Use & Care Manual
With Installation Instructions for the Installer

Open Loop-Pumped Solar Water Heating Systems

This Solar Water Heating system is for the models listed below:

RSO80-40BP
RSO120-64BP

The purpose of this manual is twofold: one, to provide the installer with the basic directions and recommendations for the proper installation and adjustment of the water heating system; and two, for the owner–operator, to explain the features, operation, safety precautions, maintenance and troubleshooting of the water heater. This manual also includes a parts list.

It is very important that all persons who are expected to install, operate or adjust this water heating system read the instructions carefully so they may understand how to perform these operations. If you do not understand these instructions or any terms within it, seek professional advice.

Any questions regarding the operation, maintenance, service or warranty of this water heating system should be directed to the seller from whom it was purchased. If additional information is required, refer to the section on "If you need service."

Do not destroy this manual. Please read carefully and keep in a safe place for future reference.

Recognize this symbol as an indication of Important Safety Information!

California Proposition 65 Warning: This product contains chemicals known to the State of California to cause cancer, birth defects or other reproductive harm.

AP15640 (01/10)

Safety Information

FOR YOUR RECORDS

Write the model and serial numbers here:

Model Number of Solar System Tank:_______________________

Serial Number of Solar System Tank:_______________________

Model Number of Collector Panel #1: _______________________

Serial Number of Collector Panel #1: _______________________

Model Number of Collector Panel #2: _______________________

Serial Number of Collector Panel #2: _______________________

Model Number of Solar Control System:_____________________

Serial Number of Solar Control System: _____________________

You can find them on a label on the appliance.
Staple sales slip or cancelled check here.
Proof of the original purchase date is needed to obtain service under the warranty.

READ THIS MANUAL

Inside you will find many helpful hints on how to use and maintain your water heater properly. Just a little preventive care on your part can save you a great deal of time and money over the life of your water heater.

You'll find many answers to common problems in the Before You Call For Service section. If you review our chart of Troubleshooting Tips first, you may not need to call for service at all.

READ THE SAFETY INFORMATION

Your safety and the safety of others are very important. There are many important safety messages in this manual and on your appliance. Always read and obey all safety messages.

This is the safety alert symbol. Recognize this symbol as an indication of Important Safety Information! This symbol alerts you to potential hazards that can kill or hurt you and others.

All safety messages will follow the safety alert symbol and either the word "DANGER", "WARNING", "CAUTION" or "NOTICE".

These words mean:

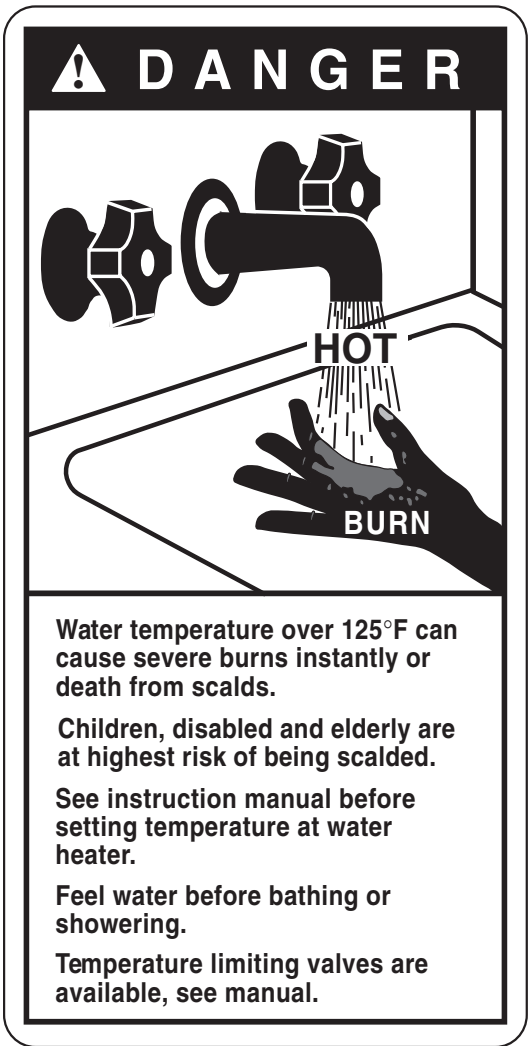
DANGER	**An imminently hazardous situation that will result in death or serious injury.**
WARNING	**A potentially hazardous situation that could result in death or serious injury and/or damage to property.**
CAUTION	**A potentially hazardous situation that may result in minor or moderate injury.**
Notice:	**Attention is called to observe a specified procedure or maintain a specific condition.**

IMPORTANT SAFETY INFORMATION. READ ALL INSTRUCTIONS BEFORE USING.

⚠DANGER!

WATER TEMPERATURE SETTING

Safety and energy conservation are factors to be considered when selecting the water temperature setting of water heater's thermostat. Water temperatures above 125°F can cause severe burns or death from scalding. Be sure to read and follow the warnings outlined on the label pictured below.



⚠DANGER: Burns from Hot Water and Steam - Use extreme care when opening relief valves, charging closed loop, and filling storage tank.

The electrical element booster thermostat has been factory set at 50°C (120°F) to reduce the risk of scald injury. Adjusting the thermostat to a higher setting is not recommended. Hotter water increases the potential for Hot Water Scalds.

Time/Temperature Relationship in Scalds

Temperature	Time To Produce a Serious Burn
120°F (49°C)	More than 5 minutes
125°F (51°C)	1½ to 2 minutes
130°F (54°C)	About 30 seconds
135°F (57°C)	About 10 seconds
140°F (60°C)	Less than 5 seconds
145°F (63°C)	Less than 3 seconds
150°F (66°C)	About 1½ seconds
155°F (68°C)	About 1 second

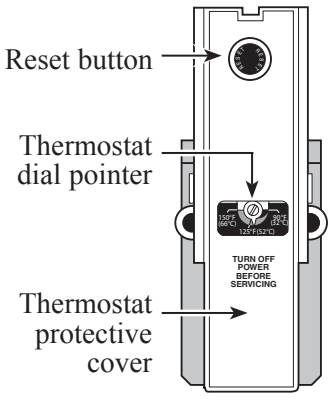
Table courtesy of Shriners Burn Institute

The chart shown above may be used as a guide in determining the proper water temperature for your home.

⚠DANGER: Households with small children, disabled, or elderly persons may require a 120°F or lower thermostat setting to prevent contact with "HOT" water.

NOTICE: Mixing valves should be installed to reduce the point of use water temperature by mixing hot and cold water in branch water lines. Contact a licensed installer or the local plumbing authority for further information.

The temperature of the water in the water heater can be regulated by setting the temperature dial of the adjustable surface mounted thermostat located behind the jacket access panel.



This thermostat controls the water heater's heating element only. (A separate thermostat should be utilized in monitoring the temperature from the collector).

To comply with safety regulations the thermostat is factory set at 120° F (49°C) or less where local codes require.

⚠DANGER: Hotter water increases the potential for Hot Water SCALDS.

IMPORTANT SAFETY INFORMATION. READ ALL INSTRUCTIONS BEFORE USING.

⚠WARNING!

For your safety, the information in this manual must be followed to minimize the risk of fire or explosion, electric shock, or to prevent property damage, personal injury, or loss of life.

Be sure to read and understand the entire Use and Care Manual before attempting to install or operate this water heater. It may save you time and cost. Pay particular attention to the Safety Instructions. Failure to follow these warnings could result in serious bodily injury or death. Should you have problems understanding the instructions in this manual, or have any questions, STOP, and get help from a qualified service technician, or the local utility.

FOR INSTALLATIONS IN THE STATE OF CALIFORNIA

California Law requires that residential water heaters must be braced, anchored or strapped to resist falling or horizontal displacement due to earthquake motions. For residential water heaters up to 52 gallon capacity, a brochure with generic earthquake bracing instructions can be obtained from: Office of the State Architect, 1102 Q Street, Suite 5100, Sacramento, CA 95814 or you may call 916-445-8100 or ask a water heater dealer.

However, applicable local codes shall govern installation. For residential water heaters of a capacity greater than 52 gallons, consult the local building jurisdiction for acceptable bracing procedures.

SAFETY PRECAUTIONS

Have the installer show you the location of the circuit breaker and how to shut it off if necessary. Turn off the circuit breaker if the water heater has been subjected to overheating, fire, flood, physical damage or if the ECO fails to shut off.

- Read this manual entirely before installing or operating the water heater.
- Use this appliance only for its intended purpose as described in this Use and Care Manual.
- Be sure your appliance is properly installed in accordance with local codes and the provided installation instructions.
- **Do not** attempt to repair or replace any part of your water heater unless it is specifically recommended in this manual. All other servicing should be referred to a qualified technician.

READ AND FOLLOW THIS SAFETY INFORMATION CAREFULLY.

SAVE THESE INSTRUCTIONS

Preface

Thank you for purchasing a solar water heating system. It is one of the most effective and trouble-free systems available today. In addition to reducing your water-heating bills, it will help preserve precious natural resources by using free energy from the sun.

As with an electric or gas water heater, your new solar water heating system operates automatically to ensure you will always have an ample supply of hot water. However, there are simple steps you can take to increase both its efficiency and service life.

This manual provides the manufacturers recommended procedures for solar water-heating systems. The procedures are essential for correct installation, troubleshooting and maintenance.

Read each section of this manual thoroughly before beginning work on the system.

⚠CAUTION: Changes to the design or intended use of the Solar Water Heating System will void the manufacturers warranty. Installation, troubleshooting, and maintenance must be performed by a qualified technician.

This manual will help you get the most out of your solar water heating system. Please read it carefully when the installation is complete, and review it from time to time to refresh your memory about the service requirements and safety measures.

The Operation section of the manual contains important information regarding the system procedures as well as safety measures pertaining to the system. It is important that you follow these guidelines to ensure safe, efficient and trouble-free operation.

While the system requires very little maintenance, there will be a periodic need for some upkeep. The Maintenance section outlines those requirements for service, which you may do yourself, as well as those procedures best performed by a qualified service technician.

The Troubleshooting section contains steps you can take if the system is not performing, as it should.

The solar energy system described by this manual, when properly installed and maintained, meets the minimum standards established by the Solar Rating and Certification Corporation (SRCC). This certification does not imply endorsement or warranty of this product by the SRCC.

The solar energy system described by this manual, when properly installed and maintained, meets the minimum standards established by the Florida Solar Energy Center, in accordance with Section 377.705, Florida Statutes. This certification does not imply endorsement or warranty of this product by the Florida Solar Energy Center or the state of Florida.

The components of the system include a water storage tank, solar collector panels, pump valves and fittings.

Your hot water is stored in a steel tank lined with porcelain enamel and thickly insulated to help maintain the water temperature throughout the day and night.

To ensure your hot water supply is never depleted, the system is equipped with a backup heater or heating element. When there may be insufficient solar energy, you are still assured of all the hot water you will need.

While your system is one of the most efficient available, there are two simple steps you can take to increase your water-heating cost savings.

