostat to appropriate setting See Section VII
	Circulator does not pump fluid through system	Check electrical connections
		Check that proper valves are open
		Check that system is bled
		Replace as necessary
	Electrical problem (Control, wiring, etc.)	Check fuse and replace
		Check circuit breaker and reset (if applicable)
		Check power supply
	Scale build-up	If controls, heat sources, circulator, and tank are operating satisfactorily, coil may have scale coating. See Section VIII: Maintenance
	Clogged cold water filter	Clean or replace filter or strainer
Water at faucet too hot	Thermostat set too high	Adjust thermostat setting. See Section VII
	Improper system plumbing	Compare plumbing to Section V
	Improper system wiring	Compare wiring to Section VI
	Mixing Device temperature set too high	Adjust Mixing Device setting. Refer to Mixing Device instructions.
Insufficient hot water	Thermostat setting too low	Adjust thermostat to higher setting. See Section VII
	Undersized heat source	Review calculations for proper heat source size and possible orientation
	Faulty system sensor or controller	Check connections, power and sensor resistance. Replace as necessary.
	Peak use of hot water is greater than tank storage capacity	Determine peak usage and compare to tank capacity
	Circulator does not pump fluid	Check electrical connections
		Check that proper valves are open
		Check that system is bled
		Replace as necessary
	Faulty tank thermostat	Replace thermostat

SECTION X
PARTS LIST



PART NAME & DESCRIPTION	
1. Hole Closure	9. Cold Water Inlet Diptube
2. Hex Head Anode	10. Escutcheon
3. Heat Trap	11. Thermostat with ECO (89T33)
4. Conduit Grounding Cover	12. Thermostat Mounting Bracket
5. Electrical Outlet Cover	13. Thermostat Protector (Large)
6. Approved Mixing Device	14. Access Cover
7. Junction Box	15. Brass Drain Valve
8. Hot Water Outlet/Anode	16. T&P Relief Valve

Contact your supplier or plumbing professional for replacement parts or contact the company at the address given on the rating plate of the water heater.

Provide the part name, model, and serial numbers of the water heater when ordering parts.

READ THE WARRANTY FOR A FULL EXPLANATION OF THE LENGTH OF TIME THAT PARTS AND THE WATER HEATER ARE WARRANTED.

Manufactured under one or more of the following U.S. Patents: RE.34,534;B1 5,341,770; 4,416,222; 4,628,184; 4,669,448; 4,672,919; 4,808,356; 4,829,983; 4,861,968; 4,904,428; 5,000,893; 5,023,031; 5,052,346; 5,081,696; 5,092,519; 5,115,767; 5,199,385; 5,277,171; 5,372,185; 5,485,879; 5,574,822; 5,596,952; 5,660,165; 5,682,666; 5,761,379; 5,943,984; 5,954,492; 5,988,117; 6,142,216; 6,395,280; 6,684,821; 7,007,748; 7,063,132

Other U.S. and Foreign patent applications pending. Current Canadian Patents: 1,272,914; 1,280,043; 1,289,832; 2,045,862; 2,092,105; 2,107,012; 2,108,186; 2,112,515

Complete the following information and retain for future reference:

Model No: _____

Serial No: _____

Service Phone
Days:_____ Nights:_____

Address: _____

Supplier: _____

Supplier Phone No:_____

NOTES

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