



Instruction Manual for Domestic Solar Water Heating System Numbers:

This Manual Contains:

- Installation Instructions
- Operating Instructions
- Maintenance Procedures
- Safety Precautions

- SUN HoM DB-8040
- SUN HoM DB-8042
- SUN HoM DB-8048
- SUN HoM DB-8064
- SUN HoM DBSA-8040
- SUN HoM DBSA-8042
- SUN HoM DBSA-8048
- SUN HoM DBSA-8064
- SUN HoM DBSA-12063
- SUN HoM DBSA-12064
- SUN HoM DBSA-12072
- SUN HoM DBSA-12080

PLEASE READ THIS ENTIRE MANUAL BEFORE BEGINNING INSTALLATION OR ATTEMPTING TO OPERATE THIS SYSTEM

All **Safety Precautions** are posted as **WARNINGS** or **CAUTIONS** in text boxes.

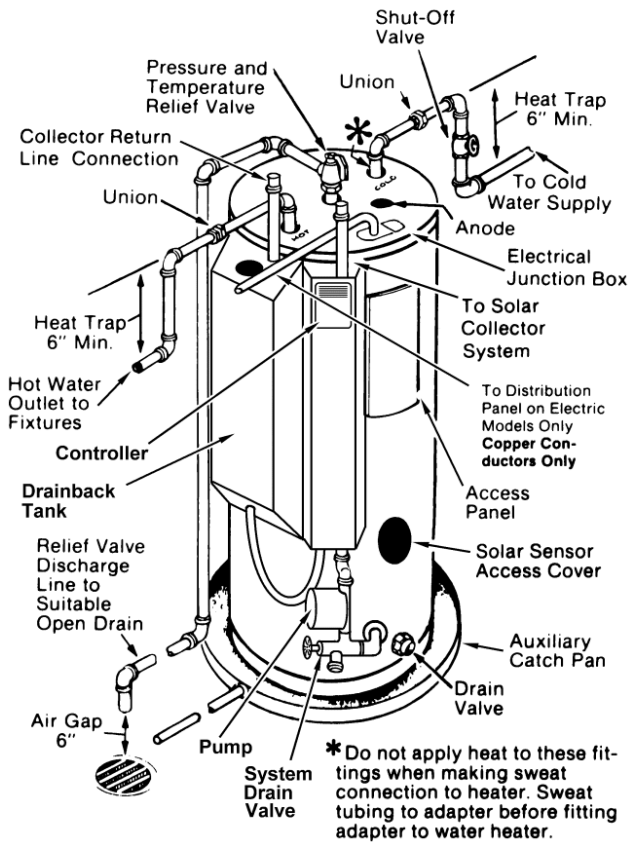


Figure 1. Tank System Assembly, DB type

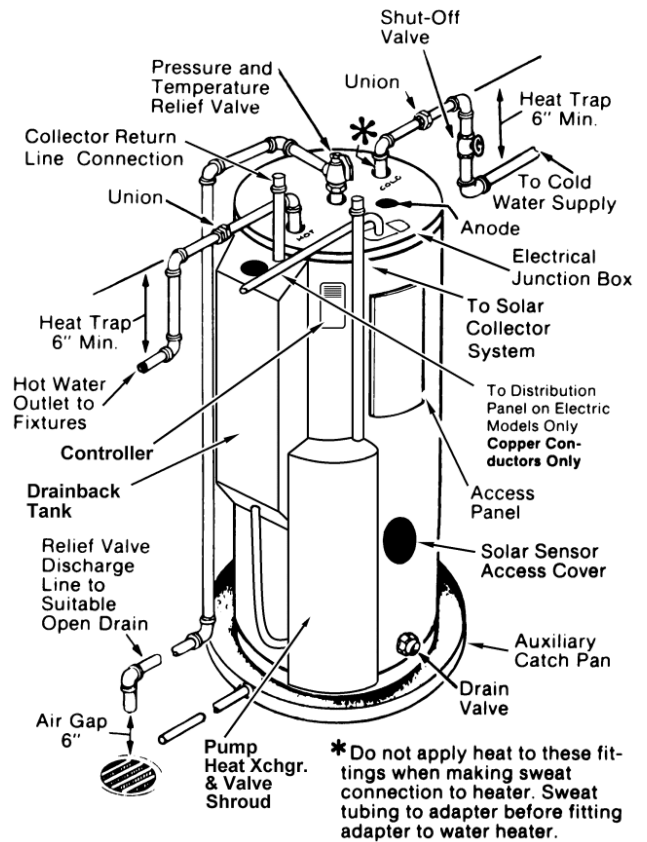


Figure 2. Tank System Assembly, DBSA type

INSTALLATION

This product is designed for use in indirect domestic solar water heating systems – other applications, made without written factory approval, will void the warranty.