Keep the use of the Backup Heater to a Minimum

You can save the most money on your water-heating bills by using the backup heater on your system as little as possible. If the sun shines brightly between 10 am and 3 pm, enough heat will normally be generated to keep the water hot throughout the rest of the day and night.

However, on days when the sky is cloudy or when large quantities of hot water are being used, we suggest that the backup heater be left “ON” overnight to ensure adequate hot water the next morning.

Try to use Hot Water during Daylight Hours

When possible, schedule heavy hot water use, such as dish washing, laundry and showers, in the middle of the day. If hot water usage occurs while the sun is up, the fresh (cold) water added to the storage tank is heated more quickly.

When water is used late in the day or at night, the fresh water entering the tank will be heated by the element so hot water is available in the morning.

Preface

Let us first offer two words of grateful appreciation.Thank You! We sincerely appreciate your business. The manufacturer also wishes to say thank you for "going solar". Solar water heating systems help to reduce our nation’s dependence on polluting fossil fuels, minimize the greenhouse gas emissions associated with conventional water heating and, very importantly, lower your monthly utility costs.

Your solar water heating system has been designed to meet exacting SRCC OG-300 certification requirements. The components found in your system have been selected for their proven reliability, longevity and performance in your specific region of the country.

Section 1: Introduction

Solar water heating systems are climate and site specific appliances. Different types of solar systems are installed around the world in accordance with regional weather and water quality conditions. System performance varies as a function of the household hot water load, including daily showers, laundry and kitchen uses, average ground water and ambient air temperatures, the home’s roof pitch and orientation, and, of course, the seasonal intensity of solar radiation. These variables, some of which change from home to home on the same neighborhood street, will determine how much energy and money your system will save on an annual basis.

Your solar system is known as a "forced circulation" system because it utilizes a mechanical pump to efficiently circulate the fluid through the collector.

This manual is intended as a basic solar water heating primer. Our goal is to familiarize you with the proper installation, operation, and maintenance of your solar system. This system is required to be installed by properly licensed solar or plumbing contractors in accordance with SRCC Standard OG-300 and all applicable national, state and local codes, ordinances and regulations governing solar water heating installations, as well as good trade practices. Failure to follow the procedures and practices described in this manual can void the manufacturer's warranty for specific component parts.

This manual covers installations utilizing a solar collector with a single storage tank and also, two tank systems that include a solar storage tank and a conventional water heater. For simplicity, the singular form will be used throughout this manual when referring to all of these components and system permutations. Frequent reference is made throughout this manual to specific component parts. The placement of each component can be seen in system schematic Figures 16a, 16b, 17a, and 17b. A description of each component and its function is found in Section 10.

Section 2: System Description And Operational Principle

2) The key components in the solar water heating system include:
    1. Solar collector.
    2. Solar storage tank.
    3. Digital controller.
    4. Expansion tank.
    5. Pressure gauge.
    6. Mixing valve.

The solar collector is the heart of the system. Simply stated, when the sun is shinning, heat energy is absorbed by the solar collector's all copper absorber plate and transferred to the water circulating through the solar collector. The system pump efficiently circulates this heated fluid through the collector piping and into the tank. As this process is continuously repeated during the average sunny day the temperature in your solar storage tank rises.

When the solar collector absorber plate is approximately sixteen degrees hotter than the temperature in the bottom of your solar storage tank, the controller will turn the circulating pump on. When the temperature difference has been reduced to eight degrees, the controller automatically turns the pump off.

Both single and double tank systems are designed to provide three separate modes of system operation. The system will:

(1) Accommodate 100% solar operation.
(2) Serve as a pre-heater to your solar storage tank or back-up water heater.
(3) Bypass the solar collector and run 100% on utility power.

Section 6 provides instructions for setting the system for automatic operation in each of these three modes.

In order to completely protect the integrity of the solar collector and piping, the system is designed to be drained manually if subject to extended periods of disuse or freeze conditions. (See Section 7).

Section 3: Installation Requirements-General

3. **Permits**

The contractor shall obtain all required permits and approvals.

3.1 **Regulations, Codes, Ordinances and Standards**

The installation shall conform to all federal, state and local regulations, codes, ordinances and standards governing solar water heating system installations, and the contractor shall adhere to sound building safety and trade practices. Special consideration must be given to building code requirements for the penetration of structural members and fire rated assemblies.

3.2 **Location**

The solar collector must be located in a structurally sound area of the roof that will be un-shaded for the majority of the day all year round. Adjacent buildings and trees should be checked for possible winter shading. An instrument such as the Pathfinder can be used for solar site analysis.

3.3 **Roof Inspection**

Before the installation the contractor shall inspect the condition of the roof and notify the homeowner of any existing roof damage or necessary repairs.

3.4 **Confirmation**

The homeowner and contractor shall confirm the location of all roof and ground mounted components in advance of the installation.

Section 4: Installation Requirements-Specific

4. **Collector Orientation**

The performance of solar water heating systems in the Northern Hemisphere is optimized when the collector is mounted facing True South. (See Figures 1 & 2) Performance, however, suffers very little when the collector is oriented no more than 45° East or West of True South. The collector should be unshaded by any permanent obstacle between 9:00 a.m. and 3:00 p.m. on any day of the year.

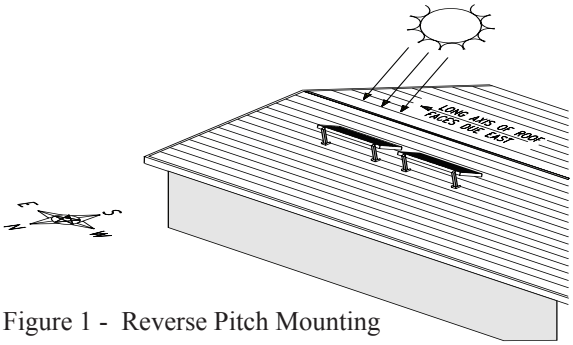


Figure 1 - Reverse Pitch Mounting

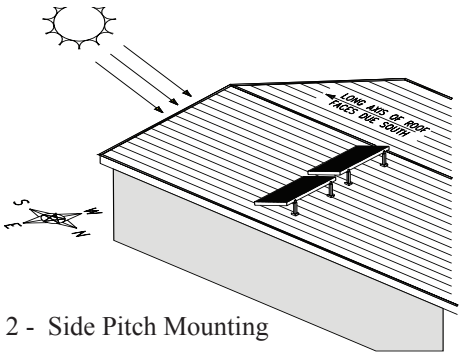


Figure 2 - Side Pitch Mounting

The solar collectors in a two collector staggered mount installation must be spaced far enough apart to prevent winter shading. Figure 3 and Table 1 show the correct spacing between collectors to prevent shading on December 21, when the sun is at its lowest angle.

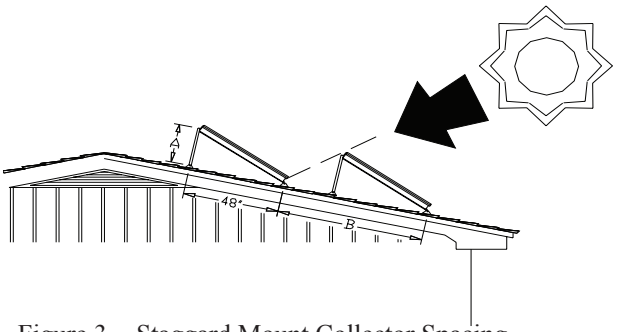


Figure 3 - Staggard Mount Collector Spacing

4.1 **Collector Tilt**

Optimal annual efficiency is achieved by tilting the solar collector at an angle that equals your latitude plus an additional 10°. This tilt angle favors the lower winter sun when collector performance is at it's lowest and minimizes overheating during the hottest summer months.

TABLE 1

LATITUDE			25°N		30°N		35°N		40°N		45°N		50°N	
COLL. TILT			35°		40°		45°		50°		55°		60°	
			A	B	A	B	A	B	A	B	A	B	A	B
	FLAT		29	96	33	113	37	145	41	145	44	145	48	145
	5°	1/12	25	83	29	93	33	113	37	132	41	133	44	141
	9°	2/12	22	74	26	82	30	77	34	110	38	115	41	118
	14°	3/12	17	66	22	72	26	82	30	92	34	95	38	98
	18°	4/12	14	61	18	66	22	74	26	82	30	85	34	87
ROOF	23°	5/12	10	58	14	60	18	66	22	72	26	74	30	77
PITCH	27°	6/12	7	58	11	58	15	61	19	66	23	68	27	70
	30°	7/12	4	58	8	58	13	58	17	62	21	65	25	66
	34°	8/12	0	58	5	58	9	58	13	58	17	60	22	62
	37°	9/12	0	58	3	58	7	58	11	58	15	58	19	58
	40°	10/12	0	58	0	58	4	58	8	58	13	58	17	58
	43°	11/12	0	58	0	58	2	58	6	58	10	58	14	58
	45°	12/12	0	58	0	58	0	58	4	58	8	58	13	58
DIMENSIONS A AND B ARE DESIGNATED IN INCHES														

4.2 **Basic Mounting Procedures**

The solar collector in your solar system can be mounted in either a vertical or horizontal orientation on the roof (See Figure 4). It is still important to slope the collectors just slightly to allow for complete drainage if necessary. The recommended slope is 1/4" per foot of horizontal run.

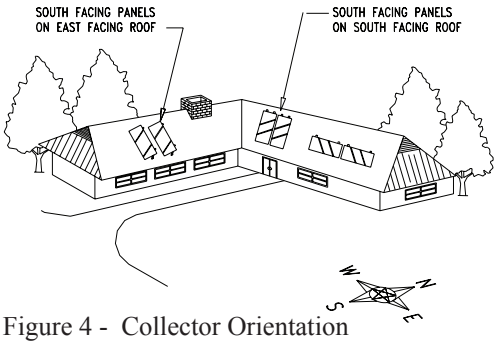


Figure 4 - Collector Orientation

To ensure proper water drainage the collectors must maintain a minimum angle from horizontal of at least 10°. Never mount the collector directly or parallel to a flat roof surface. Use "Solar Strut" tilt mount kits to rack the collectors to the proper angle.

The collector should be mounted as close to the storage tank as possible to minimize heat loss in the piping runs. If the home has attic access, mounting the collectors near the roof peak provides for additional attic workspace.

The solar collector should be mounted on the roof in accordance with these general principles.

4.3 The most important structural consideration is to securely anchor the solar collector and the mounting hardware to the structural members of the roof with stainless steel hanger or lag bolts. The solar collector must be attached to the mounting hardware as detailed in **Figures 5–10** located at the end of this section. (Note: The drawings in this manual detail mounting hardware for the series collector.)

4.3.1 The collector must be raised from the roof surface to allow for rainwater and debris to pass under the collectors and for proper ventilation of the roofing material. There should be at least 3" of clearance between the roof surface and the bottom of the solar collectors.

4.3.2 In selecting mounting hardware and fastener it is extremely important to avoid galvanic corrosion resulting from the direct contact of incompatible metals. Use of anodized aluminum mounting hardware and stainless steel lag or hanger bolts, lock washers and round washers is recommended.

