

Pumped Solar Water Heating Systems




This Solar Water Heating system is for the models listed below:
RS80-48BP
RS120-64BP


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 heater; 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 heater 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 heater 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.



Safety Information

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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 System Pump: _____

Serial Number of Solar System Pump: _____

Model Number of Solar System Control: _____

Serial Number of Solar System Control: _____

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.

Introduction

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 Rheem 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 Rheem 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, expansion tank, pump valves and fittings.

In locations which are subject to temperatures below 41°F, a mixture of heat transfer fluid and water circulates through the solar collector panels. This fluid is heated by the sun, then circulated through a heat exchange, heating the potable (drinking) water inside the storage tank. The heat transfer fluid is a non-toxic, food-grade liquid, which provides freeze protection for the closed loop heat transfer loop. It is colored to differentiate the closed system fluid from the potable water supply.

This circulation of the heat transfer fluid is accomplished by a pump and sensors. These solar water heaters are referred to as closed loop systems.

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.

Introduction continued...

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.

IMPORTANT SAFETY INFORMATION. READ ALL INSTRUCTIONS BEFORE USING.

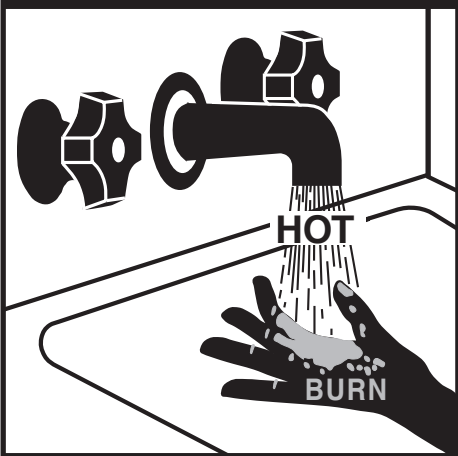
⚠️ DANGER!



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



Water temperature over 125°F can cause severe burns instantly or death from scalds.

Children, disabled and elderly are at highest risk of being scalded.

See instruction manual before setting temperature at water heater.

Feel water before bathing or showering.

Temperature limiting valves are available, see manual.

Time/Temperature Relationship in Scalds

Temperature	Time To Produce a Serious Burn
120°F	More than 5 minutes
125°F	1½ 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 1½ seconds
155°F	About 1 second

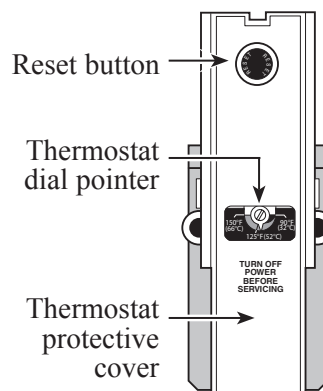
Table courtesy of Shriners Burn Institute

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 or less where local codes require.

⚠️ 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.

⚠️ 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

Let us first offer two words of grateful appreciation. Thank You! We sincerely appreciate your business. Rheem 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 Rheem 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.

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 Rheem system will save on an annual basis.

Your Rheem solar system is known as a "forced circulation" system because it utilizes a mechanical pump to efficiently circulate the Dow Chemical Dowfrost HD propylene glycol heat transfer fluid (HTF) throughout the system. The HTF protects the collector piping from freezing and inhibits scaling deposits that can reduce performance in "open-loop" systems utilizing potable water as the HTF. Proper application and maintenance of the HTF can protect your Rheem solar water heating system to minus 30° Fahrenheit.

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

Rheem 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.

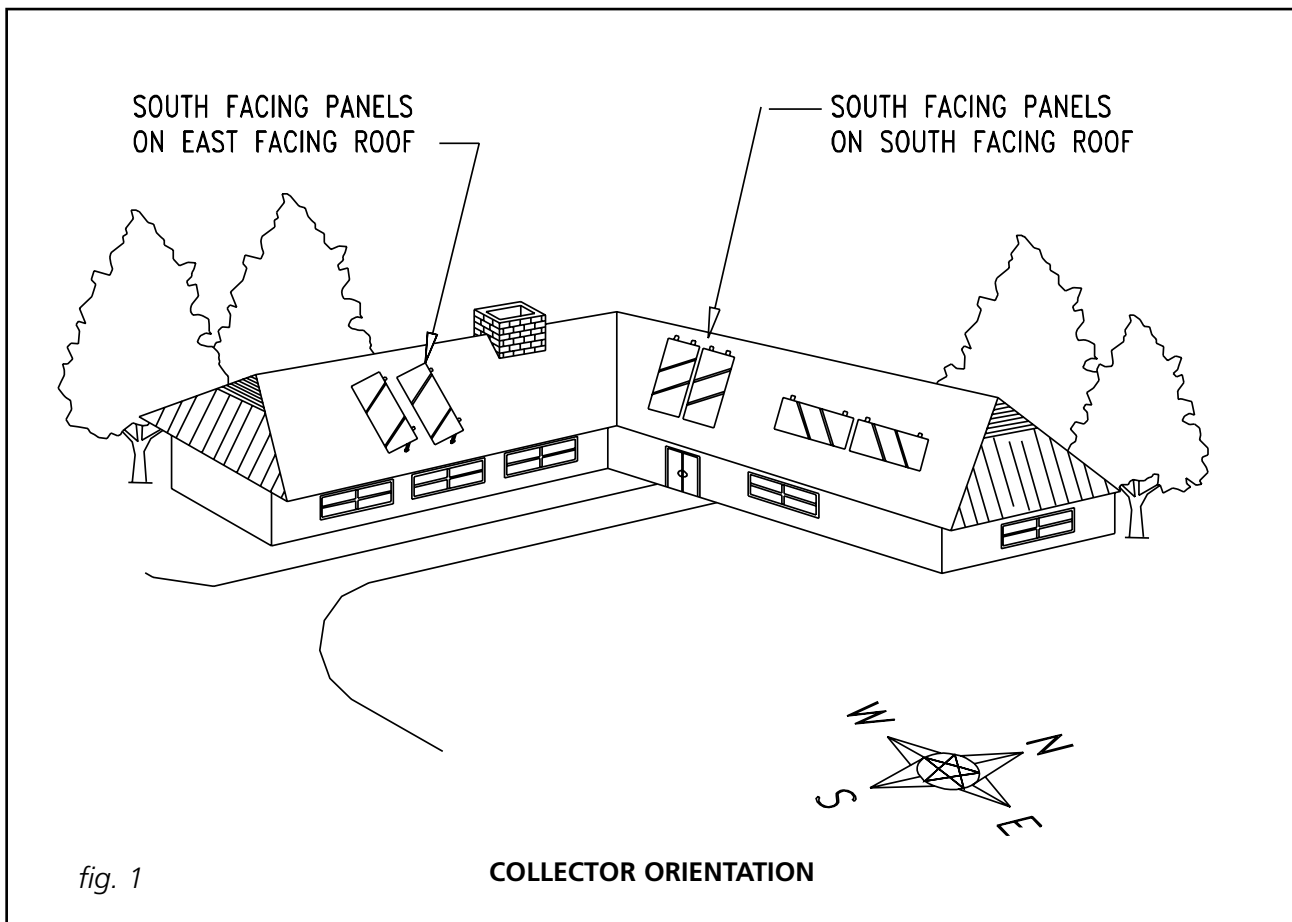
This manual covers installations utilizing two Rheem solar collectors with a single solar storage tank and also two tank systems that include a solar storage tank and a conventional water heater. For simplicity, the singular form will be used throughout this manual when referring to all of these components 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 16 and 17. A description of each component and its function is found in Section 10.

2) SYSTEM DESCRIPTION AND OPERATIONAL PRINCIPLE

The key components in the Rheem solar water heating system include the solar collector, solar storage tank with integral heat exchanger, circulation pump, differential thermostat, expansion tank, pressure gauge, mixing valve and the non-toxic propylene glycol heat transfer fluid (HTF).

The Rheem solar collector is the heart of the system. Simply stated, when the sun is shining, heat energy is absorbed by the solar collector's all copper absorber plate and transferred to the HTF circulating through the solar collector. The system pump efficiently circulates this heated fluid through the collector piping and integral tank heat exchanger. As the HTF passes through the heat exchanger the heat in the fluid is transferred by conduction to the potable water in your solar storage 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 Rheem systems are designed to provide three separate modes of system operation. The system will, (1) accommodate 100% solar operation, (2) serve as a preheater to your solar storage tank or back-up water heater, or (3) bypass the solar collector and run 100% on utility power. Section Six provides instructions for setting the system for automatic operation in each of these three modes.

The Dowfrost HD HTF protects your Rheem solar system against freezing. Dowfrost HD can provide reliable freeze protection at temperatures as low as minus 30° Fahrenheit if properly applied and maintained. Use of uninhibited propylene glycol, plain water or a concentration of these two fluids as the HTF in this system is strictly prohibited.

Propylene glycol can degrade over time. The process of degradation is accelerated in presence of oxygen and/or heat. We strongly encourage you to establish a preventative maintenance schedule with your installation contractor. The HTF pH level must be maintained between 8 and 10 in order to prevent glycol oxidation and corrosion of the collector piping. Rheem's collector warranty specifically excludes freeze damage for any reason and absorber plate damage resulting from the oxidation of the propylene glycol HTF.

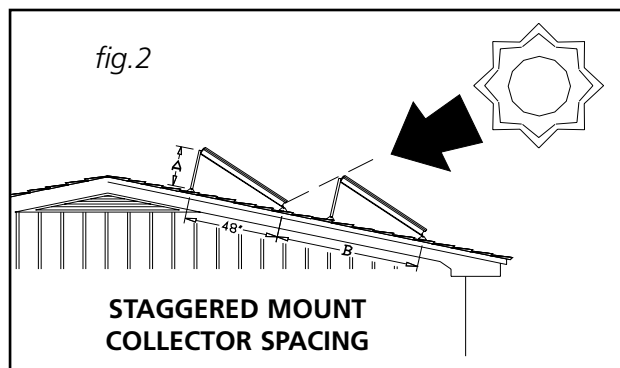


TABLE 1

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

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 persistent hard freeze conditions below minus 30° Fahrenheit. (See Sections 8.1 and 8.2 below).

3) INSTALLATION REQUIREMENTS - GENERAL

3.1 The contractor shall obtain all required permits and approvals.

3.2 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.

3.3 The solar collector must be located in a structurally sound area of the roof that will be unshaded 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.