The design and installation of solar water heating systems should only be undertaken by qualified individuals. Solar water heating systems involve components and operating principles not found in standard household plumbing installations. Often, high operating temperatures, alternate fluids and unusual plumbing techniques are an integral part of solar systems. Failure to understand good design and installation practices can affect the health and safety of the system user. Poor practices will also reduce system performance.

This systems described in this manual are equipped with electrical heating elements in the storage tank. This qualifies them as solar electric storage water heaters and as such must be installed in accordance with federal and local codes. The location chosen for the system should be as close as possible to the faucets most frequently used, and the piping should be insulated.

HEAT EXCHANGER LOOP AND SOLAR CONNECTIONS:

The DB type systems are equipped with a wrap around, vented double wall heat exchanger that provides positive leak detection. DBSA systems have an external side arm, thermo-syphon heat exchanger that is not double walled. Both type heat exchangers are of copper and brass construction. To prevent dissimilar metals corrosion, use only copper and/or brass panels, piping, and fittings in the solar loop.

Flow rates through the solar heat exchange loop are recommended to be no more than 4 gpm to limit the effects of erosion corrosion. The system employs a **TACO 008 or 009 Bronze** circulator pump to move the heat collection fluid from the heat exchanger to the collector. Table 1., shows the flow rate curves for these pumps. If the distance from the pump to the top of the collectors is sufficient to keep the flow at or below 4 gpm then no flow control is required. If not it may be necessary to install flow metering devices in the collector loop. Only a licensed, certified contractor should do this.

This system is a DRAINBACK type using a high strength, high temperature polymer drainback

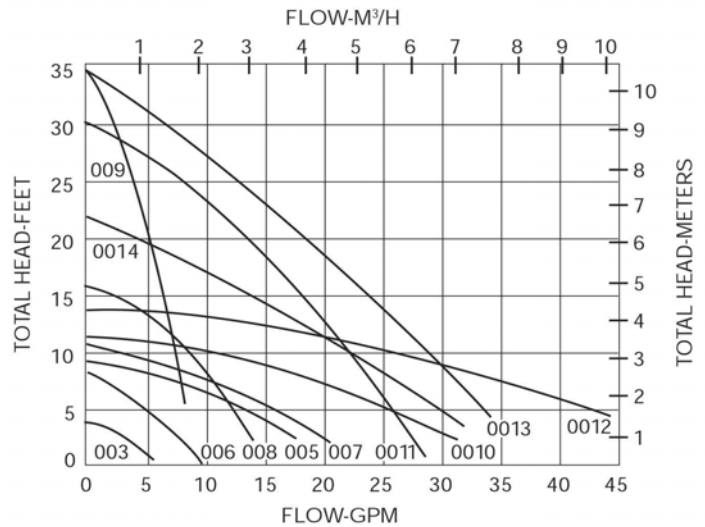


Table 1. Taco Pump Curves

reservoir with a capacity of 8.4 gallons. The recommended heat transfer fluid (HTF) for these systems is **DISTILLED WATER**. The drainback configuration insures that there is no fluid present in the solar collectors when the pump is turned off thereby removing the need for anti-freeze solutions. In the event the installer wishes to further insure the safety of the system against freezing, a gallon of propylene glycol can be added to the heat transfer reservoir before the distilled water is added. See “Parts Number List”, page 17, for recommended Brand.

Adding propylene glycol IS NOT REQUIRED.

At the owner’s or installer’s request the manufacturer can supply the proper additive. If this option is selected then a regular method of checking the heat transfer fluid for PH level must be implemented to insure the protection of the heat transfer piping and components. (See System Fluid Check, page 15.)

WARNING: Many heat transfer fluids are TOXIC. Be absolutely sure of the fluid being introduced into the drainback reservoir before it is added.

Damage to the heat transfer loops can occur when temperatures exceed 180°F. The solar controller incorporated in this system has a high limit preset at the factory to 170°F. Increasing this setting will void the warranty on the system. Do not operate the solar system if water temperature exceeds 170°F. If temperatures exceed 170°F shut off the solar system and perform “**Water is to HOT**” troubleshooting checks on page 18.