4.3.3 Preserving the integrity of the roof membrane is the most important roofing consideration. Ensure that all roof penetrations required to plumb and mount the solar collector are properly flashed and sealed in accordance with standard roofing practices.

4.3.4 If the region is subject to hurricane conditions, additional steps may be required to secure the collector and mounting hardware to the structural members. In certain areas of the country, local building codes may require collector wind load testing or prescribe specific mounting procedures. Consult your local building department.

Figures 5-10

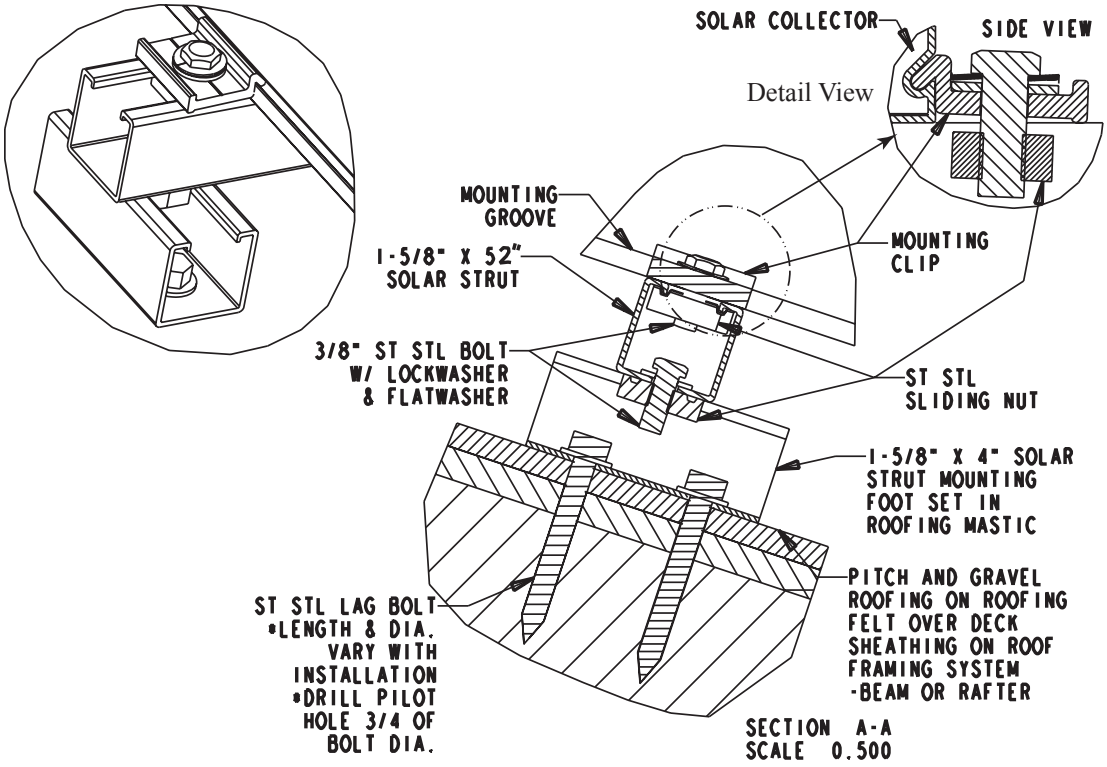


Figure 5- Composition Shingle Mounting

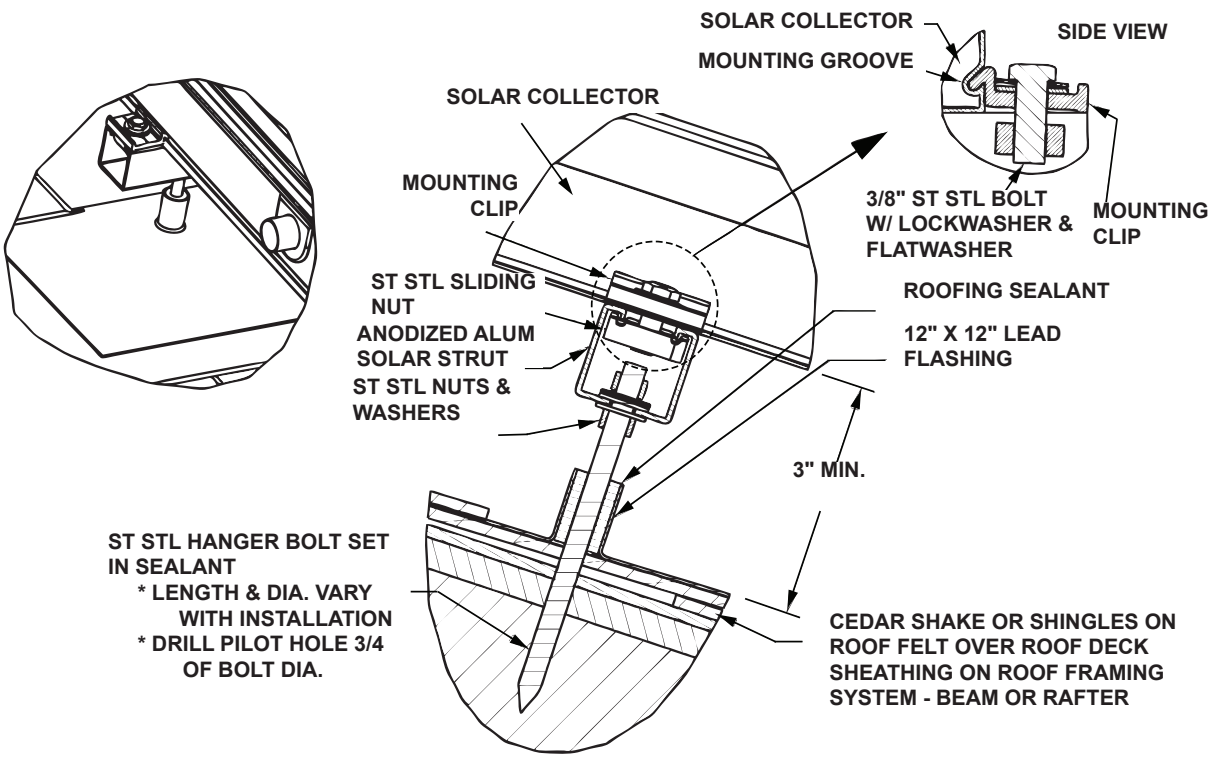


Figure 6- Shingle Roof Mounting

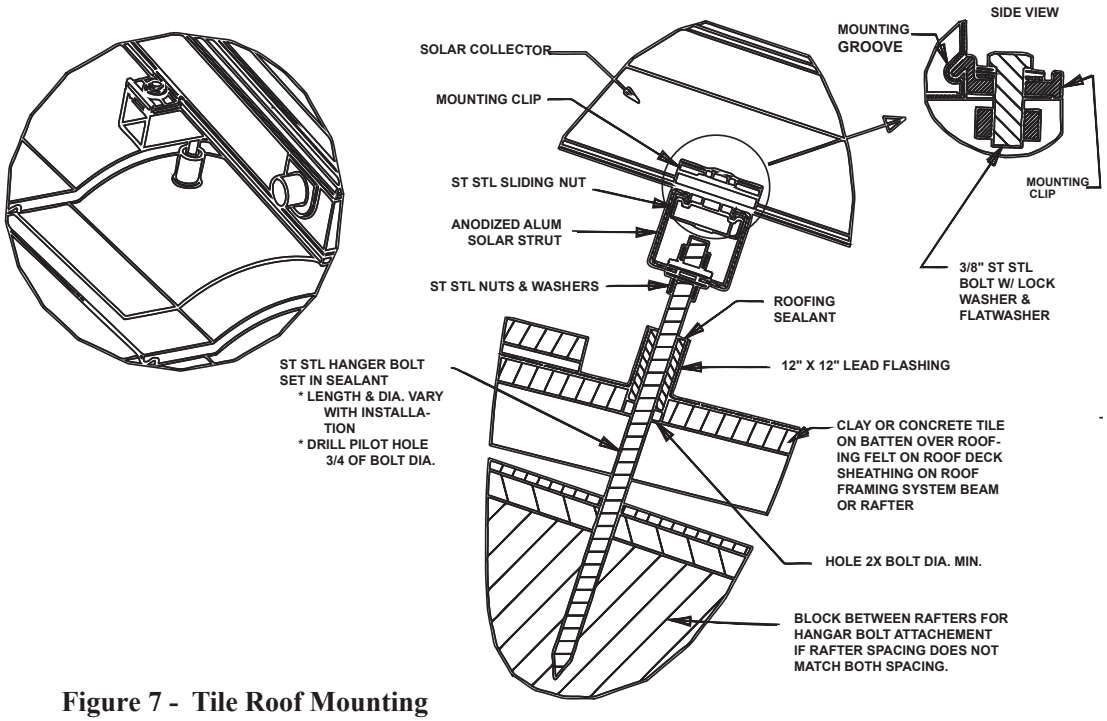


Figure 7 - Tile Roof Mounting

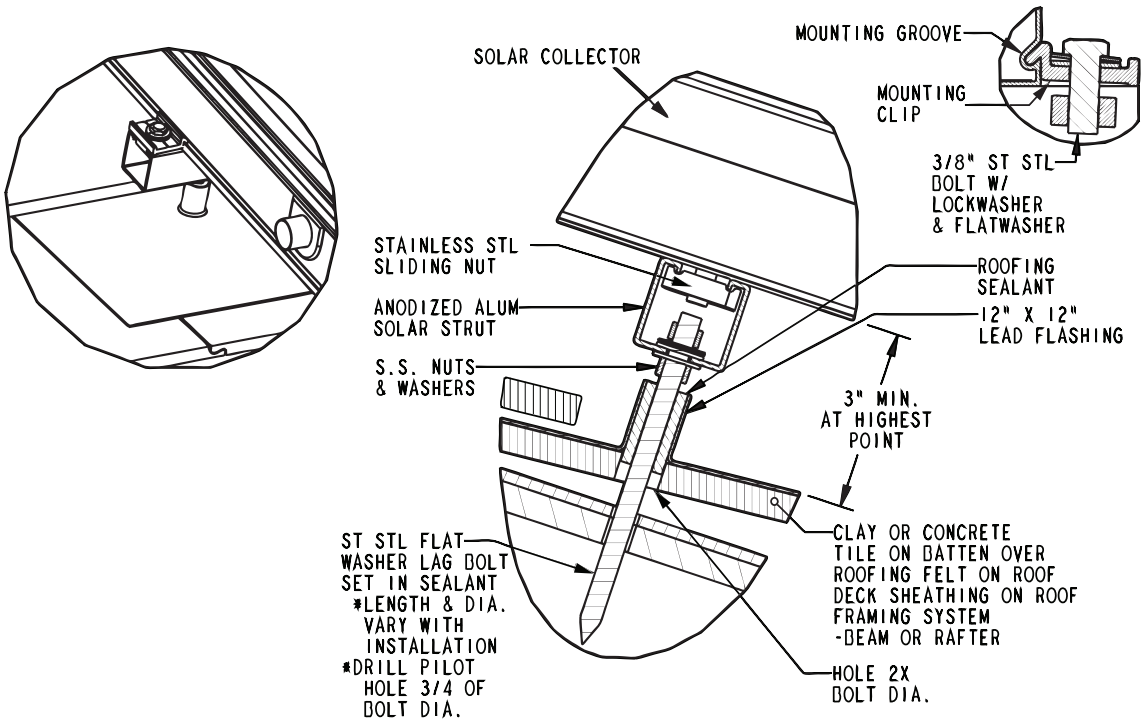


Figure 8 - Tile Roof Mounting

Figures 5-10

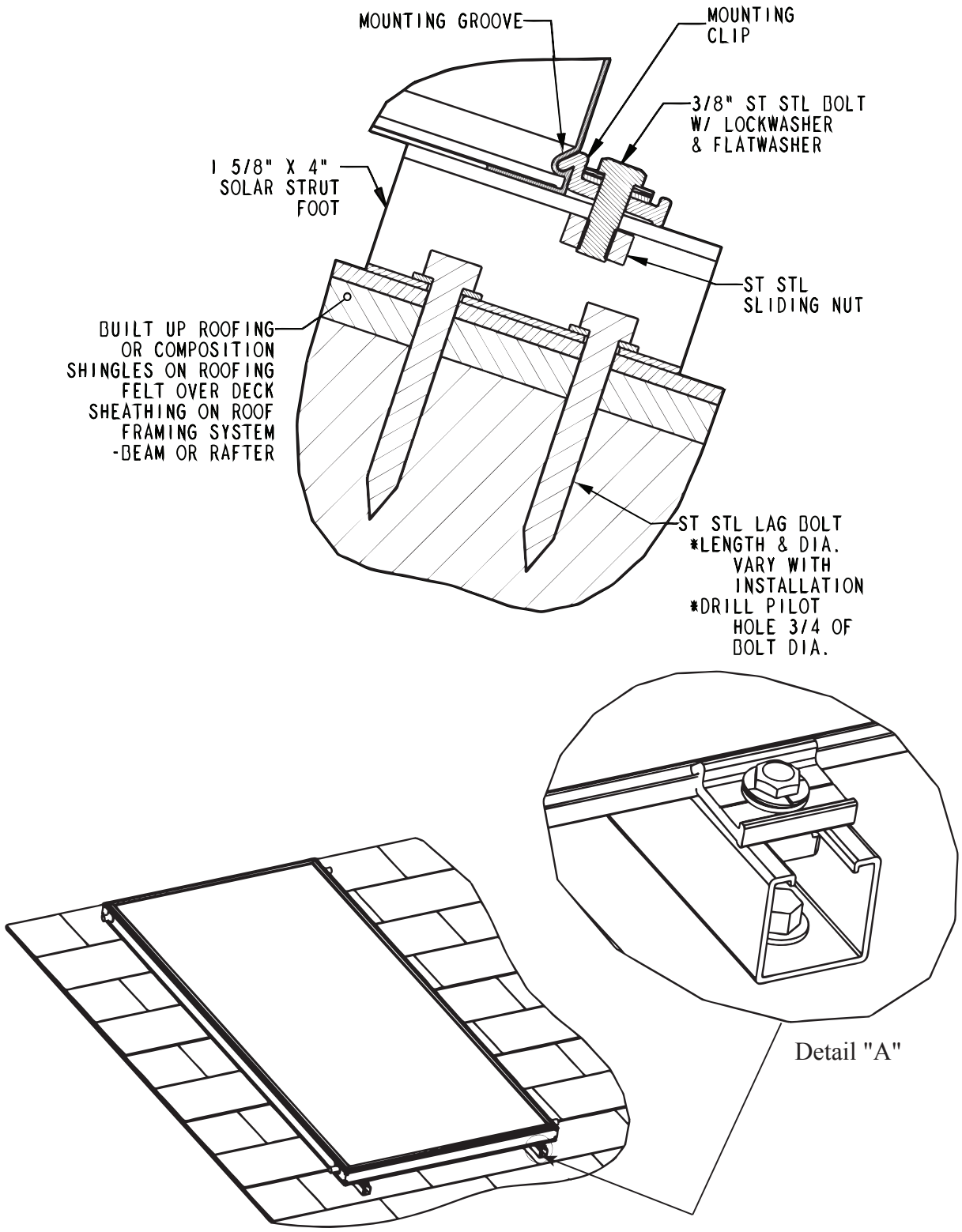


Figure 9 - Flush Mounting

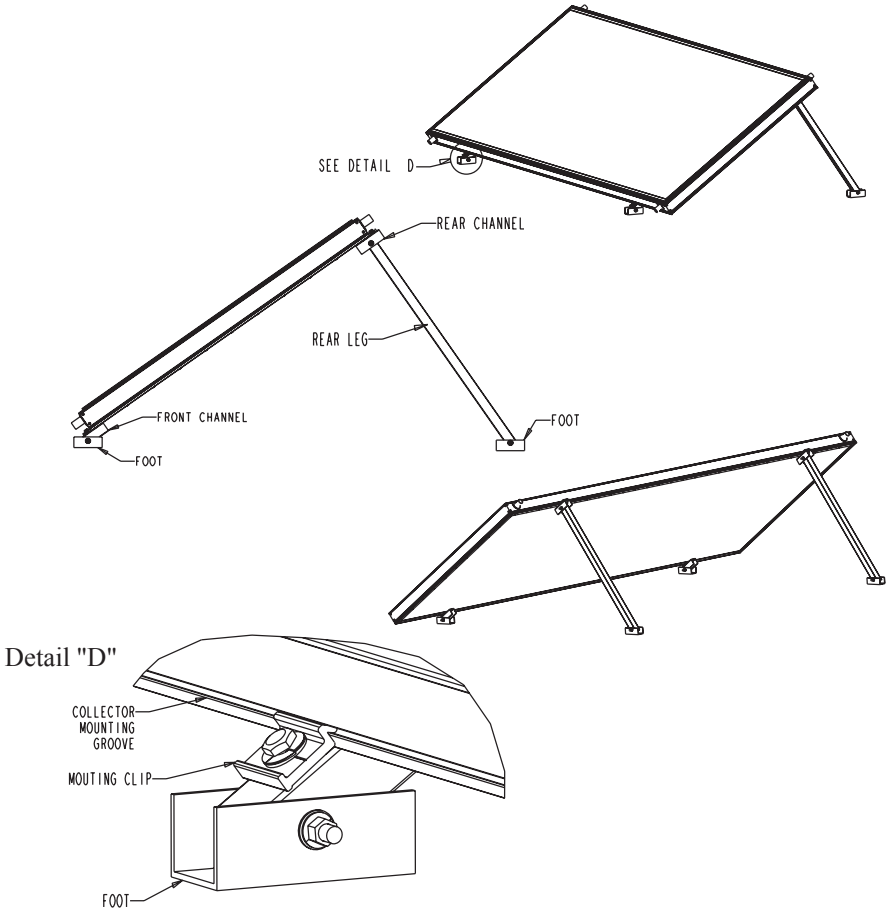


Figure 10 - Universal Tilt Mount

Section 4: Installation Requirements-Specific

4.4 **Collector Loop Pipe Insulation**

The collector loop cold supply and hot return lines must be well insulated with a high quality flexible closed cell insulation to minimize heat loss. The wall thickness of the pipe insulation should not be less than 3/4". A 1" wall thickness is required in all areas prone to annual hard freeze conditions. When it comes to pipe insulation the rule is simple: thicker is better. Use 3/4" Armaflex (or similar) flexible elastomeric closed cell thermal insulation.

To the extent possible, slide the insulation material over the pipe without cutting or taping. All butt joints must be sealed with contact adhesive.

NOTICE: **The use of rigid polyethylene pipe insulation is prohibited.**

The temperatures generated by your collector in the summer months or under stagnation conditions can melt this type of material.