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

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

4) INSTALLATION REQUIREMENTS - SPECIFIC

4.1 Collector Orientation

The performance of solar water heating systems

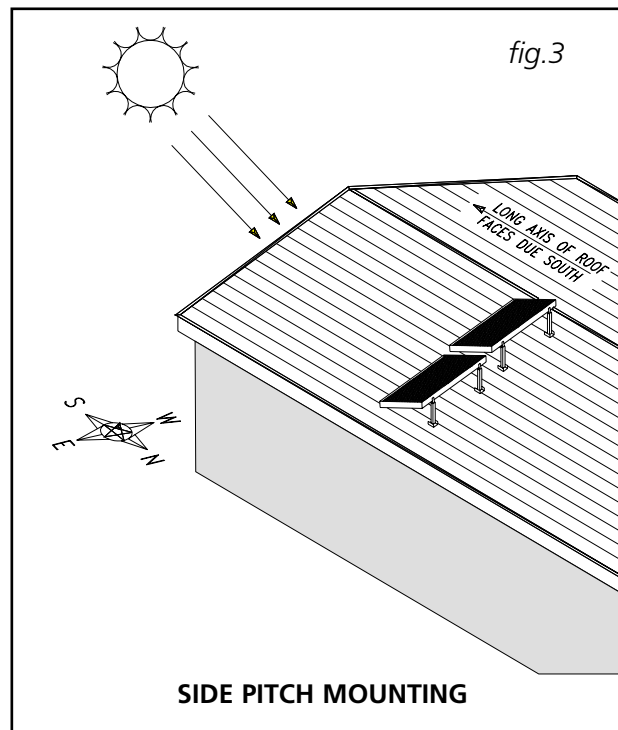
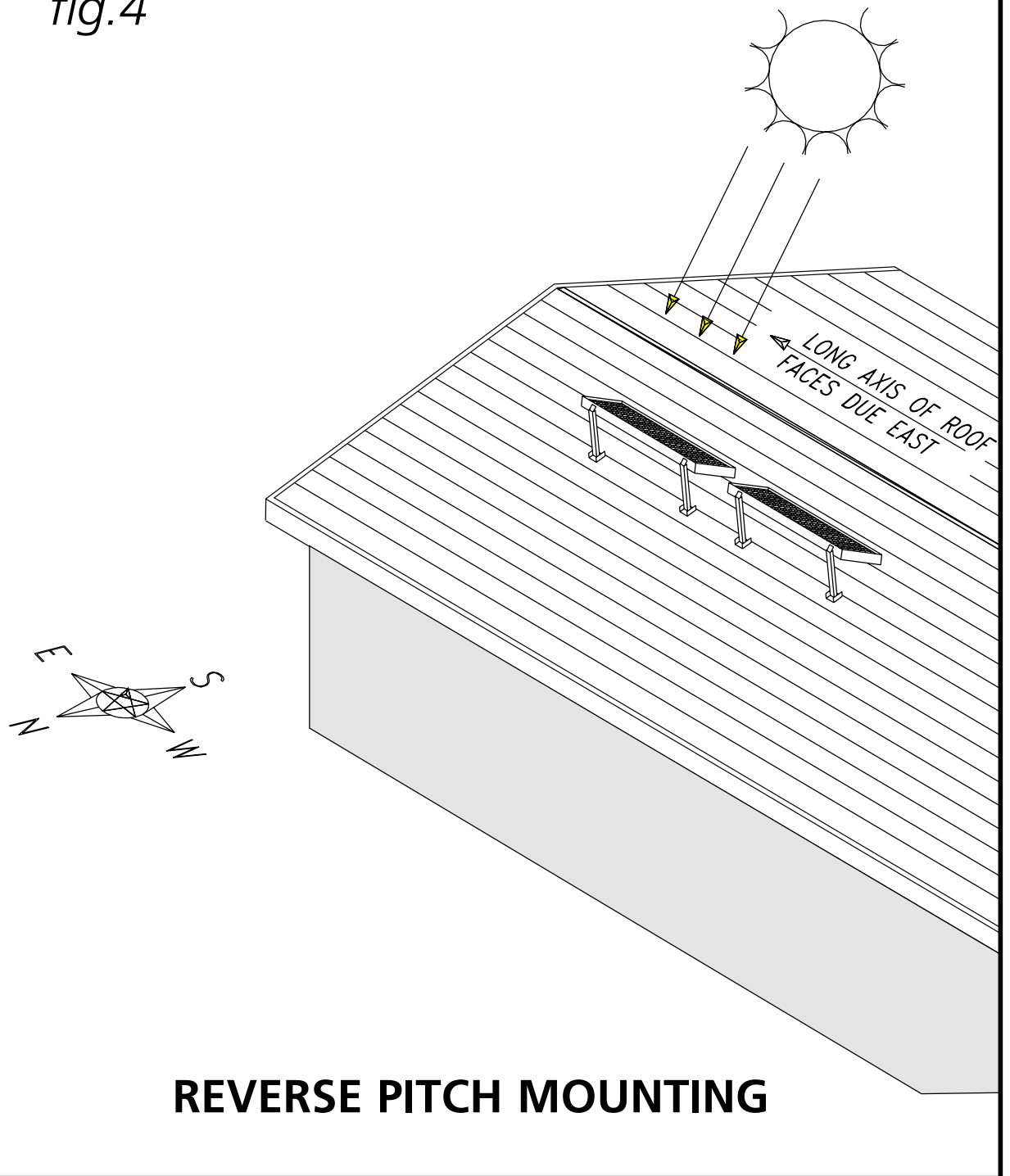


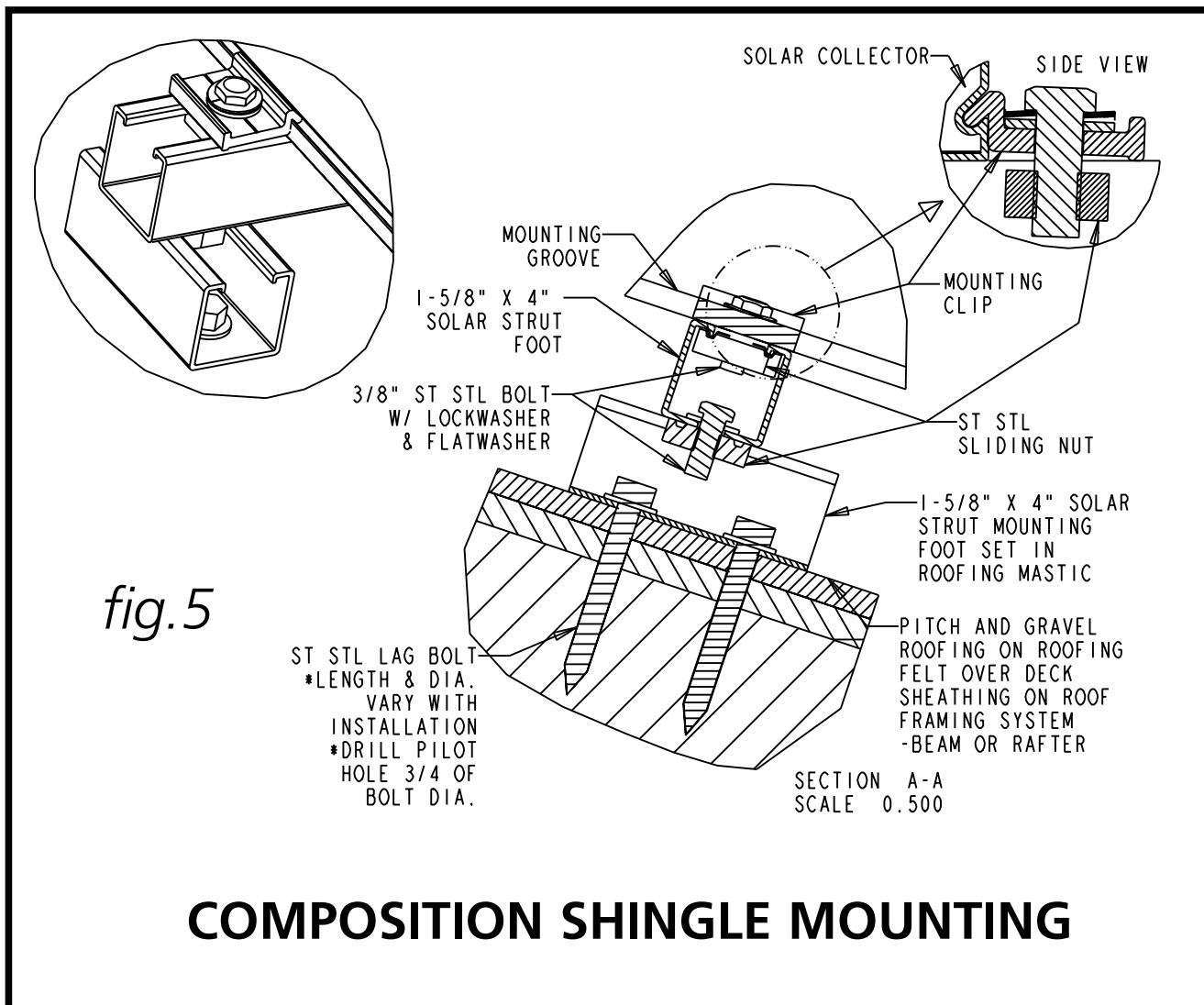
fig.4



REVERSE PITCH MOUNTING

in the Northern Hemisphere is optimized when the collector is mounted facing True South. 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.



4.2 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 its lowest and minimizes overheating during the hottest summer months.

The solar collectors in a two collector staggered mount installation must be spaced far enough apart to prevent winter shading. Figure 2 and Table 1 show the correct spacing between collectors to prevent shading on December 21, when the sun is at its lowest angle.

4.3 Basic Mounting Procedures

The Rheem solar collector in your Rheem solar system can be mounted in either a vertical or

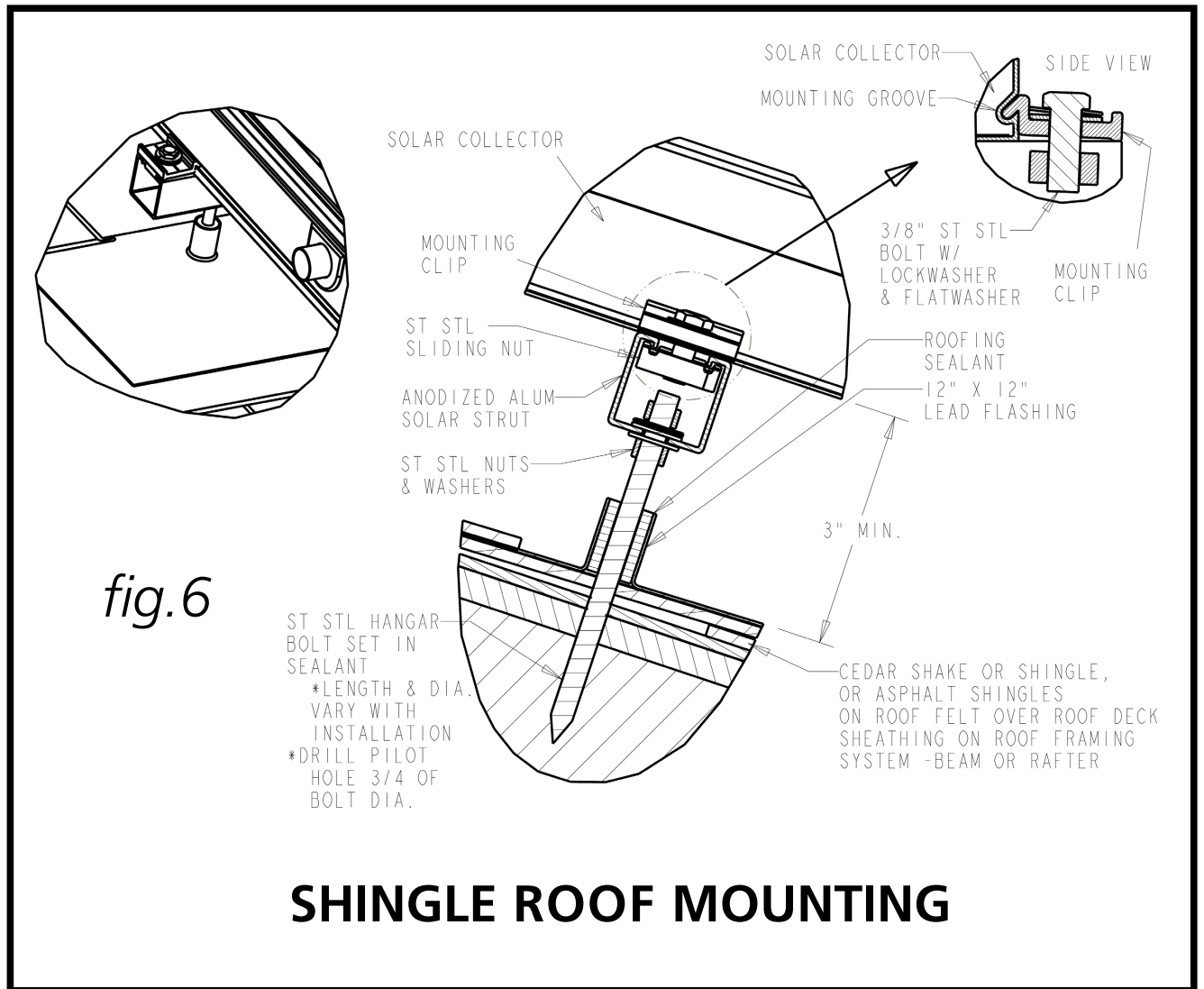
horizontal orientation on the roof (See Figure 1).

Although the collector is protected from freeze conditions by the glycol HTF and does not normally need to be drained, 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.

To ensure proper water drainage from the glazing 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

Installing the water heater.



attic workspace.