POTABLE WATER CONNECTIONS:

Be sure to make all potable water connections prior to installation of the solar components. Follow the steps below to insure proper sequence. With the exception of the tank drain valve, all potable water connections are located on the top of the water heater. Locate and identify connections before proceeding with the installation.

WARNING: DO NOT Connect potable water lines to the To and From connections to the solar collector. Serious injury and damage can occur. DO NOT introduce heat transfer fluids to potable water lines

1. **“COLD”** Connect the cold water supply to the connection marked “COLD” on the top of the water heater tank. Install a shut off valve in the cold water line near the water heater. See Figures 1 and 2.
2. **“HOT”** Connect the hot water line to the connection marked “HOT” on top of the water heater tank. See Figures 1 and 2.

WARNING: The manufacturer’s warranty does not cover any damage or defect caused by installation, attachment or use of any type of energy saving devices (other than those authorized by the manufacturer) into or onto or in conjunction with the water heater system. The use of unauthorized energy saving devices may shorten the life of the water heater and may endanger life and property. The manufacturer disclaims any responsibility for such loss or injury resulting from the use of such unauthorized devices.

If it is more convenient, the COLD connection on top of the water heater can be used as the HOT water outlet. If connections are used in reverse, remove the dip tube and gasket from COLD outlet. Discard the gasket. Install close a nipple in HOT connection and insert the dip tube into the close nipple. HOT connection can then be used as regular COLD connection.

CAUTION: The water heater should not be located in an area where leakage of the tank or connections will result in damage to the area adjacent to it or to lower floors of the structure. When such areas cannot be avoided, it is recommended that a suitable catch pan, adequately drained, be installed under the water heater. See Figure 1. and 2.

NOTE: Catch pan must conform to local codes

3. **“Temperature and Pressure (T&P) Relief Valve”** Install the T&P Relief Valve in the marked opening on top of water heater. See Figure 1. and 2. The pressure rating of the relief valve must not exceed the working pressure rating of the water heater tank as marked on the tank’s rating plate (150 psi for standard glass-lined tank). If other components in the system have a lower working pressure, the T&P relief valve should be selected accordingly. The BTUH Rating of the relief valve must not be less than the input rating of the water heater (1 watt = 3.412 BTUH).

Refer to Figures 1. & 2. for the following. Install the T&P relief valve in the 3/4" NPT fitting provided and marked for the purpose on the water heater. The outlet of the relief valve should be directed to a suitable open drain, so that the discharge water cannot contact live electrical parts and to eliminate potential water damage. The discharge line must be no smaller than outlet of the relief valve. Material for the discharge line shall be of the type used for hot water distribution. The valve and the line must drain fully by gravity. The end of the discharge line should terminate within 6 inches of an open drain, should not be concealed and should be protected from freezing. No valve or restriction of any type shall be installed between the relief valve and tank or in the discharge line. Follow all local codes.

CAUTION: For protection against excessive pressure and temperature, install temperature-and-pressure protective equipment required by local codes, but not less than a combination temperature-and-pressure relief valve certified as meeting the requirements of ANSI Z21.22-1979, by a nationally recognized testing laboratory.

4. **FILL the TANK.** Refer to Figures 1 & 2 for this procedure. After making sure the Drain Valve is closed, open the Shut Off Valve in the cold water line. Open hot water faucet in the highest location in the dwelling and keep it open until water flows from it in a steady stream.

CAUTION: Hydrogen gas can be produced in a water heater that has not been used for a long period of time (generally two weeks or more). HYDROGEN GAS IS EXTREMELY FLAMMABLE. To dissipate such gas and to reduce the risk of injury, it is recommended that the hot water faucet be opened for several minutes at the kitchen sink before using any electrical appliance connected to the hot water system. If hydrogen is present, it usually sounds like air escaping through the pipe as the water begins to flow. Do not smoke or use an open flame near the faucet at the time it is open.

ELECTRICAL CONNECTIONS:

WARNING: The water heater should not be installed in an area where flammable liquids are stored, or where vapors from combustible liquids might be ignited by the arc drawn within the water heater's thermostat when it cycles.

All connections for power to the electric element are to be made to the junction box on top, front of the tank. A separate branch circuit from the electrical distribution panel that uses copper conductors, an overcurrent protective device and suitable disconnecting means must be provided by a qualified electrician. (Refer to Table 2) All wiring must conform to local codes or National Electrical Code NFPA No. 70 -1981.