Any above ground exterior pipe insulation is subject to UV degradation and must be wrapped with foil tape or painted with two coats of high quality water-based acrylic resin coating as supplied by the insulation manufacturer. Use 3/4" Armaflex (or similar) flexible elastomeric closed cell thermal insulation.

4.5 **Collector Plumbing**

The manufacturer requires the use of all copper and brass fittings in the collector loop plumbing. Couplings rather than unions should be used to join the collectors to avoid leaks and fluid loss. Use only lead-free solder.

NOTICE: Use of 50/50 lead solder is expressly prohibited.

NOTICE: Use of galvanized steel, CPVC, PVC, or any other type of plastic pipe is prohibited.

All vertical piping between the storage tank and the collector shall be supported at each story or at maximum intervals of ten feet (10'). (See Figure 13, Collector Plumbing - Vertical Mount) Copper plumbers tape or tube strap is required. The pipe insulation may not be compressed or crimped by the strapping material.

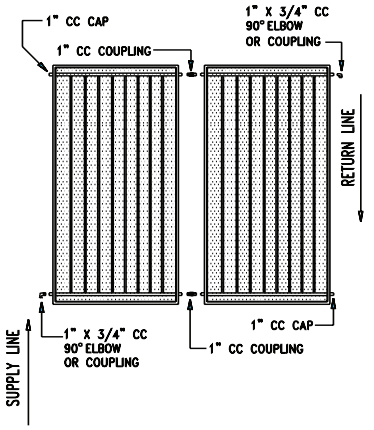


Figure 13 - Collector Plumbing - Vertical Mount

The installation of all horizontal and vertical piping may not reduce the performance or rating of any structural member or fire rated assembly. (See Figure 14, Collector Plumbing-Horizontal Mount) Adhere to all applicable local codes and ordinances.

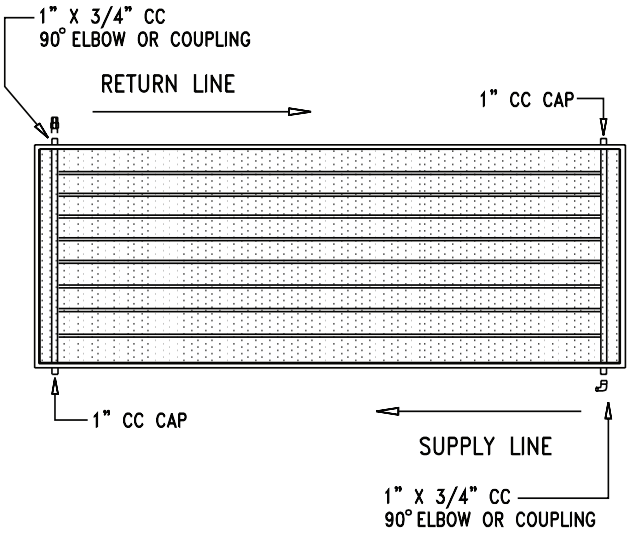


Figure 14 - Collector Plumbing - Horizontal Mount

4.6 **Collector Sensor Placement**

The collector sensor must be located on the hot water return line as close to the collector as possible. Sensors are typically accurate to +/- 1/2°F if properly installed and weatherized. To maximize sensor accuracy, attach the flanged portion of the sensor to the collector header pipe with a stainless steel hose clamp. Wire nuts used to connect the sensor and low voltage wiring shall be all plastic, sealed with silicone and thoroughly wrapped in electrician's tape.