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

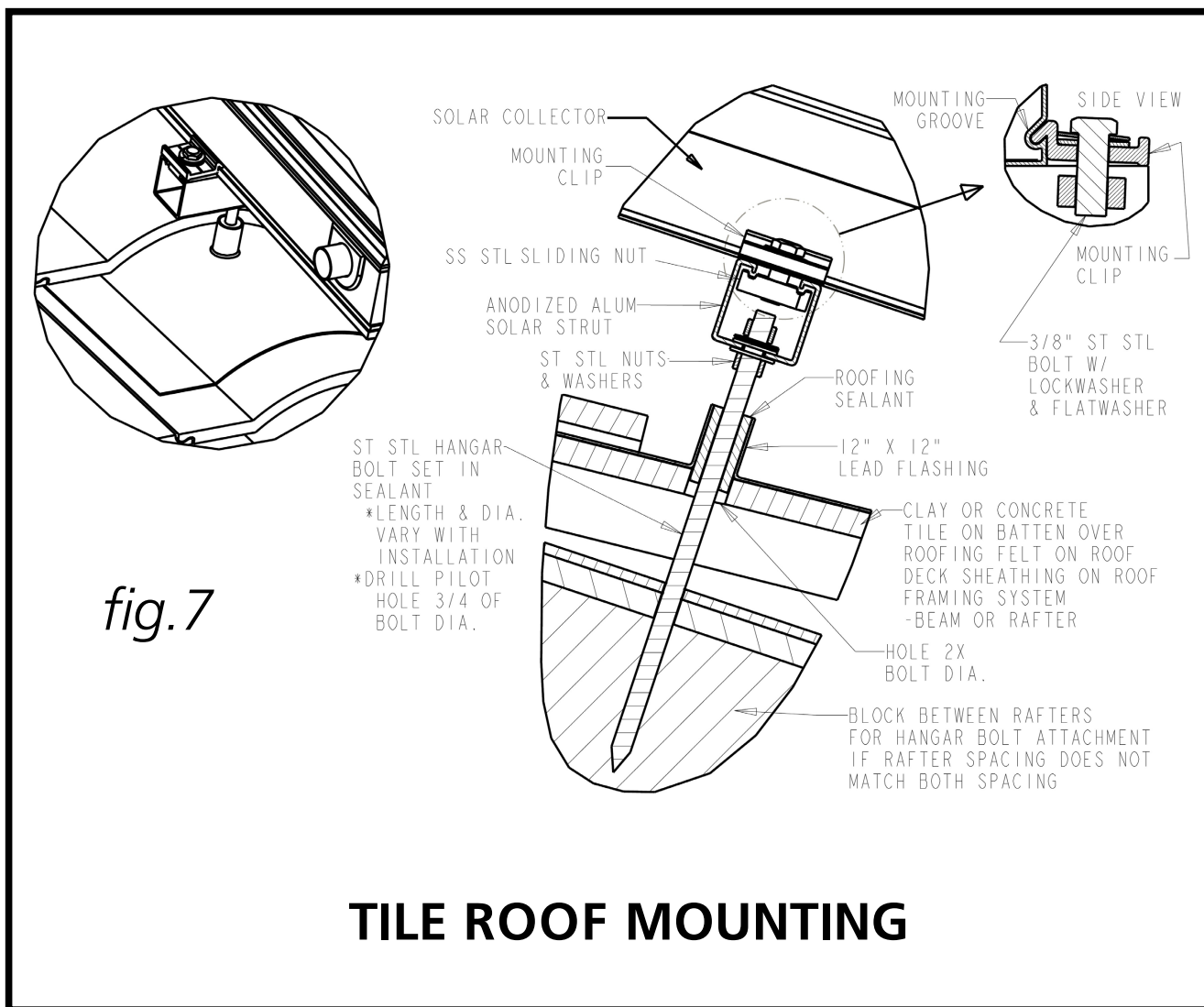
4.3.1 The most important structural consideration is to securely anchor the solar collector and the Rheem mounting hardware to the structural members of the roof with stainless steel hanger or lag bolts. The solar collector must be attached to the mounting hardware as detailed in Figures 5–12. (Note: The drawings in this manual detail mounting hardware for the Rheem series collector.)

4.3.2 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.

4.3.3 In selecting mounting hardware and fasteners it is extremely important to avoid galvanic corrosion resulting from the direct contact of incompatible metals. Use of Rheem anodized aluminum Rheem mounting hardware and stainless steel lag or hanger bolts, lock washers and round washers is recommended. In climates subject to severe winters or high humidity use of galvanized fasteners is prohibited.

4.3.4 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.

4.3.5 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.

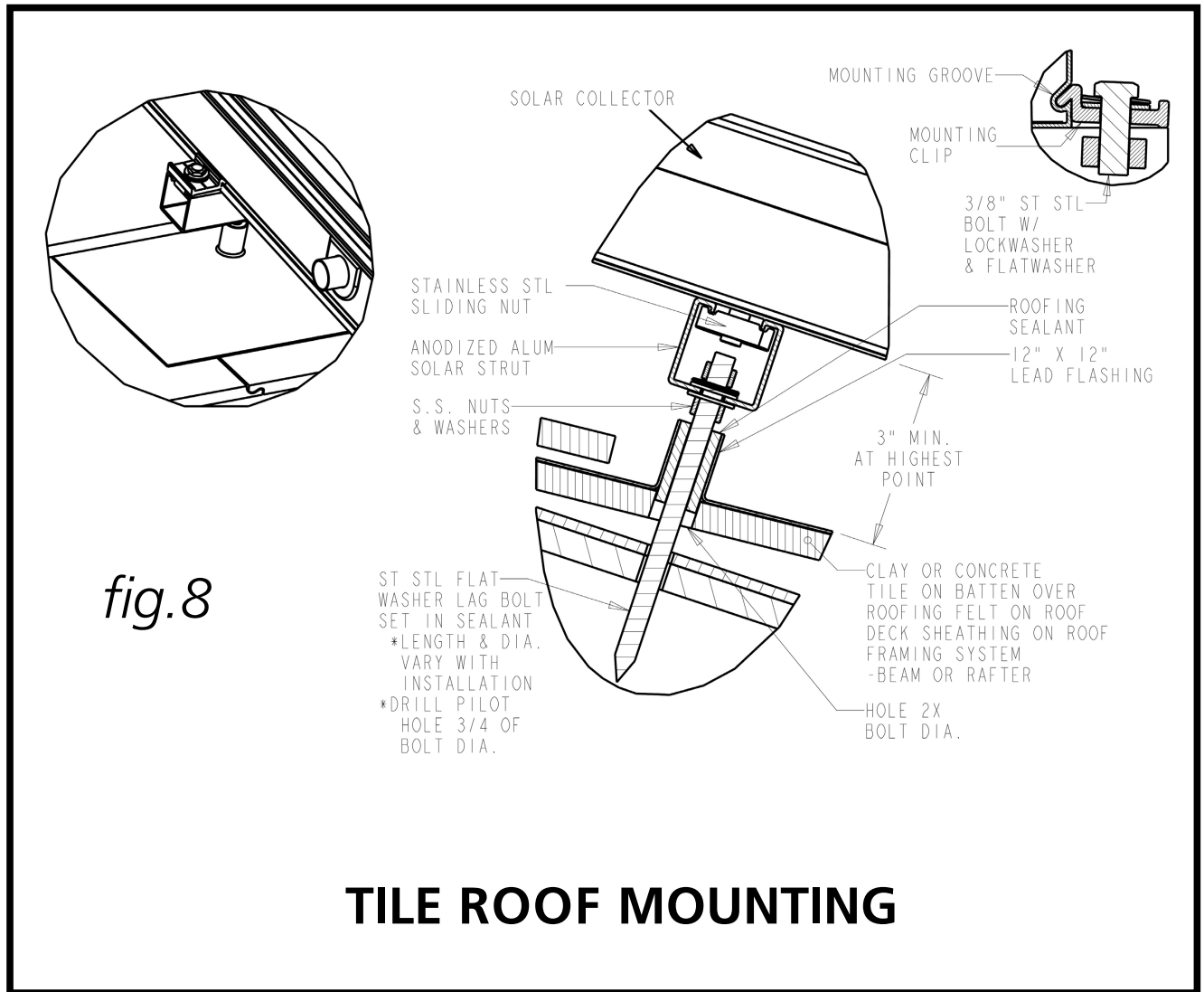
4.4 Collector Loop Pipe Insulation

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. 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.

Installing the water heater.



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.

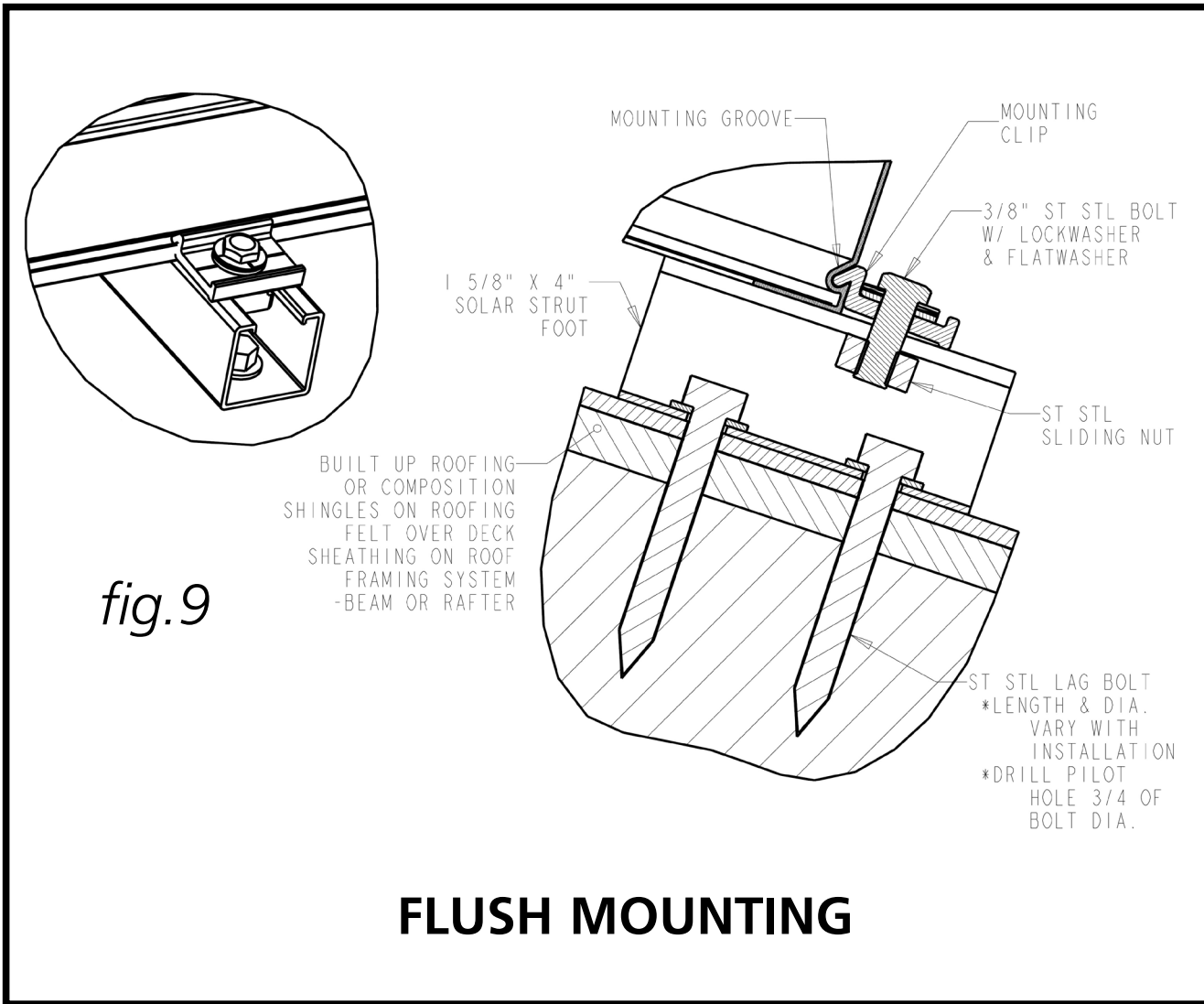
4.5 Collector Plumbing

Rheem 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. Use of 50/50 lead solder is expressly prohibited. Use of galvanized steel, CPVC, PVC, or any other type of plastic pipe is prohibited.

Piping in new solar installations can be covered with dirt, grease, solder flux or other impurities that over time affect the quality of the glycol HTF. A thorough cleaning is required before charging the system with glycol. Carefully review the cleaning procedures in "Charging The System" outlined below.

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

The installation of all horizontal and vertical piping may not reduce the performance or rating of any structural member or fire rated assembly. Adhere to all applicable local codes and ordinances.



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 Rheem 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 13 for collector sensor installation detail.