WARNING: The presence of water in the piping and water heater does not provide sufficient conduction for a ground. Non-metallic piping, dielectric unions, flexible connectors, etc., can cause the water heater to be electrically isolated.

The branch circuit wiring should include either:

1. Metallic conduit or metallic sheathed cable approved for use as a grounding conductor and installed with fittings approved for the purpose.
2. Non-metallic sheathed cable, or metallic conduit or metallic sheathed cable not approved for use as a grounding conductor, shall include a separate conductor for grounding. It should be attached to the ground terminals of the water heater and the electrical distribution box.

CAUTION: Tank **MUST BE FULL OF WATER BEFORE** power is turned on. Heating element **WILL BE DAMAGED** if energized for even a short time while tank is dry, thus voiding the limited warranty for the electric element.

Adjusting the Thermostat: The Thermostat is set at the factory to 120°F. This setting is satisfactory for average household use. If water of different temperature is required set indicator on thermostat to the desired temperature.

NOTE: Households with small children, elderly people or invalids may require lower temperature settings to prevent accidental contact with "HOT" water.

Adjustments to the temperature setting of the electrical element can be made through the access panel located on the front panel of the water heater tank.

CAUTION: Make certain Power to water heater is **OFF** prior to opening access panel for any reason. Power is removed by throwing the breaker supplying power.

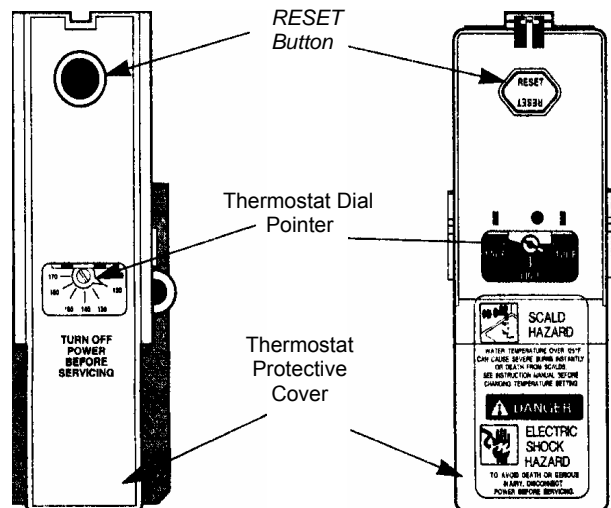
There is a Hot Water SCALD Potential if the thermostat is set too high.

TIME /TEMPERATURE RELATIONSHIPS IN SCALDS

Temperature	Time to Produce Serious Burn
120°F.	More than 5 minutes
125° F.	1 1/2 to 2 minutes
130°F.	About 30 seconds
135°F.	About 10 Seconds
140°F.	Less than 5 seconds
145° F.	Less than 3 seconds
150°F.	About 1 1/2 seconds
155°F.	About 1 second

Table courtesy of Shriners Burn Institute

If adjustment of the tank thermostat is necessary, **turn off** the power to the water heater. (Throw the breaker) Remove jacket access panel and insulation exposing thermostat. The thermostat protective cover **should not be removed**. With a small screwdriver, set the thermostat dial pointer to desired temperature. Replace the insulation and jacket access panel. Turn on the power to the water heater.



CAUTION: HOTTER Water increases risk of SCALD injuries.

COMBINATION Thermostat-High Limit Control

This water heater is equipped with a combination "Thermostat-High Limit Control" which is located above the heating element. If for any reason the water temperature becomes excessively high, the "High Limit Control" breaks the circuit to the heating element. Once this switch opens, it must be manually reset. However, THE CAUSE OF THE OVER TEMPERATURE CONDITION MUST BE CORRECTED FIRST.

To Reset — Press the "Red" reset button in toward the tank.

!!! DANGER !!! Changing the setting of the electric backup element does not reduce the temperature which the solar energy can raise the water too. This can only be done by changing the high limit setting on the solar controller or by the installation of an approved tempering valve in the HOT water line to the house.

The final step in the electrical installation procedure is to plug in the solar controller which is done at the end of the solar equipment installation and after the Drainback tank has been filled. **Do Not** plug in the controller prior to this.