The sensor "bundle" must be placed under the rubber pipe insulation covering the collector header. Thoroughly wrap and weatherize the insulation with electrician's tape or insulation tape as provided by the manufacturer (Rubatex Insul-Tape or equal). See *Figure 15, Collector Sensor,* for collector sensor installation detail.

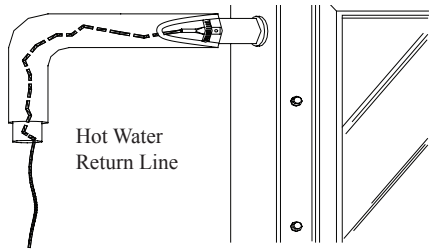


Figure 15 **COLLECTOR SENSOR**

4.7 **Low Voltage Wiring**

The low voltage wiring used to connect the sensors to the controller should be a minimum 18 AWG. The wiring should be bare or tinned copper, two conductor, PVC insulated, with a PVC UV rated gray jacket suitable for exterior use. Use Eastman Wire & Cable No. 5704, Belden Wire and Cable No. 8461 or equal.

4.8 **Installing the Solar Storage Tank and Expansion Tank**

Refer to the installation manuals for the storage tank and expansion tank.

Refer to Figure 16a & b, Single Tank System Schematics and Figure 17a & b, Double Tank System Schematics on pages 25 - 28, for all items listed as (No.##) throughout out this manual.

In plumbing the solar storage tank make sure that all the components are accessible and easy to reach. Provide for clear access to the storage tank, pump, mixing valve, and other key components. If a component in the potable water side of the system may require future service or maintenance make the connections with brass unions. Use only brass nipples and unions and copper and brass fittings in plumbing the solar storage tank.

NOTICE: The use of galvanized fittings or nipples, dielectric unions, CPVC, PVC or other plastic pipe is prohibited.

Hard copper connections to the city cold water supply line and the home hot water feed lines are recommended. The gaskets in standard water heater flex hose connectors can become brittle and compressed over time and begin leaking on the water heater. If not detected in a timely manner even a small drip or leak may cause serious damage to the tank's electrical components or, in extreme cases, may cause the tank to leak from the outside in.

Tank plumbing is required to provide for the isolation of the solar storage tank from the city cold water supply line by means of an isolating ball valve (No. 20).

The circulation pump shall be the Grundfos model UPS 1558 FCLC, 115 volt or equivalent. The pump shall be pre wired with a 6' line cord so that it can be plugged directly into the 115 volt receptacle on the side of the differential control. Two way ball valves must be installed on either side of the circulating pump (Nos. 9 and 10) so that the pump can be isolated from the collector loop.

A high quality thermostatic mixing valve is a required component in all OG-300 certified systems and should be plumbed in line with brass union connections for ease of future repair or replacement (No. 12). The specified mixing valve shall be the Heatguard model HGBASE or equal and shall have an operating range between 95°F and 140°F. The mixing valve shall be set to 120°F.

Section 4: Installation Requirements-Specific

The temperatures generated by your system will vary throughout the year. In the Northern Hemisphere the water temperature will be hottest in the spring and summer months while cooler temperatures are to be expect from November through March. On sunny days system temperatures may range between 110º F to 180º F depending upon the season and hot water demand. The mixing valve described above blends the hot and cold water supplies to deliver hot water to your fixtures at a safe, controlled temperature.

⚠WARNING: SCALDING CAN OCCUR WITHIN FIVE SECONDS WHEN WATER TEMPERATURES APPROACH 140º F. THE MIXING VALVE SHOULD BE ADJUSTED BY YOUR CONTRACTOR TO PROVIDE WATER TO YOUR FIXTURES AT NO MORE THAN 120º F.

The 3/4" cold water supply line to the solar storage tank must be insulated with minimum 7/8" X 1/2" pipe insulation to a minimum distance of 5' behind the storage tank, or to the wall if closer than 5'.

4.9 **Tank Sensor Placement**

Figure 18 details the proper placement of the solar storage tank sensor. Make sure the sensor is secured to the threaded stud on the storage tank with a 10-24 stainless steel nut. Thoroughly weatherize the wire connections in accordance with the roof sensor detail above. Replace the fiberglass insulation batting and close the access cover.

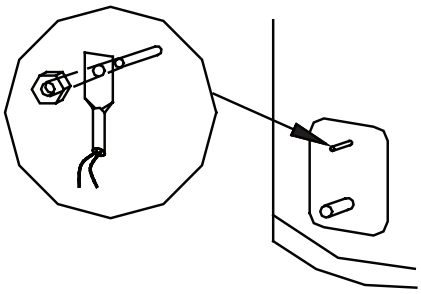


Figure 18 TANK SENSOR

A properly licensed contractor must make the 230 volt electrical connection to the water heater or solar storage tank and the electronic time switch (Optional No. 24). If your solar contractor is not allowed by law to make these connections consult a licensed electrician.

Never activate the circuit breaker controlling the electrical heating element until the solar storage tank is completely filled with water. This will prevent “dry firing” of the heating element. The electrical heating element will be destroyed almost instantaneously if not completely submerged in water when activated. Make sure the water heater circuit breaker is off until the solar storage tank is completely filled.

We recommend the use of a 115 volt differential control with a factory installed six foot line cord. The installation requires one 115 volt outlet to be installed near the solar storage tank. Plug the control into the outlet. The circulation pump line cord is plugged into the receptacle on the side of the controller. A 230 volt control and circulation pump may be substituted, but troubleshooting the components in the future becomes more difficult.

4.10 **Charging the System**

Once the components are plumbed you are ready to fill the solar storage tank with water and to charge the collector loop.

Proceed as follows:

4.10.1 Begin by filling the solar tank with water. Do this by opening the cold water isolation ball valve to the solar tank (No. 20). When the tank is filled, inspect all threaded fittings and solder joints for leaks.

4.10.2 After you have determined the integrity of the entire piping system turn on the circulating pump. Do this by setting the manual switch within the controller to the “on” position. Run the pump for a full five minutes and carefully check to ensure there is proper fluid flow and that all the air has been purged from the solar collector loop. A flow meter allows you to monitor and adjust the flow rate through the piping and also to visually inspect fluid quality, track the energy collected by the collector.

Set the controller to the "off" position and proceed to the next step.

Adjust the valve settings in accordance with Section 5.

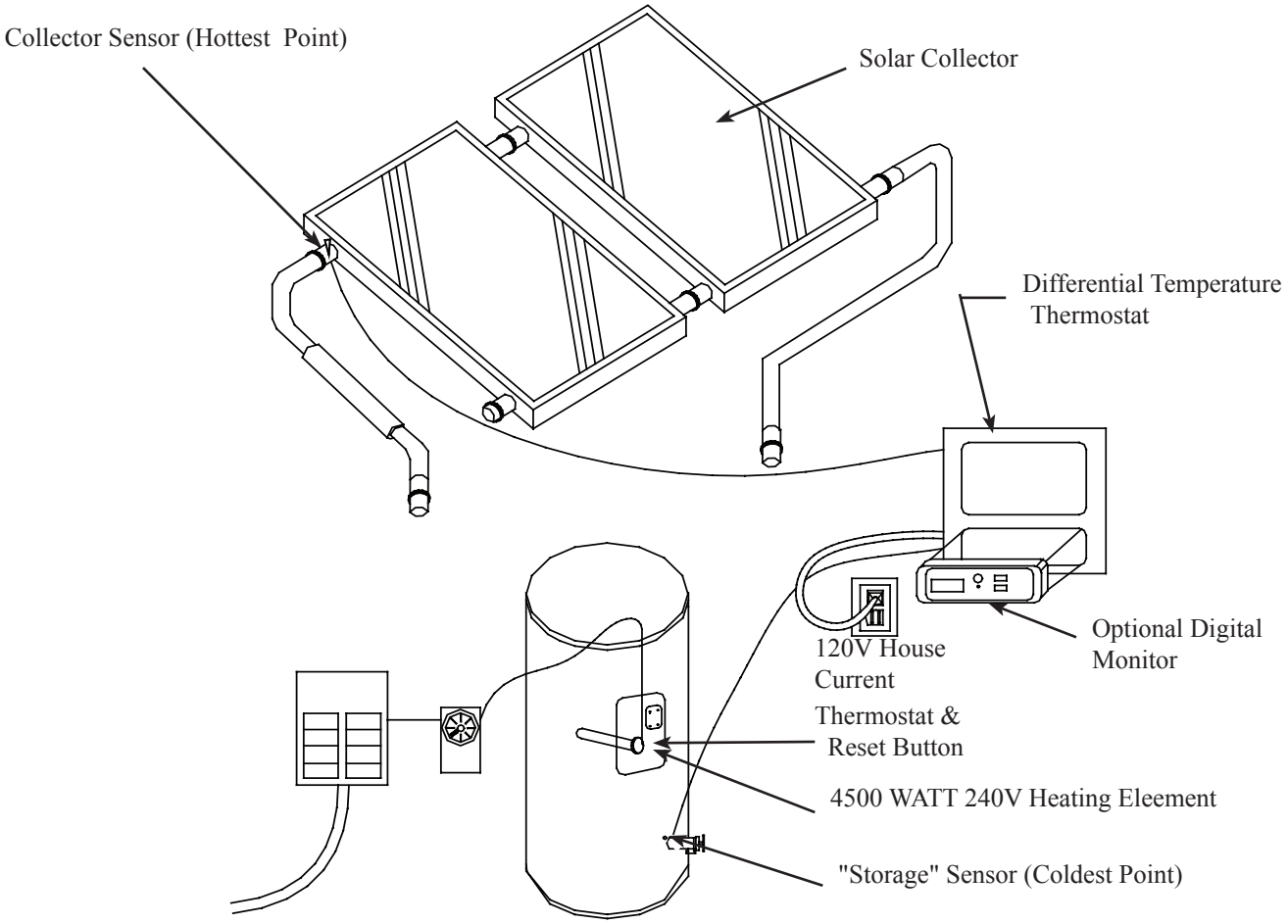


Figure 19 - Electrical Components

Section 5: System Operating Instructions

5.0 THREE MODES OF SYSTEM OPERATION

Both single and double tank systems are designed to accommodate three separate modes of operation.

Your solar water heating system can:
(1) Provide 100% solar operation during good weather.
(2) Serve as a pre heater to your electric water heater adding solar energy when and as available.
(3) Completely bypass the solar collector loop and solar storage tank and run 100% on utility power during inclement weather.

Single Tank Operating Instructions:

5.1 **100% Solar Operation:**

Turn off the circuit breaker to your solar storage tank. If a water heater time switch has been installed, set the switch to the "off" position. If you have a mechanical timer remove the trippers from the face of the switch.