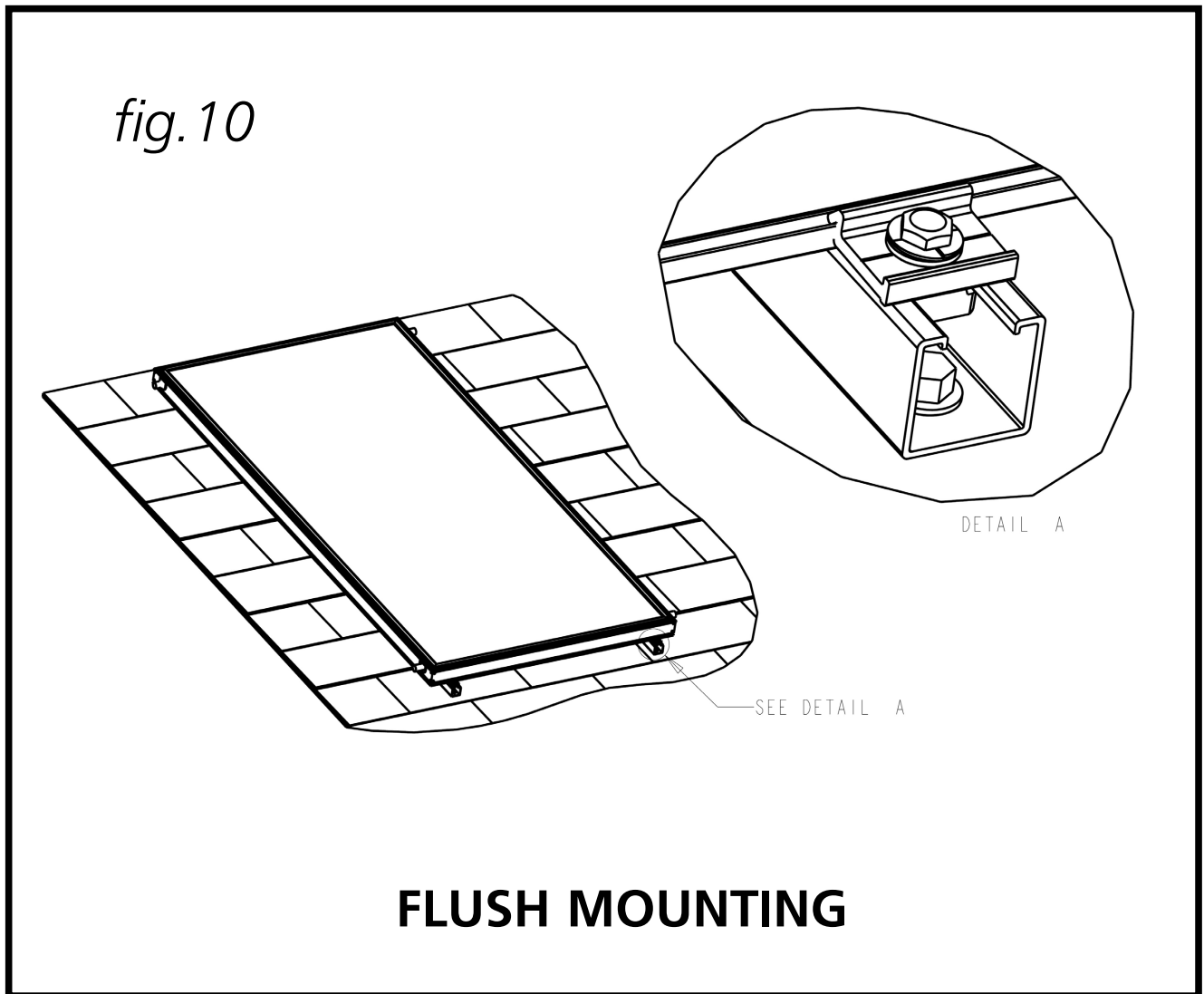
4.7 Low Voltage Wiring

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

In plumbing the solar storage tank and expansion tank make sure that all the components are accessible and

Installing the water heater.



easy to reach. Provide for clear access to the storage tank, pump, expansion tank, mixing valve, time clock (optional, not provided) 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 and expansion tank. The use of galvanized fittings or nipples, di-electric 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. 23).

Line thermometers shall be installed in the collector supply and return lines to allow for a simple diagnostic check of proper system operation. On a sunny day the hot water return line should be approximately 5 – 12° warmer than the water in the collector supply line. Compare the temperature readings in the two line thermometers (No. 3).

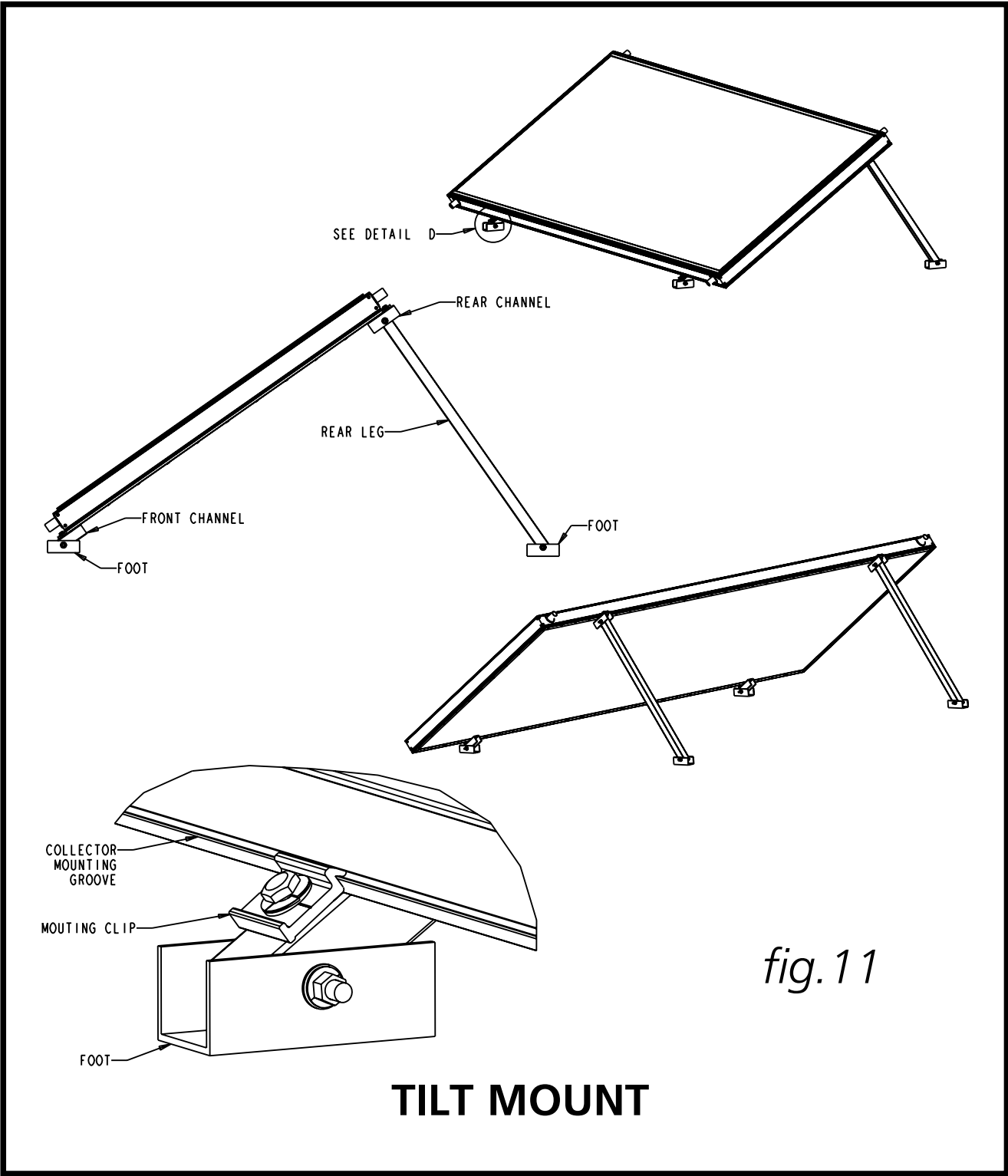


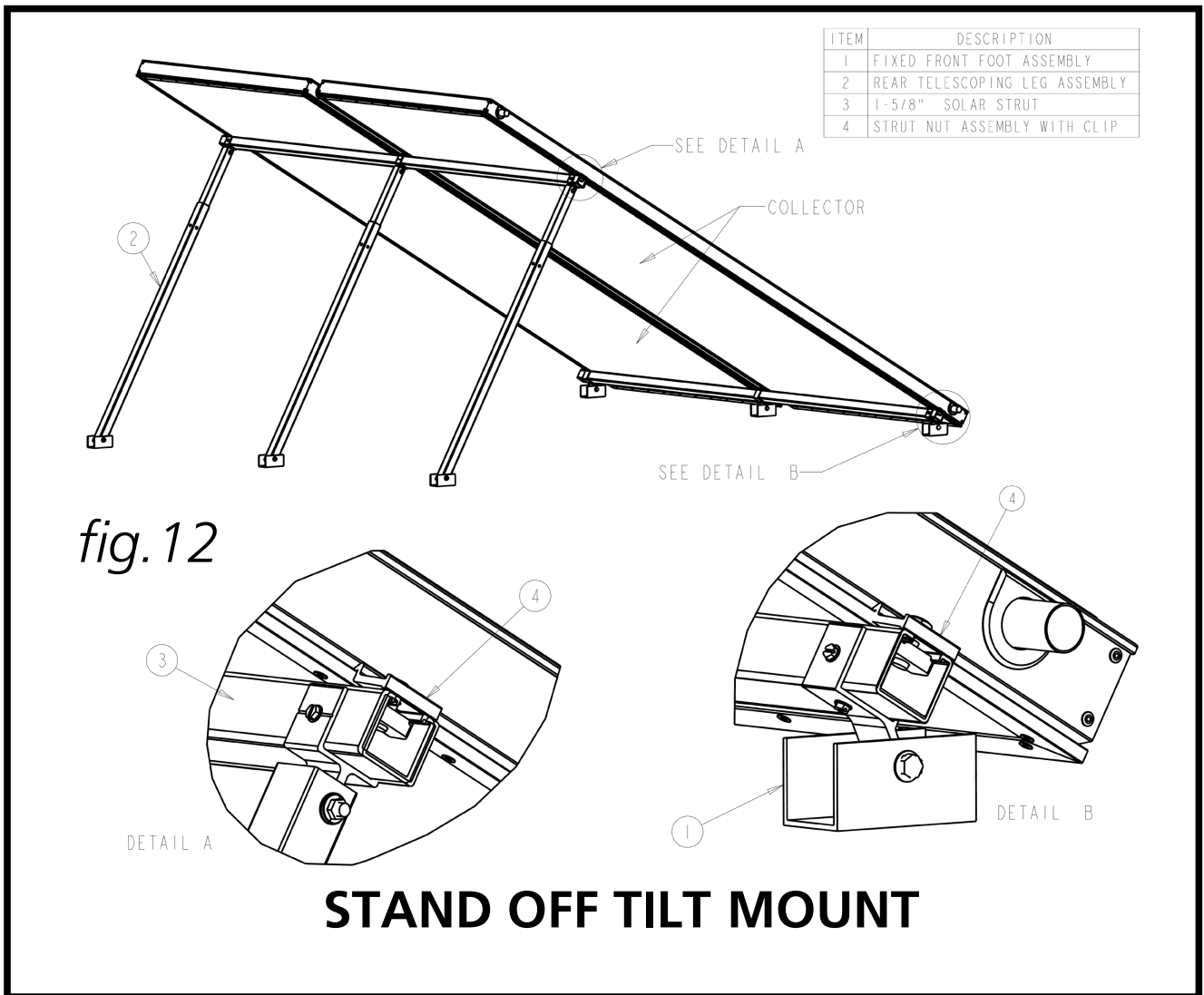
fig. 11

In a single tank system install a third thermometer (No. 3) directly after the mixing valve above the solar storage tank. In a two tank system you may install the third thermometer either directly above the hot outlet

on the solar storage tank or after the mixing valve on the back-up water heater.

The circulation pump shall be the Grundfos model

Installing the water heater.



UPS15-5BFC/LC, 115 volt. The pump shall be prewired 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.12 and 14) so that the pump can be isolated from the collector loop. Repairs or routine system maintenance can be completed without introducing air into the system or draining the HTF.