WATER HEATER TANK SERVICE:

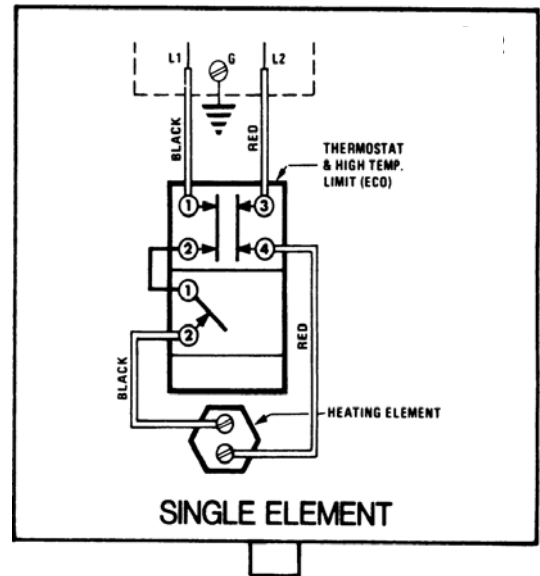
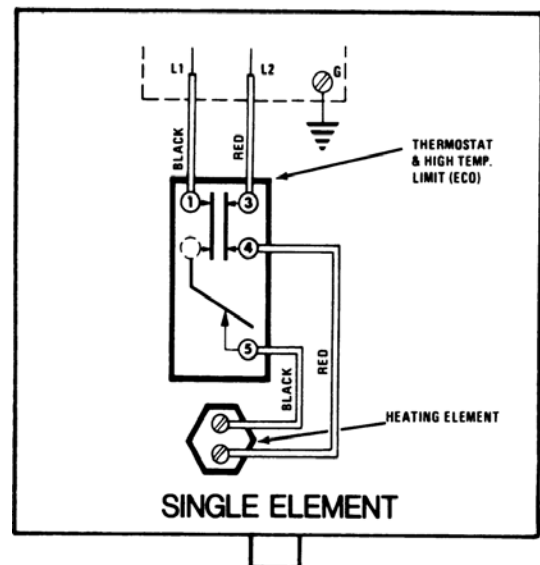
It is recommended that a few gallons of water be drained from the water heater every two months. This will flush lime and sediment deposits from the bottom of the water heater and lengthen the water heater's service. To flush the tank:

1. first attach a hose to the 3/4" hose connection on the Drain Valve.
2. Place hose so that water is directed to a drain where it will not cause damage.
3. Open the Drain Valve and allow several gallons to purge.
4. Close Drain Valve

CAUTION:

The water released by this valve CAN BE HOT.

Electric Element Wiring Diagrams

ROBERTSHAW THERMOSTATS**THERM-O-DISC THERMOSTATS**

Watt Load	Recommended Over Current Protection Rating			Copper Wire Size - AWG Based on N.E.C. Table 310-16 (60°C.)			Approx. Recovery Gal. Per Hour@ 100° F. Rise
	120 V	208 V	240 V	120 V	208 V	240 V	
1500"	15	15	15	12	14	14	6.1
2000	20	15	15	10	14	14	8.2
2500	30	15	15	10	14	14	10.2
3000	30	20	15	8	12	12	12.3
3500	—	20	20	—	10	12	14.3
4000	—	25	20	—	10	10	16.4
4500	—	30	25	—	10	10	18.4
5000	—	30	30	—	10	10	20.5
5500	—	35	30	—	8	10	22.5
6000	—	35	30	—	8	8	24.6

TABLE 2

Branch Circuit Sizing Guide based on N.E.C. NPPA No. 70-1981.
 •Wattages less than 1500 watts may be wired 14 gauge with 15 amp protection.

SOLAR COLLECTOR INSTALLATION:

Collector Orientation

The performance of solar water heating systems 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 un-shaded by any permanent obstacle between 9:00 a.m. and 3:00 p.m. on any day of the year.

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.

The solar collectors in a two collector staggered mount installation must be spaced far enough apart to prevent winter shading. Figure 4 and Table 1 show the correct spacing between collectors to prevent shading on December 21, when the sun is at its lowest angle.

Basic Mounting Procedures

The solar collectors in your SUN HōM solar System can be mounted in either a vertical or horizontal orientation on the roof (Figure 3). Because the freeze protection method is Drainback it is strongly recommended the collector always be mounted in vertical orientation. It is still important to slope the

collectors just slightly to allow for complete drainage during off mode. The required slope is at least 1/4" vertical rise 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 Energy Inc. 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 limited attic access, mounting the collectors nearer the roof peak provides for additional attic workspace.