5.2 **Solar Preheat**

Leave the circuit breaker to your solar storage tank on and set the tank thermostat to the lowest acceptable temperature setting. The electric resistance heating elements will come on only when the tank temperature falls below the thermostatic set point. If the solar heated water entering the tank is warmer than the thermostatic set point, the electric heating elements will not come on. If you have a water heater timer, you may preset the timer to turn the heating element on and off at specified times throughout the day if desired.

5.3 **100% Utility Power**

Leave the circuit breaker to your solar storage tank on and close the isolation ball valves in the collector loop (Nos. 10 and 11). In this mode of operation you must turn off the circulation pump. To turn the pump off, open the controller and change the operational setting from automatic to off. Failure to turn off the pump can quickly damage the pump motor, shaft, bearings or impeller.

Two Tank System Instructions:

5.4 **100% Solar Operation**

Follow the instructions for single tank systems above. You also must change the position of the three way ball valves above both the solar storage tank and the back-up water heater (Nos. 25 and 26). Valve handle No. 25 must be in the vertical position. Valve handle No. 26 must be in the vertical position. See *Figure 19a*, 100% Solar Operation.

5.5 **Solar Preheat**

Follow the instructions for the single tank system for setting the thermostat and the heating elements for automatic operation. The three way valve above the solar storage tank (No. 25) must be in the vertical position. The three way valve above the back up water heater (No. 26) must be placed in the horizontal position. See Figure 19b, Solar Preheat.

5.6 **100% Utility Power**

Follow the instructions for the single tank system above. The three way valve above both water heaters (Nos. 25&26) must have the valve handles placed in the horizontal position. See Figures 19c 100% Utility Power and 19d.

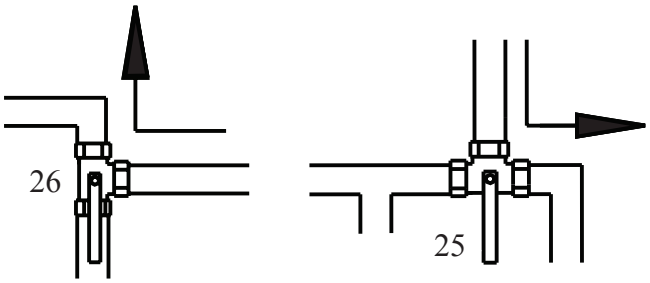


Figure 19a - 100% Solar Operation

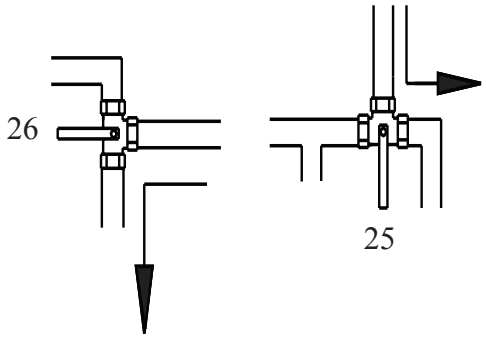


Figure 19b - Solar Preheat Operation

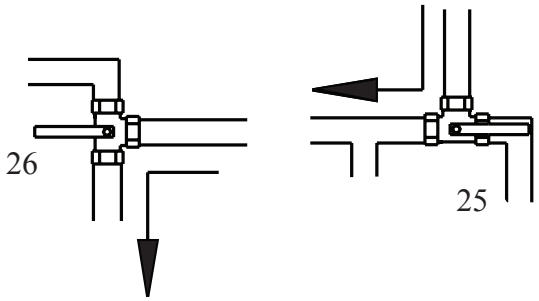


Figure 19c - 100% Utility Power Operation

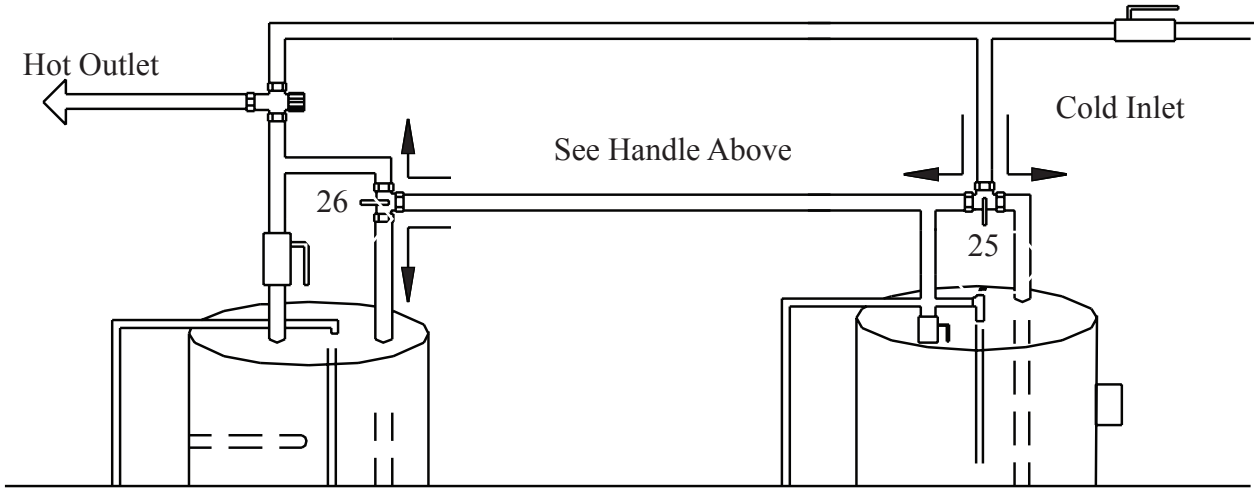


Figure 19d - Valve Position Diagram - Two Tank System

Section 6: Isolating Major Components & System ShutDown

6.0 Your solar water heating system is designed so that the key components can be easily isolated for emergency repairs or routine maintenance. By shutting a single valve you can isolate the entire system from the pressurized cold water supply line (No. 20). In the case of a storage tank or fitting leak immediately shut this valve and call your installation contractor for service.

In two tank systems the solar storage tank can be isolated from the back-up water heater.

Set all necessary isolation ball valves to the off position to service the solar storage tank or the back up water heater.

Section 7: Summer Vacation and Freeze Protection Recommendations & Procedures

7.0 Solar water heating systems can build up very high temperatures when there is no daily draw on the system. If a short summer vacation is planned the best way to dissipate heat in the system is to set the controller to the "on" position. The circulating pump will run twenty-four hours a day and cool off the water in the solar storage tank at night. The collector radiates heat back to the atmosphere at night, preventing the system from stagnating at very high temperatures. This will not harm the pump or add substantially to your monthly utility bill. Remember to set the control to the "Automatic" setting upon your return!

During extended summer vacations (4 weeks or more) it is advisable to either cover the solar collectors with an opaque material or to manually drain the collector loop. The manufacturer recommends that you cover the collectors if practical.

If you choose to drain the collector loop follow these steps:

7.1 **Turn the controller to the “off” position**.

7.2 If the system is installed with an optional time clock make sure the clock is not preset to go "ON" during your absence. If you have a mechanical time switch, remove the "on" tripper from the clock face (No. 24).

7.3 When a hard freeze is imminent or a power failure occurs, the system should be drained by closing the two ball valves that isolate the collector loop and opening the two drain valves that allow the collectors to drain.

7.4 If the freeze recirculation function on the controller is activated, the controller switches the pump on as soon as the collector temperature falls below +41 F. The collector fluid is thus pumped through the collector and the system is prevented from freezing. If the collector reaches +45 F, the pump is switched off. Despite the freeze recirculation function, the solar system can freeze under the following conditions:

- In a power outage
- If long-term frost is expected

Therefore, under these conditions, open loop collectors should be drained.

Section 8: Maintenance And Trouble Shooting

8.0 The following simple procedures are intended to optimize the performance of your solar water heating system and also to extend the life of the primary components.

8.1 The second most important component in your system, at least from a longevity standpoint, is often ignored and never seen. We are referring to the sacrificial "anode rod" installed in your solar storage tank (No. 17). Typically constructed from magnesium, anode rods are installed in "glass lined" water heaters and storage tanks to inhibit corrosion.

As the name implies, the "sacrificial" anode rod is consumed so that the tank lining is not. At a certain point in the process, the anode rod is no longer completely effective and the corrosive processes begin to eat away at the tank's glass lining. In time the solar storage tank, like any other gas or electric water heater, will begin to leak. The process is not reversible and the tank must be replaced.

System temperatures and water quality affect the rate at which the anode rod is consumed. In general, the higher the average system temperature the faster the rate of corrosion. By changing the anode rod after the fifth year of system operation, and every three to five years thereafter, it is possible to extend the life of the solar storage tank. Periodic replacement of the anode rod in your solar storage tank can significantly extend the tank life.

8.2 The solar storage tank also should be flushed annually to minimize sediment build-up on the bottom of the tank. If you live in an area with high mineral content in your water, flush the tank on a semi-annual basis. Disconnect the power to the solar tank at the circuit breaker or time switch (if present) before flushing. Turn the controller to the off position.

Open the flush valve on the bottom of the storage tank (No. 15) and drain a sufficient volume of water to eliminate the sediment. After the procedure is complete make sure the tank is completely full of water before restoring power to the thermostat and heating element. Turn the controller to the "on" position.

8.3 If you live in a dusty climate it is a good idea to wash off the dirt that settles on the collector glass once a month. Clean glass allows the collector to maintain a high level of thermal performance.

8.4 Check the exterior pipe insulation annually and patch or repair any exposed surfaces or degraded areas. Repaint as necessary.

8.5 In the unusual instance of collector glass breakage, the collector should be replaced immediately. Contact your installation contractor.

8.6 If you detect a water leak, or the loop pressure drops unexpectedly, disconnect the power to the solar tank at the circuit breaker or time switch (if present). Turn the controller to the off position. Turn off cold water supply line isolation ball valve (No. 20). Contact your installation contractor immediately to diagnose the problem and recharge the system.

8.7 If it’s been a sunny day and you don’t have hot water, first make sure that the controller is set in the automatic position. If the controller is properly set and the pump has not been running, unplug the line cord from the controller receptacle and plug the controller into a different 115 volt outlet. If the controller does not run it may need to be replaced. Contact your installation contractor for service.

8.8 If you have a full tank of hot water before bed and the solar storage tank is cold in the morning, the check valve (No. 7) may not be seating correctly and should be cleaned or replaced. Also make sure that the circulating pump is not running after nightfall. If the pump is running and the control indicates the potable pump is operating by the arrow icon on the display after nightfall, check both sensors to see that they calibrate to 10K ohm resistance at 77°F. If you find a defective sensor replace it immediately. Note that in a two tank system nighttime heat loss will be harder to detect, especially if you are operating in the solar preheat mode. Check the

line thermometers in the collector loop piping to detect night thermosiphoning.

8.9 If the weather is poor and the auxiliary heating element will not fire, the bright red reset button on the thermostat may have to be depressed to be reset. Single tank systems have one heating element and thermostat. Double tank systems with conventional electric water heaters have two heating elements and thermostats (see figs. 17 a & b, No. 31).

Never remove the protective access plate on the exterior of the solar storage tank or conventional water heater without disconnecting the 230 volt power supply at the circuit breaker.