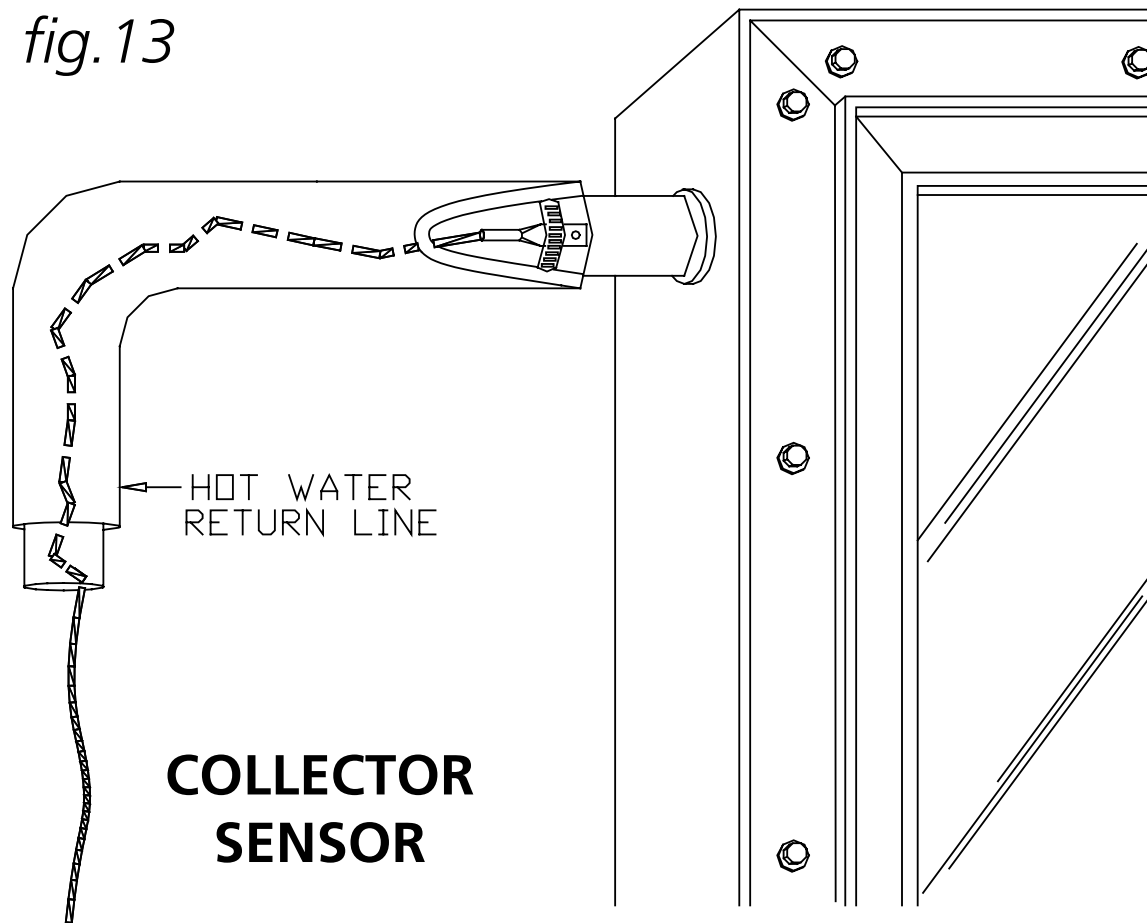
The expansion tank shall have a minimum 150 PSIG working pressure and have a total volume of not less than 4.4 gallons. The standard factory charge should be 40 PSIG. The expansion tank shall be Rheem/Ruud Therm-X-Guard Model RRT- 12 or equal (No. 8).

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. 32). 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.

The temperatures generated by your Rheem 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 110°F to 180°F depending upon the season and hot water demand. The mixing valve described above blends the hot and cold water

fig. 13



supplies to deliver hot water to your fixtures at a safe, controlled temperature.

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

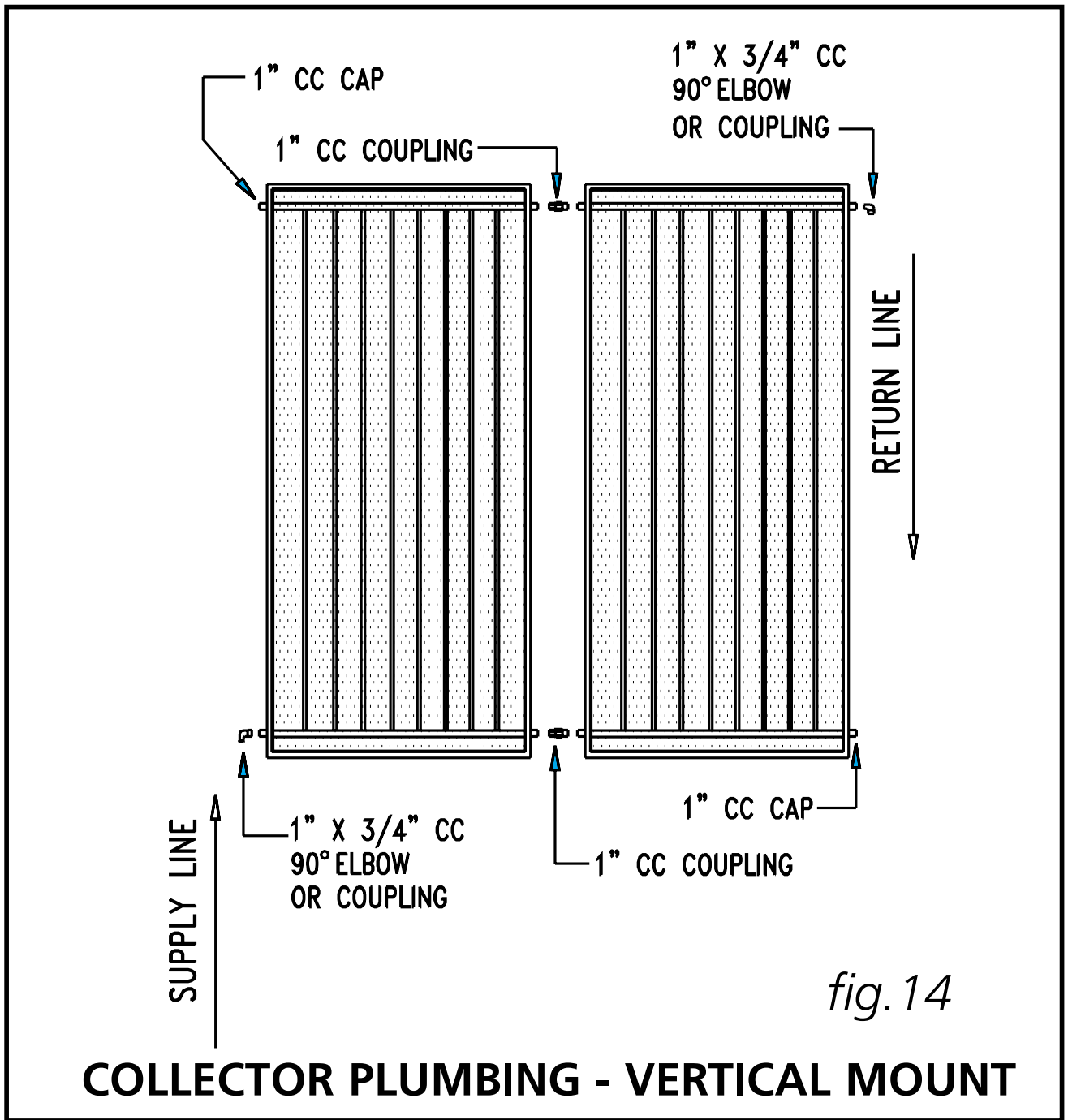
4.9 Tank Sensor Placement

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.

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. 33). 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.

4.11 Charging the System

⚠WARNING: Under no circumstances can any fluid other than Dowfrost HD be used, alternate fluids could be hazardous to your health.

Once the components are plumbed you are ready to fill the solar storage tank with water and to charge the collector loop with a mixture of heat transfer fluid (HTF) and distilled or deionized water. **The use of**

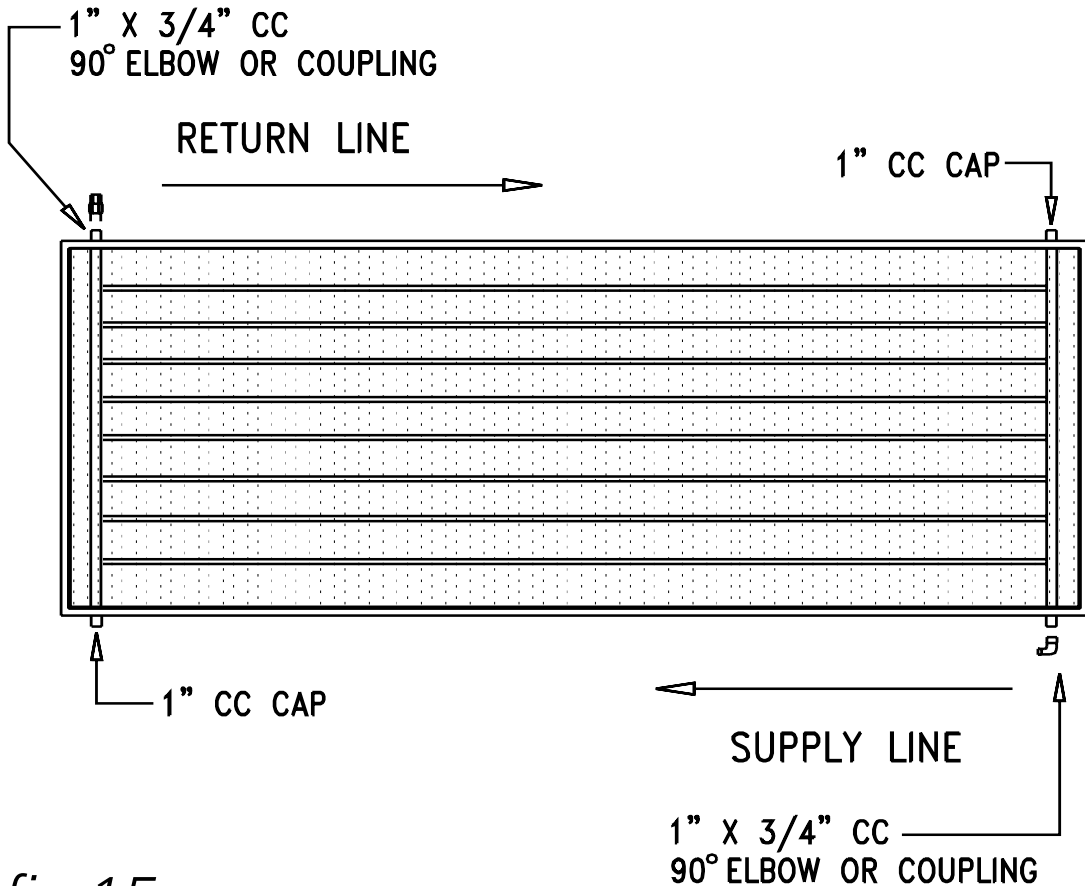


fig. 15

COLLECTOR PLUMBING - HORIZONTAL MOUNT

regular tap water as a mixing agent is prohibited.