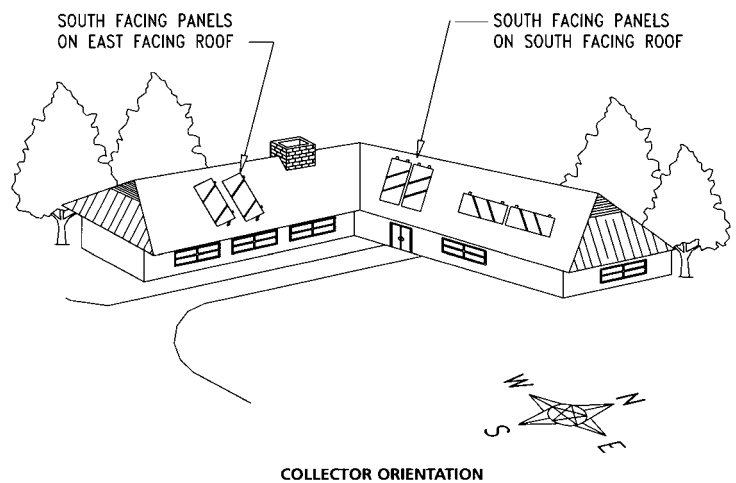


Figure 3.

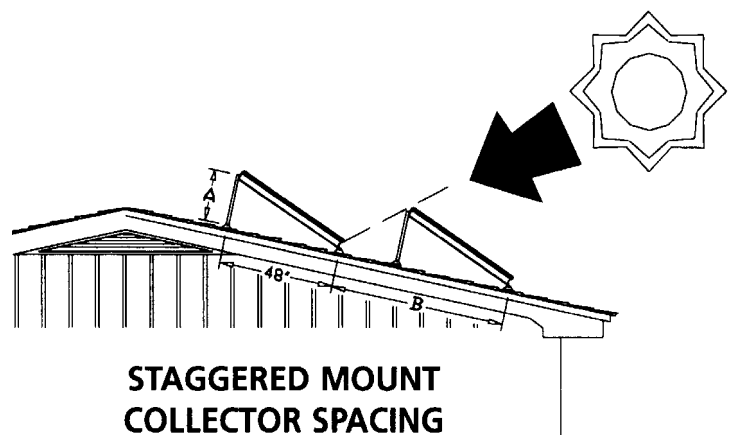
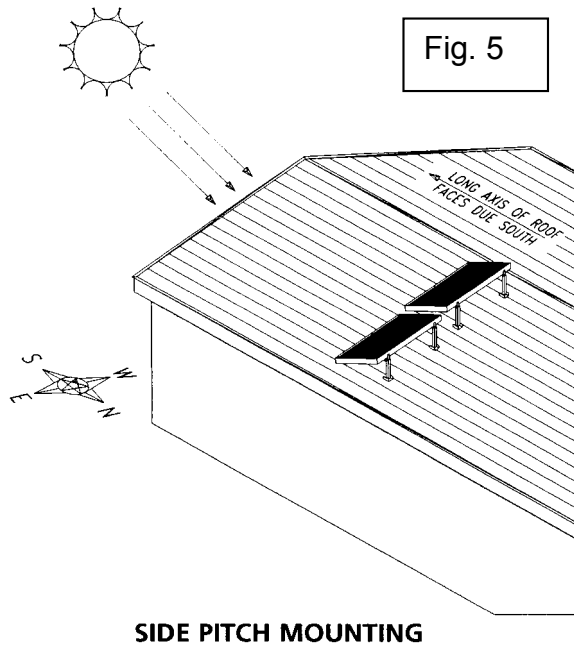


Figure 4.

TABLE 3.

LATITUDE		25°N		30°N		35°N		40°N		45°N		50°N		
COLLECTOR TILT		35°		40°		45°		50°		55°		60°		
Figure 4 Dimensions		A	B	A	B	A	B	A	B	A	B	A	B	
ROOF PITCH	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"
	23°	5/12	10"	58"	14"	60"	18"	66"	22"	72"	26"	74"	30"	77"
	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 DEFINED IN FIGURE 4. AND ARE DESIGNATED IN INCHES



SIDE PITCH MOUNTING

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

The most important structural consideration is to securely anchor the solar collector and the Solar Strut 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 SunEarth, Inc., Empire series collector. Drawings for Imperial series collectors are available upon request).