After the circuit breaker has been turned off, remove the access plate on the storage tank or water heater and depress the red reset button on the thermostat. If it clicks when depressed the heating element should fire immediately when you reconnect the circuit breaker. It the reset button does not click and you do not have hot water after one hour, the heating element or thermostat may be defective. Contact your installation contractor for service.

In two tank systems the conventional electric water heater will be wired for electrical back-up. The solar tank will serve solely as a storage tank and will not be wired.

Section 9: System Component Parts

See Figures 16a, 16b, 17a, and 17b for the location of the specific components numbered below.

1) Solar Collector(s): Absorbs the sun's heat energy and transfers this heat to the fluid circulating through the collector. *(Provided)*

2) Collector Sensor: Wired to the system controller. Works in conjunction with the tank sensor to automatically turn your circulating pump on and off at preset temperature differentials. See figure 15 on page 16 for detail. *(Provided)*

3) Air Release Valve: Used to release air pockets that collect at the highest point of the collector loop. *(Provided)*

4) Freeze Protection Valve: Used to protect collectors and exposed piping from freezing.*(Provided)*

5) Tank Sensor: Wired to the system controller. Works in conjunction with the tank sensor to automatically turn your circulating pump on and off at the preset temperature differentials. *(Provided)*

6) Differential Thermostat-known as the controller: Automatically turns the circulating pump on and off when there is sufficient heat to be gained from the solar operation. The controller also maybe set to limit high temperature build up in the solar storage tank. *(Provided)*

7) Check Valve: This valve is installed to stop or minimize convective evening heat loss in the system. The heat in the solar storage tank will rise through the collector loop piping in the evening into the much cooler solar collector and dissipate heat unless prevented from doing so by a check valve. Check valves are also referred to as one way valves. *(Provided)*

8) Circulating Pump: Circulates the fluid through the collector loop. *(Provided)*

9) Isolation Ball Valve: When closed in conjunction with No. 10 will isolate the circulation pump for repair or replacement. *(Provided)*

10) Isolation Ball Valve / Drain Valve: Used to drain the collector or isolate the circulation pump for repair or replacement when closed in conjunction with No. 9. (Provided)

11) Isolation Ball Valve / Drain Valve: Used to drain the collector or isolate the solar storage tank for repair or replacement when closed in conjunction with No. 10. (Provided)

12) Mixing Valve: automatically blends hot water from the solar storage tank with incoming city cold water to an acceptable set point.

Note: A mixing valve must be installed on every solar water heating system *(Provided)*

13) Pressure Relief Valve: Will automatically release and dump water at 75 PSI of pressure. *(Provided)*

14) Pressure Gauge: Indicates pressure in the collector loop. *(Provided)*

15) Drain Valve: Used to drain the storage tank and to flush sediment from the tank on an annual basis. *(Provided)*

16) Cold Water Dip Tube: Forces incoming city cold water to the bottom of the solar storage tank to prevent mixing with the warm water at the top of the tank. *(Provided)*

17) Anode Rod: The "sacrificial" anode rod is installed in your solar storage tank to prevent corrosion to the tank lining by neutralizing aggressive water action. Anode rods have a finite life and require periodic replacement depending on annual tank temperatures and water quality. Determine a replacement schedule with your installation contractor. *(Provided)*

18) Temperature and Pressure Relief Valve: Universally required by the plumbing code on water heaters. Will automatically release and dump water at either 150 PSI of pressure or 210°F in temperature. *(Provided)*

19) Heating Element & Tank Thermostat: The solar storage tank is equipped with an auxiliary 4500 watt, 230 volt electrical heating element. The thermostat controls the temperature setting of the auxiliary heating element. *(Provided)*

20) Isolation Ball Valve (Cold Water Supply Line): When open allows potable water to fill the solar storage tank or back-up water heater. When closed isolates the solar storage tank and backup

water heater from the pressurized city cold water supply line. *(Not Provided)*

21) Isolation Ball Valve (hot water): Used in conjunction with component No. 20 to completely isolate the solar storage tank for repair or replacement as necessary. *(Not Provided)*

22) Tank Thermometer: Will read the temperature of the water after the mixing valve feeding your fixtures. *(Optional)*

23) Line Thermometer: Will show the approximate different between the collector supply and the return lines on sunny days. *(Optional)*

24) Optional Time Switch: Allows you to automatically or manually turn the auxiliary heating element in the solar storage tank on and off. A time switch is a highly recommended option. *(Not Provided)*

25) Three Way Ball Valve: Used in conjunction with component No. 26 to establish the proper mode of system operation. *(Not Provided)*

26) Three Way Ball Valve: Used in conjunction with component No. 25 to establish the proper mode of system operation. *(Not Provided)*

27) Drain valve: See No. 15 above. (*Provided)*

28) Cold Water Dip Tube: See No.16 above. (*Provided)*

29) Anode Rod: See No. 17 above. (*Provided)*

30) Temperature and Pressure Relief Valve: See No. 18 above. *(Provided)*

31) Heating Elements and Thermostats: See No. 18 above. In a two tank system the back-up electric water heater has two heating elements and two thermostats. *(Provided)*

32) Isolation Ball Valve. Use with component No. 21 to completely isolate the back-up water heater for repair or replacement. *(Not Provided)*

33) Thermal well: Not pictured *(Two thermal wells Provided)*

SYSTEM MODEL NUMBERS:

RSO80-40BP
RSO120-64BP

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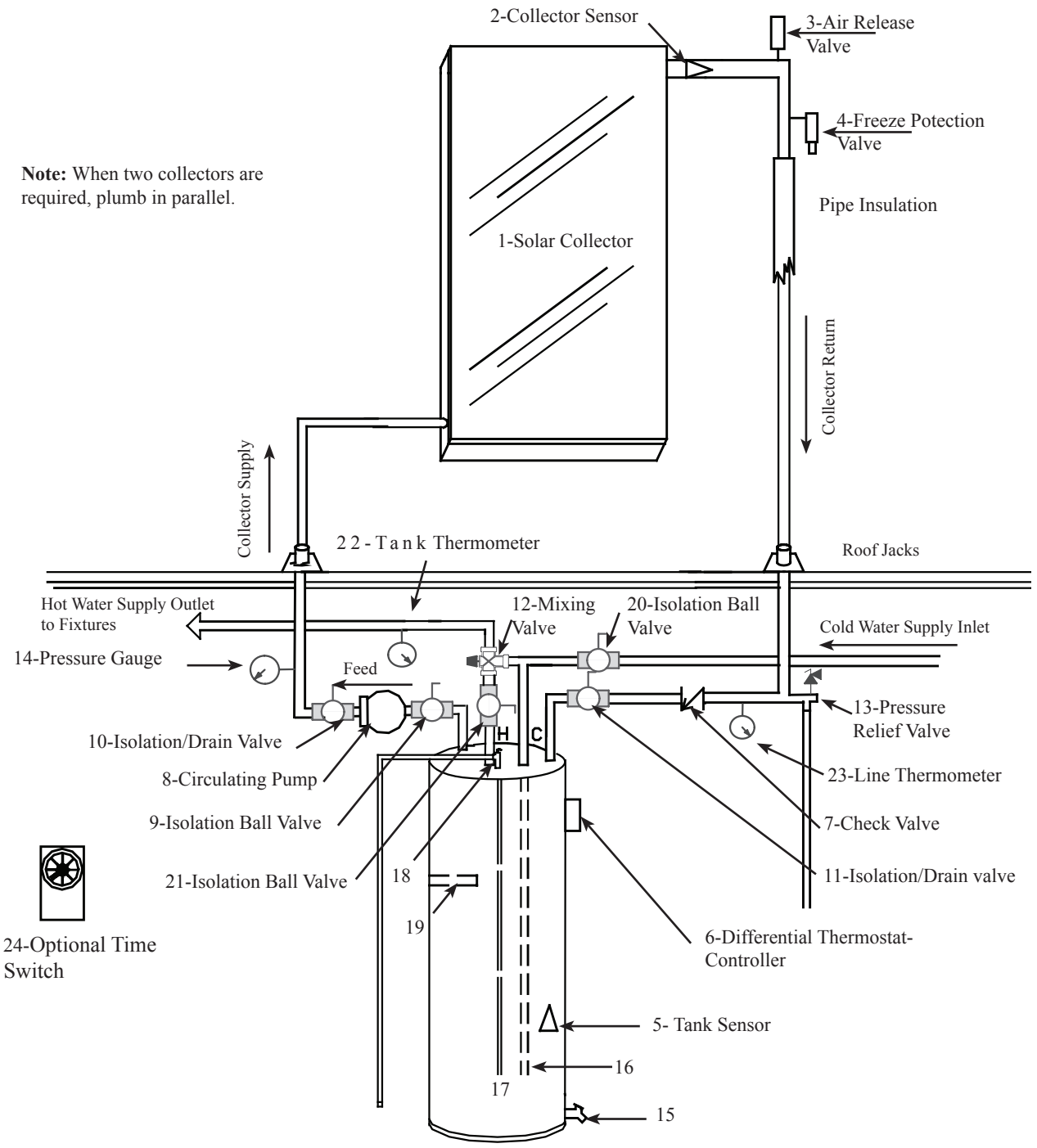