Proceed as follows:

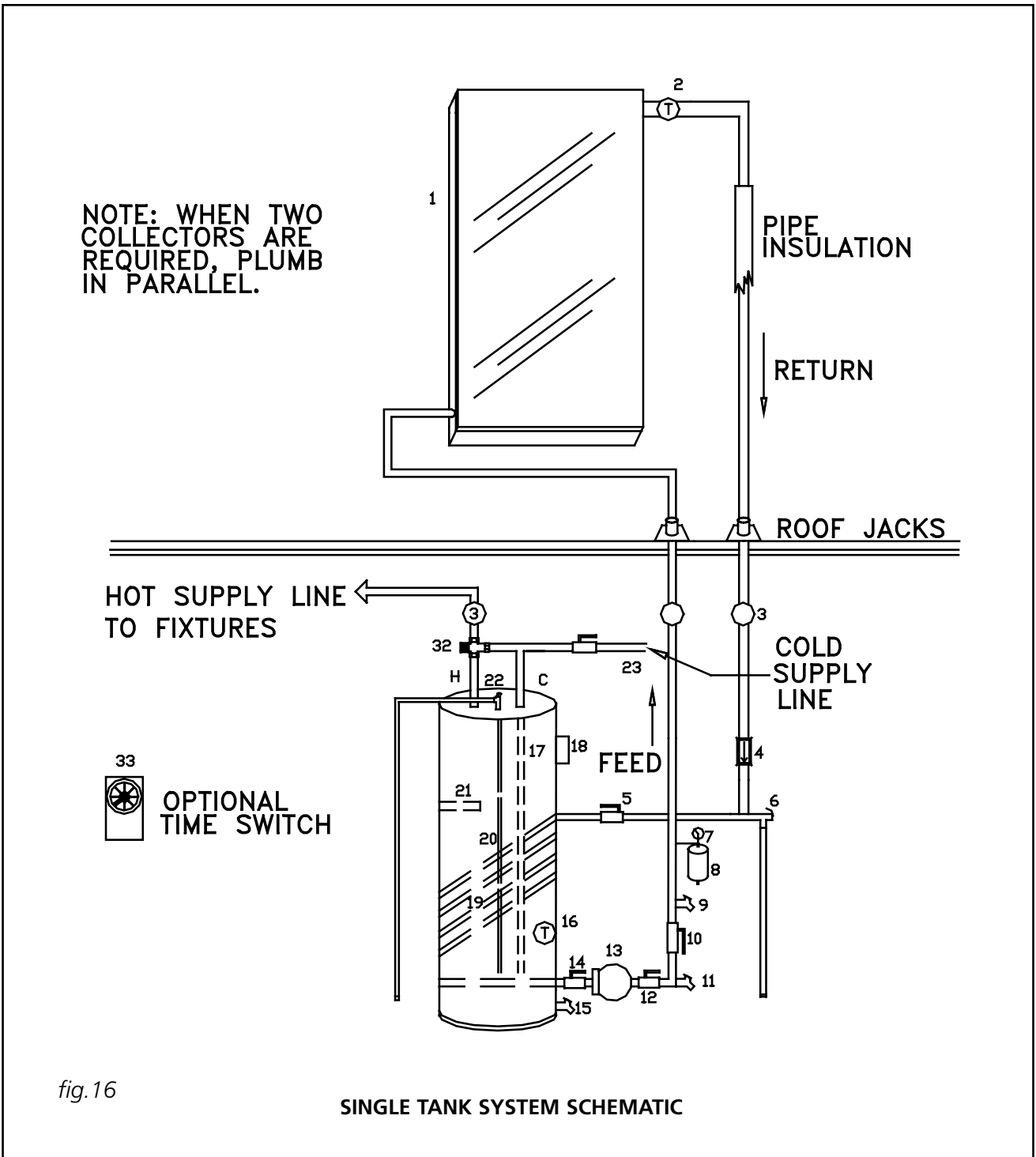
4.11.1 Begin by filling the solar tank with water. Do this by opening the cold water isolation ball valve to the solar tank (No. 23). When the tank is filled, inspect all threaded fittings and solder joints for leaks.

4.11.2 Fill and pressurize the solar collector loop with water. Begin by connecting a washing machine hose to the upper charge valve (No. 9) and fill the collector loop with water. The isolation ball valve (No. 10) remains closed at this point. While the hose is still connected to the upper charge valve and the water is running, open the lower purge/drain valve

(No. 11) and let the water run out until it is free of impurities or debris that might have entered the piping as the components were plumbed. Run the water long enough to eliminate any air bubbles that may be trapped in the system.

Close the lower purge/drain valve. The collector loop now has been subjected to city pressure and the pressure gauge should read somewhere in the range of 50 - 75 PSI in most cases (No. 7). Make a final inspection of the collector plumbing connections to ensure that there are no leaks anywhere in the collector loop piping.

4.11.3 After you have determined the integrity of the entire piping system turn on the circulating pump. Do

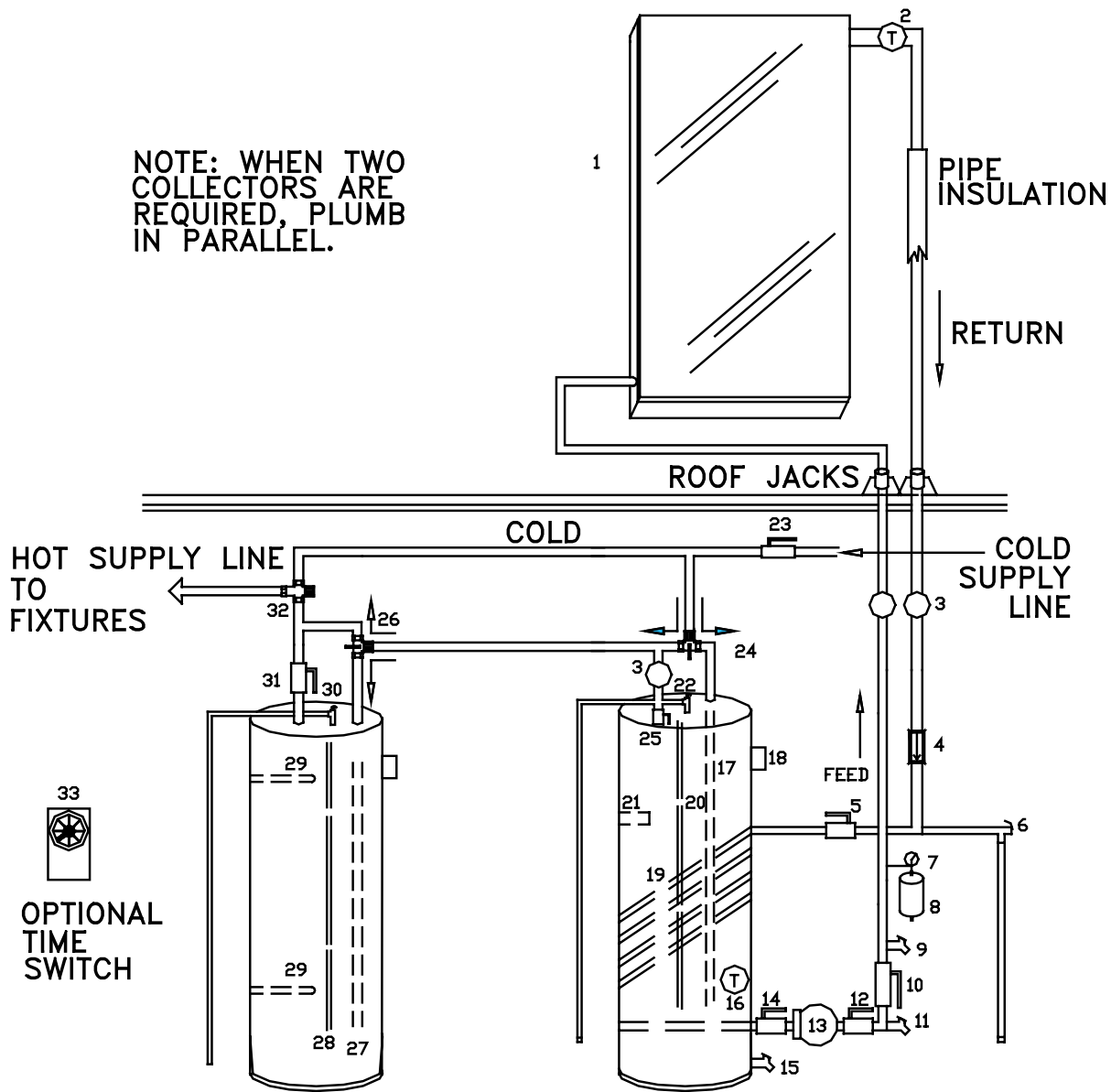


this by setting the manual switch within the controller to the "on" position. Run the pump for a full five minutes and carefully check to ensure there is proper fluid flow and that all the air has been purged from the solar collector glycol loop. An inexpensive flow meter such as manufactured by Blue White Industries or Letro is recommended as an optional system

component. A flow meter allows you to monitor and adjust the flow rate through the piping and also to visually inspect the HTF fluid quality.

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

NOTE: WHEN TWO COLLECTORS ARE REQUIRED, PLUMB IN PARALLEL.

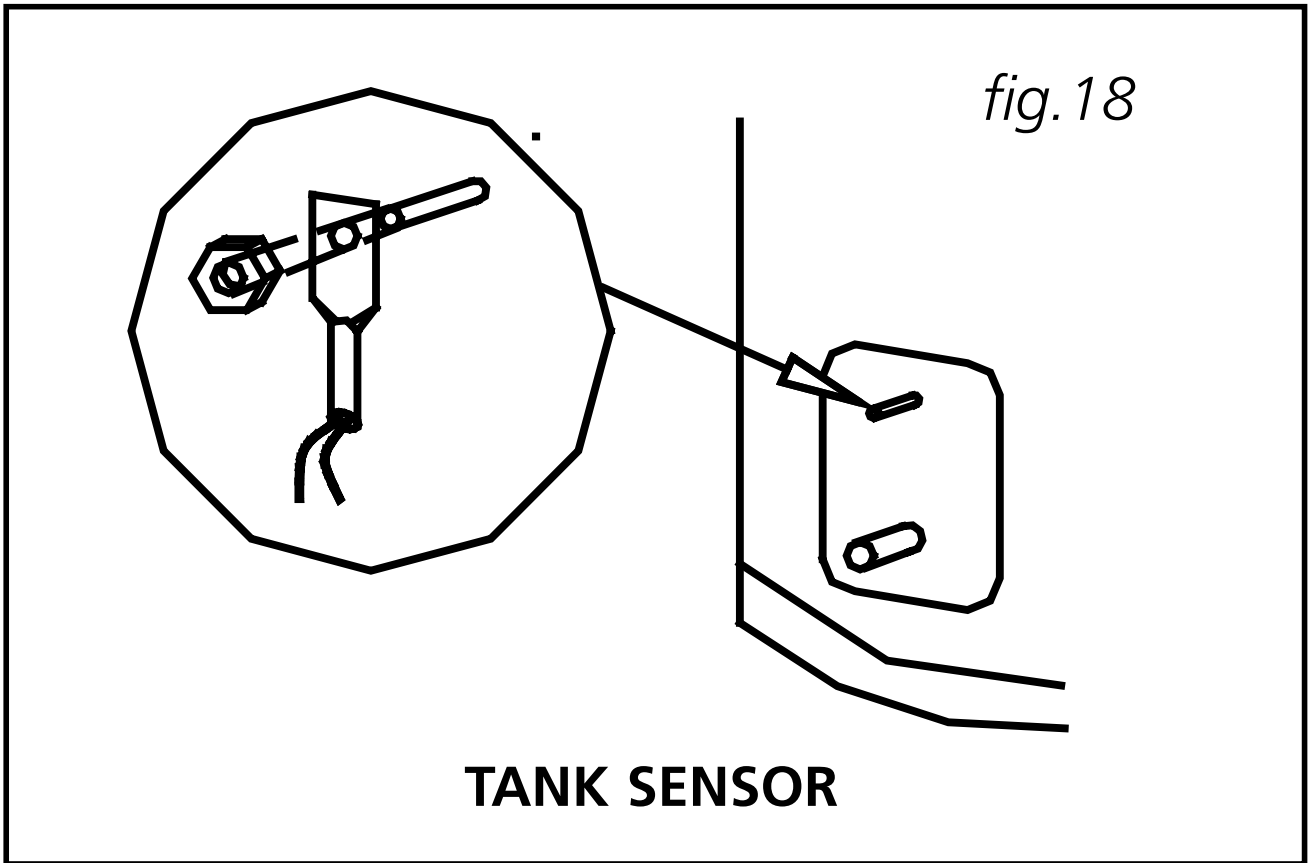


DOUBLE TANK SYSTEM SCHEMATIC

fig.17

4.11.4 Mix the Dowfrost HD propylene glycol and distilled water mixture in accordance with Table 4 and Table 5 in a large clean bucket. You will need a second empty bucket as well. The charging process also will require a low flow diaphragm pump (Flojet or equal) to fill and pressurize the collector loop.

Connect the discharge side of the pressure pump to the upper charge faucet (No. 9) Place the pump suction side hose in the glycol solution. Close the isolation ball valve (No. 10) and connect a second hose to the lower charge faucet (No. 11). Place the other end of the hose in the empty bucket.