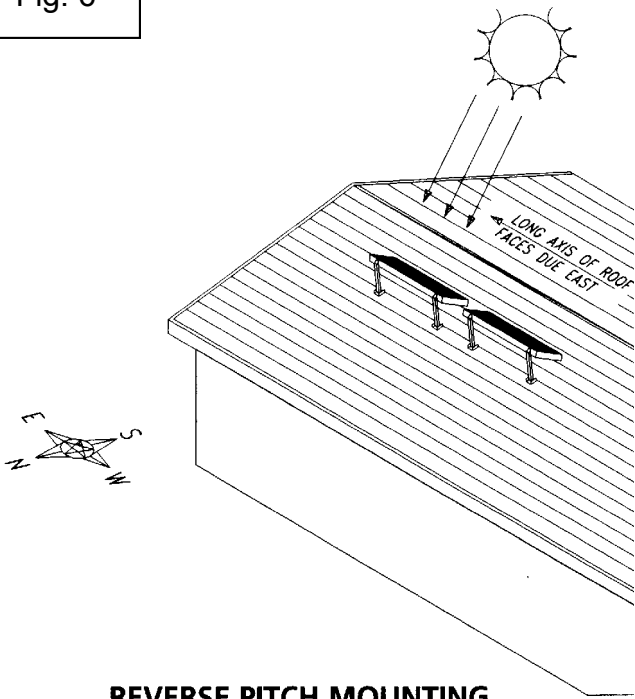
The collector must be raised from the roof surface to allow for rainwater and debris to pass under the collectors and for proper ventilation of the roofing material. There should be at least 1 1/2" of clearance between the roof surface and the bottom of the solar collectors.

In selecting mounting hardware and fasteners it is extremely important to avoid galvanic corrosion resulting from the direct contact of incompatible metals. Use of SunEarth, Inc. anodized aluminum "Solar Strut" 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, the use of galvanized fasteners is prohibited.

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. Tremco "POLYroof" is the recommended elastomer for sealing roof penetrations. Henry Co. 204, 208 or 209 roof mastic or Dow Corning Glazing Sealant also are acceptable sealants.

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.