Figure 16 a SINGLE TANK SYSTEM SCHEMATIC TOP CONNECT

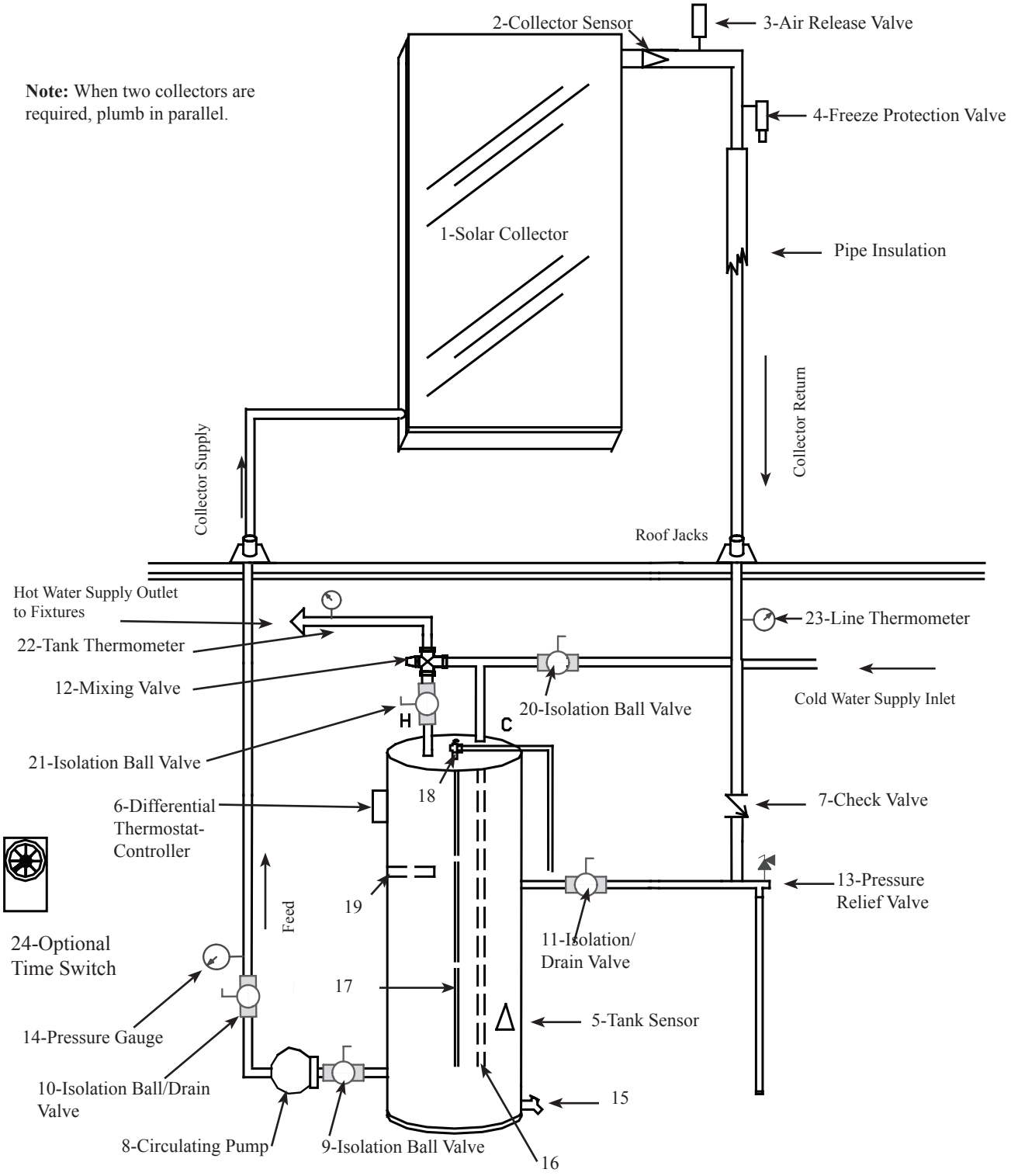

Figure 16b SINGLE TANK SYSTEM SCHEMATIC - SIDE CONNECT

Note: When two collectors are required, plumb in parallel.

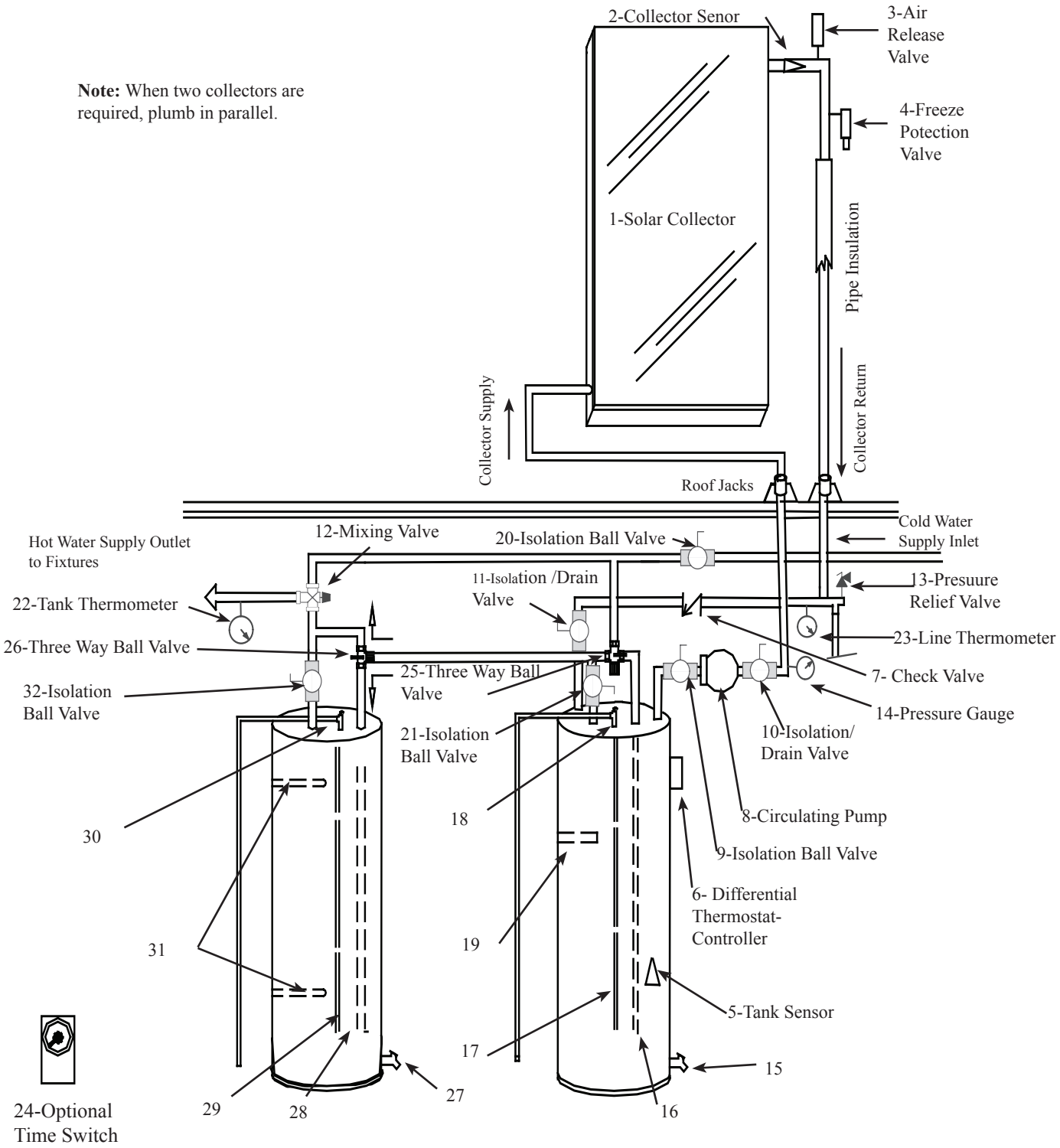

FIGURE 17a DOUBLE TANK SYSTEM SCHEMATIC - TOP CONNECT

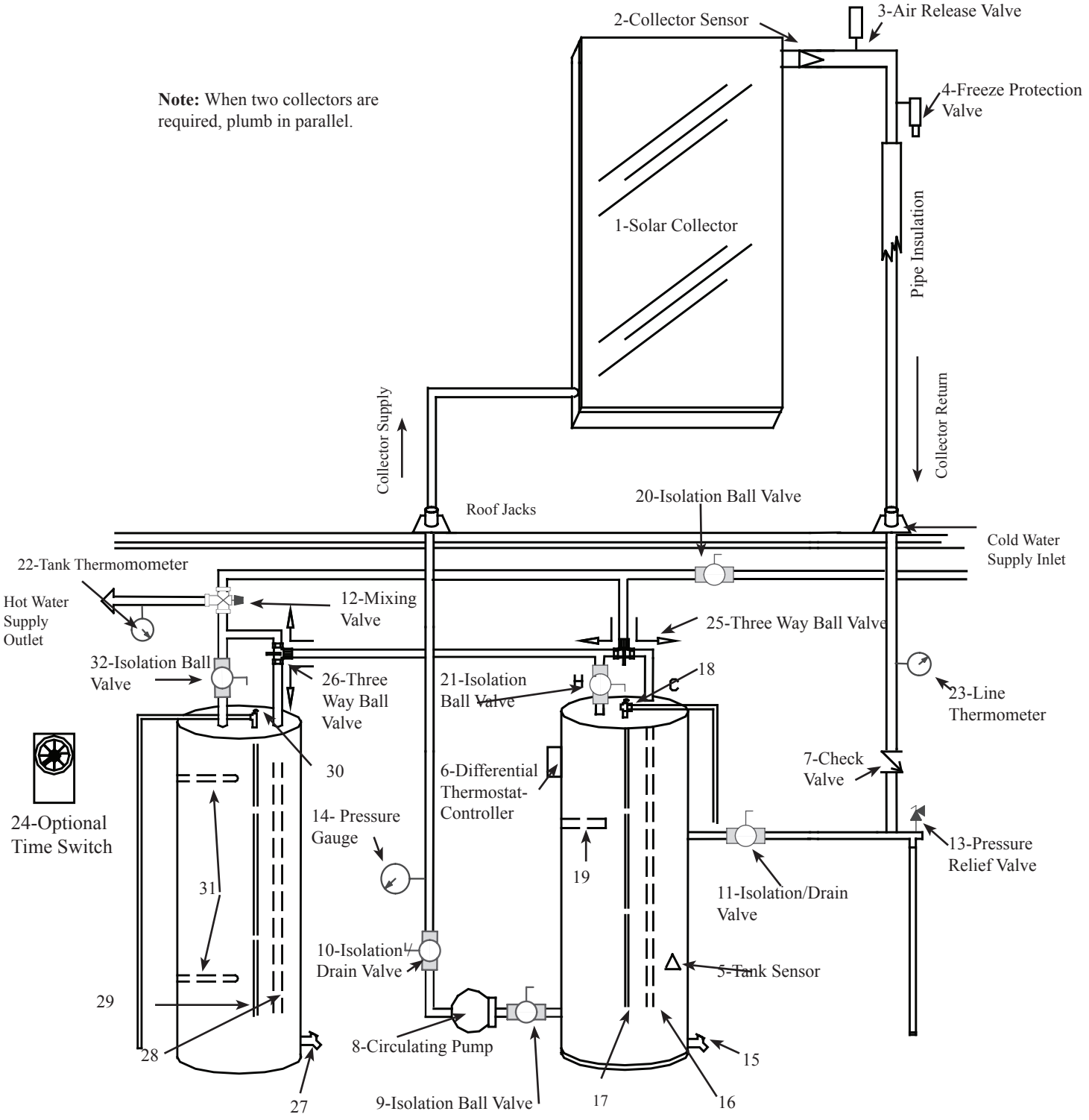

Figure 17b DOUBLE TANK SYSTEM SCHEMATIC - SIDE CONNECT

IF YOU NEED SERVICE

1. Should you have any questions about your new water heater, or if it requires adjustment, repair, or routine maintenance, it is suggested that you first contact your installer, plumbing contractor or previously agreed upon service agency. In the event the firm has moved, or is unavailable, refer to the telephone directory, commercial listings or local utility for qualified service assistance.
2. Should your problem not be solved to your complete satisfaction, you should then contact the Manufacturer's National Service Department at the following address:

   1241 Carwood Court
   Montgomery, Alabama 36117
   Phone: 1-800-432-8373.

   When contacting the manufacturer, the following information will be requested:

   a. Model and serial number of the water heater as shown on the rating plate attached to the jacket of the heater.
   b. Address where the water heater is located and physical location.
   c. Name and address of installer and any service agency who performed service on the water heater.
   d. Date of original installation and dates any service work was performed.
   e. Details of the problems as you can best describe them.
   f. List of people, with dates, who have been contacted regarding your problem.