Open the upper charge faucet and allow the pressure from the expansion tank to push the water in the glycol loop back to prime the pressure pump. When the hose in the bucket containing the glycol mixture stops bubbling you may begin charging the collector loop with glycol.

With both charge faucets now open, run the Flojet pressure pump until the pinkish glycol mixture begins flowing into the empty bucket. Quickly switch the hose from the empty/return bucket to the bucket containing the glycol mixture. Continue to circulate the fluid using the pressure pump until the bubbling has stopped and the air has been purged.

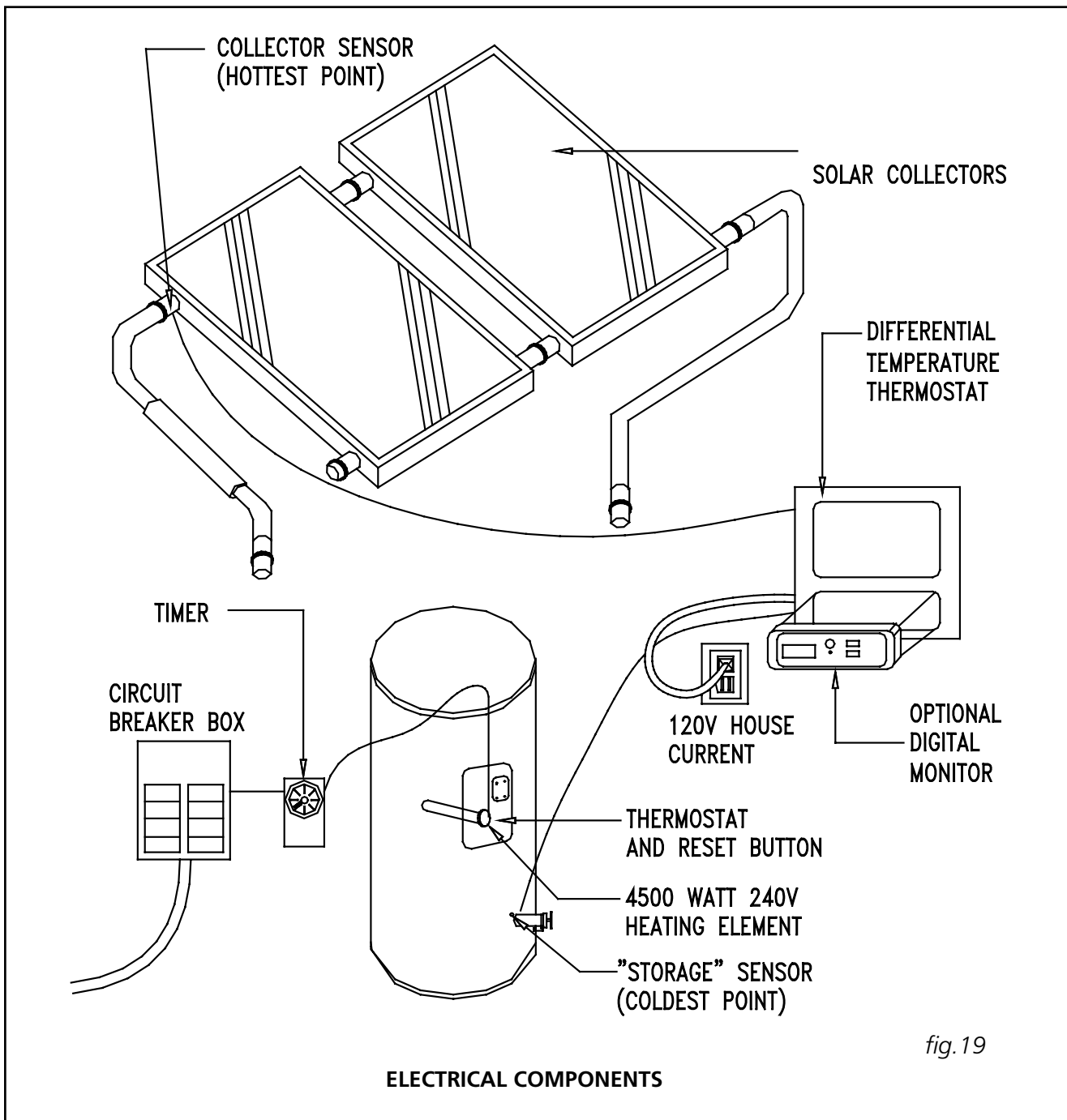
4.11.5 After charging the collector loop, shut the lower charge faucet and let the pressure pump drive up the loop pressure to the appropriate level (Generally in the range of 25 PSI). To more accurately calculate the proper pressure measure the height of the solar collector above the solar storage tank and divide this number by 2.31. Then add 20 PSI to this number. As a word of caution, the pressure in the glycol loop should not exceed 45 PSI when the system is

operational on a good sunny day. Contact your solar contractor if the charged collector loop pressure exceeds this threshold.

Your Rheem solar water heating system must be charged and the fluid quality maintained by an experienced contractor. If the system is drained during the winter, or you notice a significant drop in collector loop pressure, contact your installation contractor immediately for service. The glycol HTF provides the freeze protection for your system and must be properly maintained. An experienced contractor should periodically check the HTF fluid quality.

4.11.6 Dowfrost HD HTF

To ensure maximum effectiveness for corrosion protection, the glycol inhibitor package is designed for a minimum 25-30 percent concentration of glycol in water. Table 4 shows the concentrations of Dowfrost HD required to provide freeze and burst protection at various temperatures. Use the mixture most appropriate for your climate. Do not use a higher glycol to water concentration than necessary,



as this will adversely impact the relative heat transfer efficiency of the solution.

Generally, for an extended margin of protection, you should select a temperature that is at least 5°F lower than the expected lowest ambient temperature. These figures are examples only and should not be regarded as specifications. As conditions are not within our

control, neither Rheem nor Dow Chemical guarantees that freeze damage may not occur at temperatures other than shown.

Water used to dilute the HTF must meet certain minimum standards for purity. Impurities in the dilution water can increase metal corrosion, reduce the effectiveness of corrosion inhibitors, increase inhibitor

depletion rate, and cause the formation of scale and other deposits on the heat exchanger's internal heat transfer surfaces.

Distilled or deionized water is required.

The HTF pH level must be maintained between 8 and 10 to minimize corrosion and glycol oxidation in the piping system.

5) SYSTEM START-UP PROCEDURES

Throughout the installation procedures outlined in Section 4 above, emphasis has been placed on the correct procedures for plumbing and wiring the components, checking for plumbing leaks, pressurizing the collector glycol loop, and eliminating any trapped air that can impact fluid quality and pump performance. Having completed these tasks it is time to start up your Rheem solar water heating system.

When the glycol loop has been fully charged and the pressure is around 25 psi (check the pressure gauge, No. 7), set the differential controller to the "Automatic" setting. This will activate your circulating pump. The controller allows you to set the "on" differential. Turn the red rotary switch inside the control housing to 12.

Adjust the valve settings in accordance with Section 6 below.

Table 4		
Percent (volume) Glycol Concentration Required		
Temperature F	For Freeze Protection	For Burst Protection
20	18%	12%
10	29	20
0	36	24
-10	42	28
-20	46	30
-30	50	33
-40	54	35
-50	57	35
-60	60	35

6) THREE MODES OF SYSTEM OPERATION

Both single and double tank Rheem systems are designed to accommodate three separate modes of operation. Your solar water heating system can, (1) provide 100% solar operation during good weather, or (2) serve as a preheater to your electric water heater adding solar energy when and as available, or (3) completely bypass the solar collector loop and solar storage tank and run 100% on utility power during inclement weather.

Single Tank Operating Instructions:

6.1 100% 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.

6.2 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.

6.3 100% Utility Power

Leave the circuit breaker to your solar storage tank on and close the isolation ball valves in the collector loop (Nos. 5 and 10). In this mode of operation you must turn off the circulation pump. To turn the pump off

Table 5	
Total Collector Loop Fluid Capacity In Gallons	
1 Collector System	4 Gallon
2 Collector System	5 Gallons

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:

6.4 100% 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. 24 and 26). Valve handle No. 24 must be in the horizontal position. Valve handle No. 26 must be in the vertical position. See Figure 19a, 100% Solar Operation.

6.5 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. 24) must be in the vertical position. Each valve handle (Nos. 24, 25 and 26) must be placed in the horizontal position. See Figure 19b, Solar Preheat.

6.6 100% Utility Power

Follow the instructions for the single tank system above. All three ball valves above the heaters (Nos. 24, 25 and 26) must have the valve handles placed in the horizontal position. See Figures 19c 100% Utility Power and 19d.

7) ISOLATING THE MAJOR COMPONENTS AND SYSTEM SHUT DOWN PROCEDURES

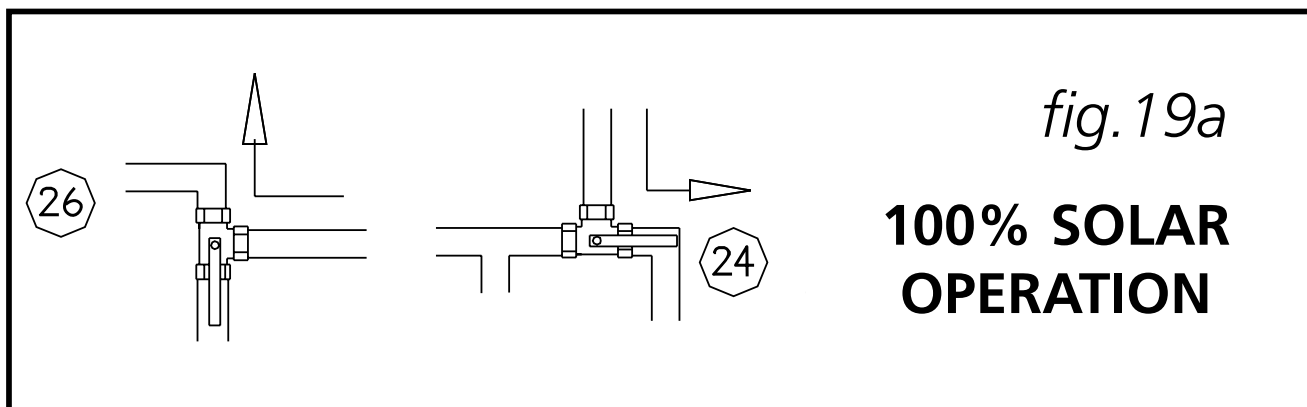
Your Rheem solar water heating system is designed so that the key components can be easily isolated for emergency repairs or routine maintenance. By shutting a single valve you can isolate the entire system from the pressurized cold water supply line (No. 23). In the case of a storage tank or fitting leak immediately shut this valve and call your installation contractor for service.

The collector loop can be isolated from the solar storage tank by closing isolation ball valves Nos. 5 and 10. If the pressure in this loop drops or you find a glycol leak shut these valves and contact your installation contractor. Turn the circulating pump off by setting the controller to the "off" position.

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

Set the valve handle on the three way ball valve (No. 24) to the horizontal position and close the isolation ball valve (No. 25). By closing these two valves the tank can be serviced or replaced. The operation of the back-up water heater will not be effected.

The back-up water heater in two tank systems also can be isolated from the rest of the system. Close the cold water supply line ball valve (No. 23) and set the three way valve handle above the conventional water heater (No. 26) to the vertical position. Set the two way ball valve handle (No. 30) directly above the heater to the horizontal position.



8) SUMMER VACATION RECOMMENDATIONS AND PROCEDURES

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 HTF. Rheem recommends that you cover the collectors if practical.

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

8.1 Turn the controller to the "off" position (No. 18).

8.2 Connect one end of a garden hose to the purge/drain valve (No 11) and place the other end in a five gallon bucket. Open the valve and gravity will drain the heat transfer fluid into the bucket. A licensed recycler, reclaimer or incinerator must dispose of the Dowfrost HD.

DO NOT DUMP DOWFROST HD INTO A STORM SEWER, ON THE GROUND OR INTO

ANY BODY OF WATER. BE CAREFUL. THE HTF MAY BE EXTREMELY HOT!

8.3 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. 33).

When you return home contact your service contractor to recharge the system with HTF. After the system has been recharged, set the controller to the "automatic" position. Reset the time switch.

9) MAINTENANCE AND TROUBLESHOOTING

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

9.1 Fluid Quality: It is extremely important to monitor the quality of the Dowfrost HD HTF on a periodic basis. The chemical composition of the heat transfer fluid may change over time. System pH must be maintained between 8 and 10 to avoid damage to the collector loop and absorber plate piping.

9.2 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. 20). 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

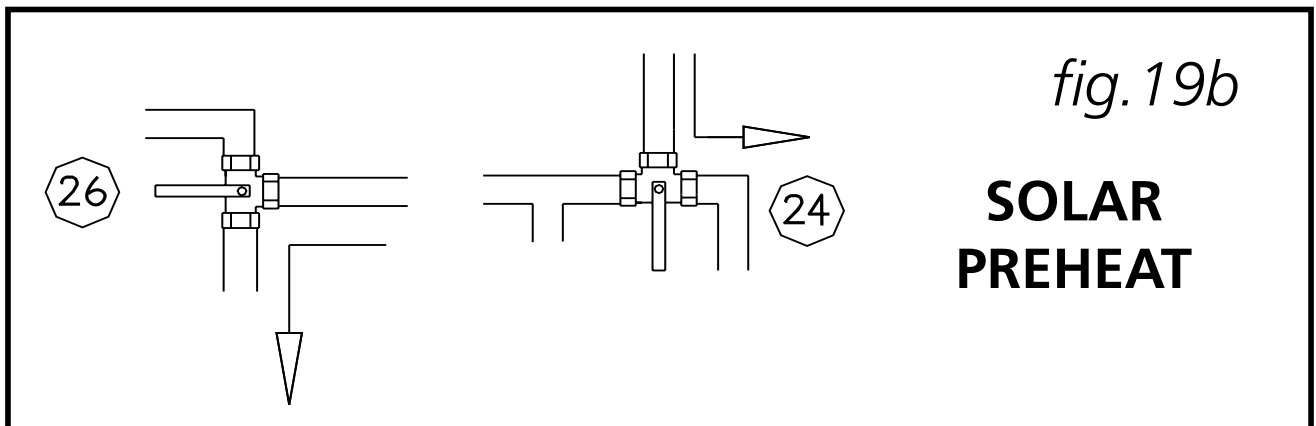
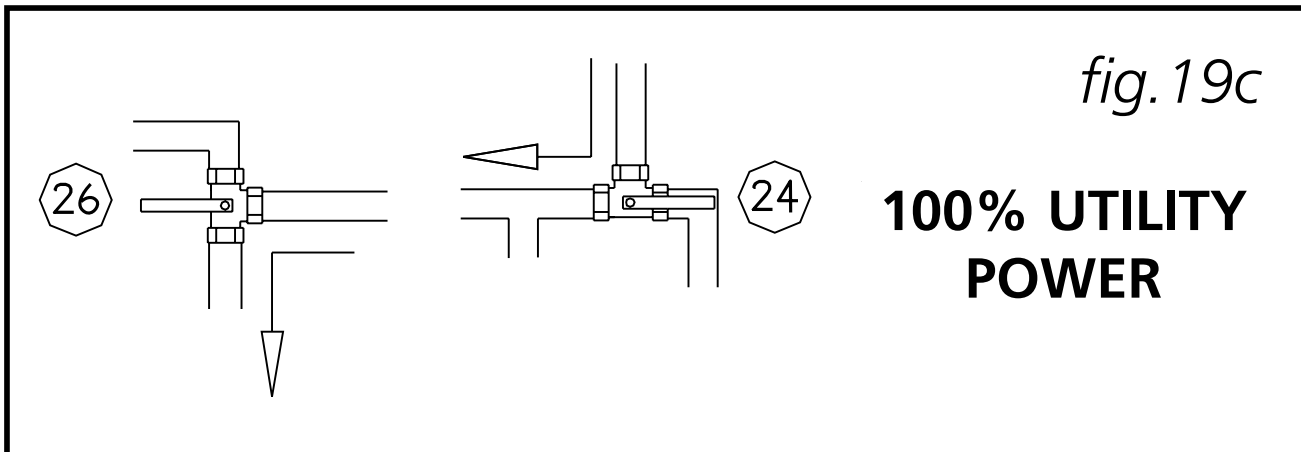


fig. 19b

**SOLAR
PREHEAT**



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.

9.3 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.

9.4 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.

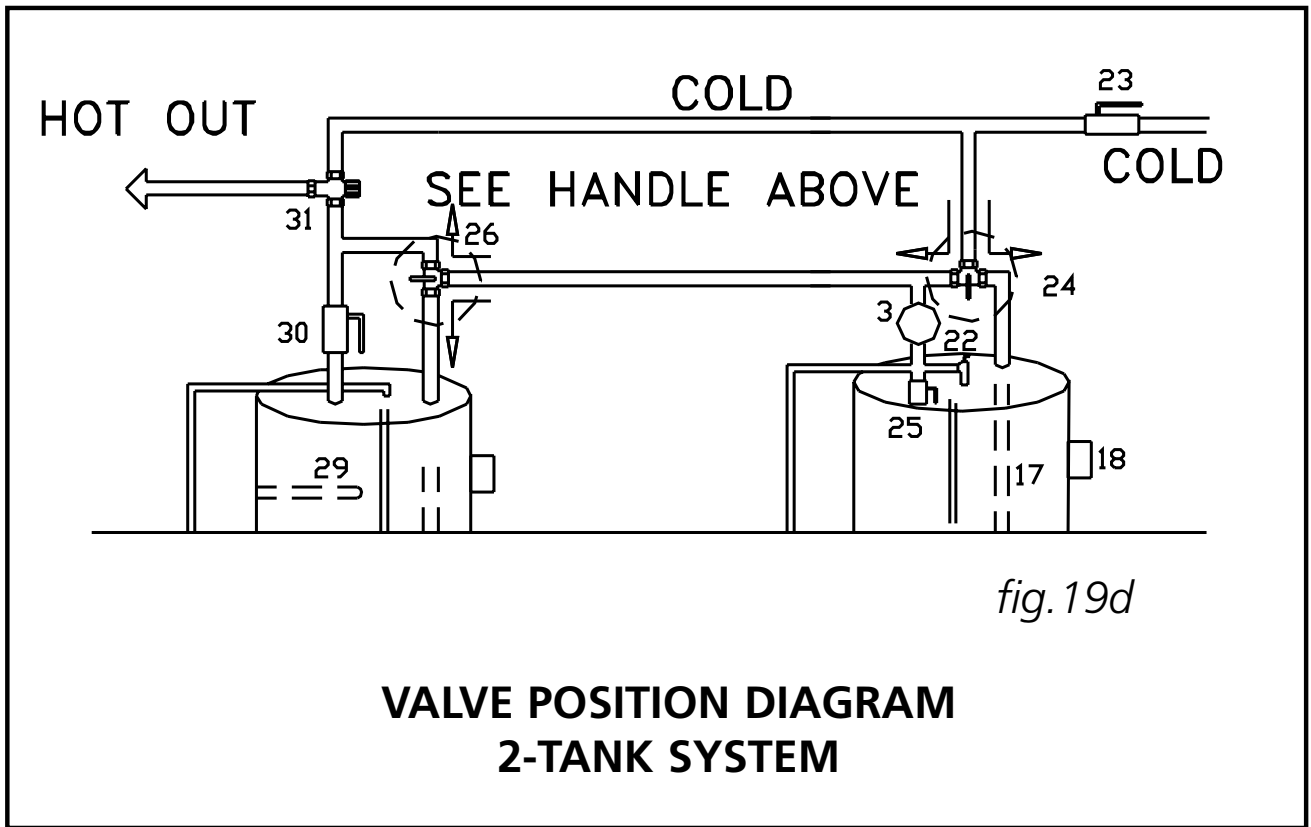
9.5 Check the exterior pipe insulation annually and patch or repair any exposed surfaces or degraded areas. Repaint as necessary.

9.6 In the unusual instance of collector glass breakage, the glass should be replaced immediately. This will reduce the likelihood of water accumulating inside the collector and deteriorating the insulation. Contact your installation contractor.

9.7 If you detect a glycol or water leak, or the glycol loop pressure drops unexpectedly, contact your installation contractor immediately to diagnose the problem and recharge the system.

9.8 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 pump directly into a nearby 115 volt outlet. If the pump does not run it may need to be replaced. If the pump does run when plugged directly into the wall outlet, the problem may be located in the controller or one of the 10k ohm sensors. Contact your installation contractor for service.

9.9 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. 4) may not be seating correctly and should be cleaned or replaced. Also make sure that the circulating pump is not running after 6:00 p.m. If the pump is running and the control indicator light "Solar" #1 is on after 6:00 p.m., 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 (No. 3) in the collector loop piping to detect night thermosiphoning.

9.10 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 fig 17, No. 29).

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. If 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.

10) Rheem SYSTEM COMPONENT PARTS

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

1) Rheem Solar Collector(s): Absorbs the sun's heat energy and transfers this heat to the HTF 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. *(Provided)*

3) Tank and Line Thermometers: Used to determine proper system operation. Line thermometers will show an approximate 5 - 12° temperature difference between the collector supply and return lines on sunny days. In a single tank system the tank thermometer will read the temperature of the water after the mixing valve feeding your fixtures. In two tank systems the thermometer will read the finished solar tank temperature. *(Provided)*

4) 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 sometimes referred to as one way valves. *(Provided)*

5) Isolation Ball Valve: Used in conjunction with component No. 10 to isolate the solar collector loop from the solar storage tank. *(Not Provided)*

6) Pressure Relief Valve: Will release glycol loop HTF at 150 PSI. If this valve opens and HTF fluid is expelled contact your contractor immediately. This valve also can be opened to drain the HTF from the charged glycol loop for replacement. *(Provided)*

7) Pressure Gauge: Indicates the pressure in the charged glycol collector loop. *(Provided)*

8) Expansion Tank: Pre-charged with air to allow for the expansion and contraction of the glycol HTF as it heats and cools. *(Not Provided)*

9) Charge Valve: Used to charge the collector loop with glycol and also to eliminate air from the system. *(Not Provided)*

10) Isolation Ball Valve: Used in conjunction with component No. 5 to isolate the solar collector loop from the solar storage tank. Also used with the charge valves to fill and pressurize the collector glycol loop (Nos. 9 and 11). *(Not Provided)*

11) Drain/Purge Valve: Used to charge the collector loop with glycol, purge air from the loop and drain the heat exchange fluid. *(Not Provided)*

12) Isolation Ball Valve: When closed in conjunction with No. 14 will isolate the circulation pump for repair or replacement. *(Not Provided)*

13) Circulating Pump: Circulates the HTF through the collector loop. *(Provided)*

14) Isolation Ball Valve: When closed in conjunction with No. 12 will isolate the circulation pump for repair or replacement. *(Not Provided)*

15) Flush Valve: Used to drain the solar storage tank and to flush sediment from the tank on an annual basis. *(Not Provided)*

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

17) 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)*

18) 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 may be set to limit high temperature build up in the solar storage tank. *(Provided)*

19) Heat Exchanger: Transfers heat from the solar collector loop to the potable water in the solar storage tank. *(Provided)*

20) 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)*

21) 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)*

22) 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)*

23) Cold Water Supply Line Isolation Ball Valve: 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)*

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

25) Isolation Ball Valve: Used in conjunction with component No. 24 to completely isolate the solar storage tank for repair or replacement as necessary. *(Not Provided)*

26) Three Way Ball Valve: Used in conjunction with component No. 24 to establish the proper mode of system operation. *(Not Provided)*

27) Cold Water Dip Tube: See No.16 above. 28) Anode Rod: See No. 18 above. 29) Heating Elements and Thermostats: See No. 19 above. In a two tank system the back-up electric water heater has two heating elements and two thermostats. *(Provided)*

30) Temperature and Pressure Relief Valve: See No. 22 above. *(Provided)*

31) Optional Isolation Ball Valve. Use with component No. 26 to completely isolate the back-up water heater for repair or replacement. *(Not Provided)*

32) Mixing Valve: Automatically blends hot water from the solar storage tank with incoming city cold water to an acceptable set point. A mixing valve must be installed on every Rheem solar water heating system. *(Provided)*

33) 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)*

34) Thermal Well (Not Pictured)

11) Rheem SYSTEM MODEL NUMBERS:

RS80-48BP

RS120-64BP

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PLEASE VISIT OUR WEB SITE FOR NEW PRODUCT UPDATES, ANSWERS TO FREQUENTLY ASKED QUESTIONS (FAQ) AND USEFUL INFORMATION ABOUT SOLAR WATER HEATING SYSTEMS.



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.