Fig. 6



REVERSE PITCH MOUNTING

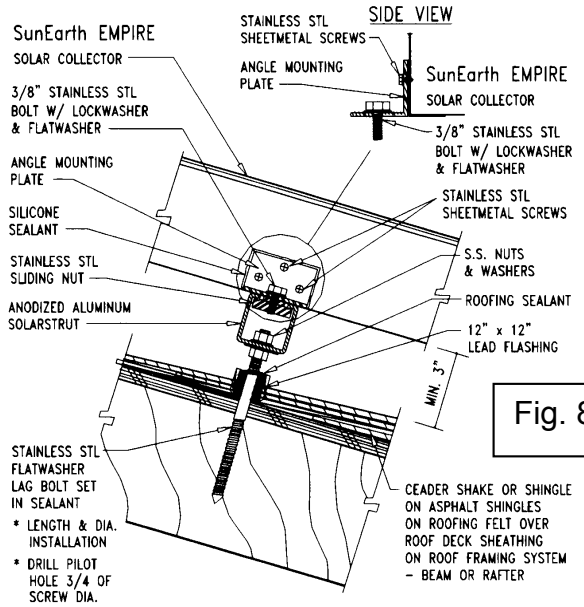


Fig. 8

SHINGLE ROOF MOUNTING

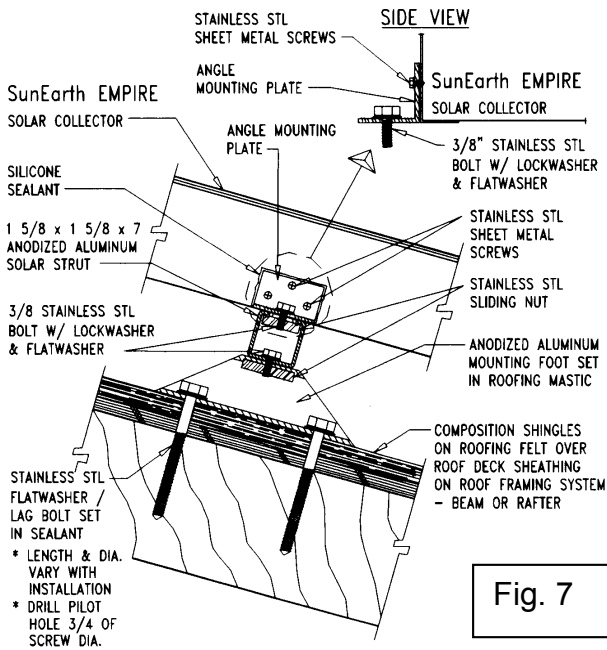


Fig. 7

COMPOSITION SHINGLE MOUNTING

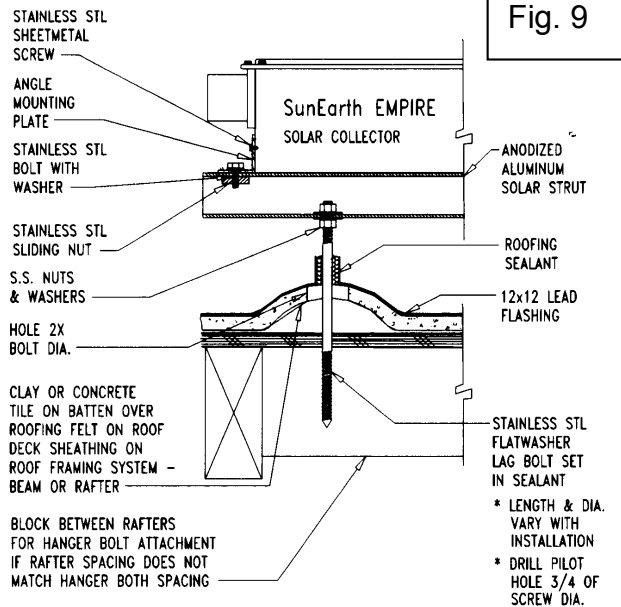
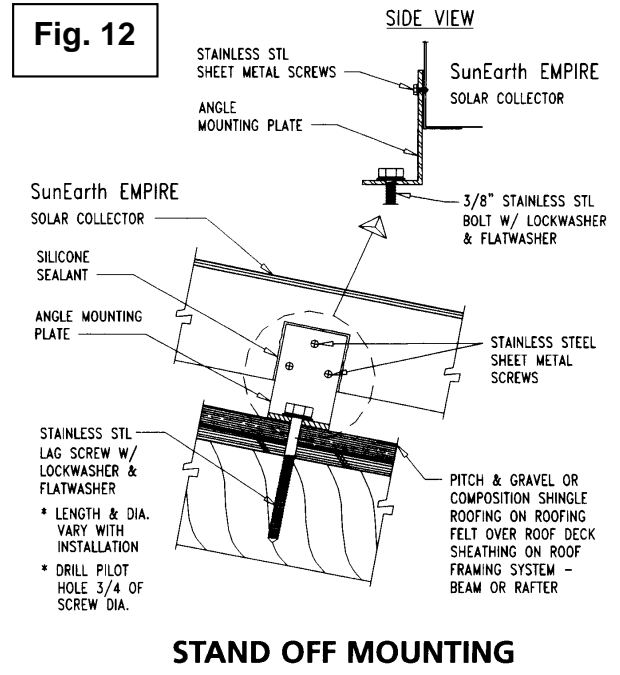
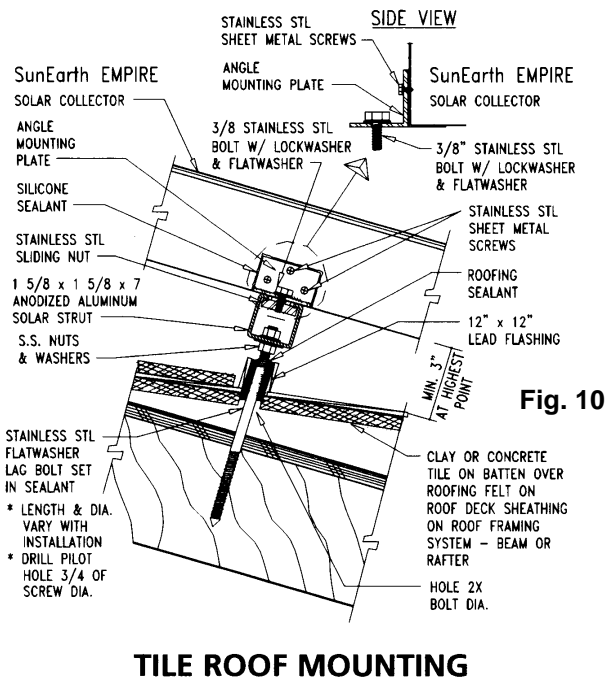


Fig. 9

TILE ROOF MOUNTING



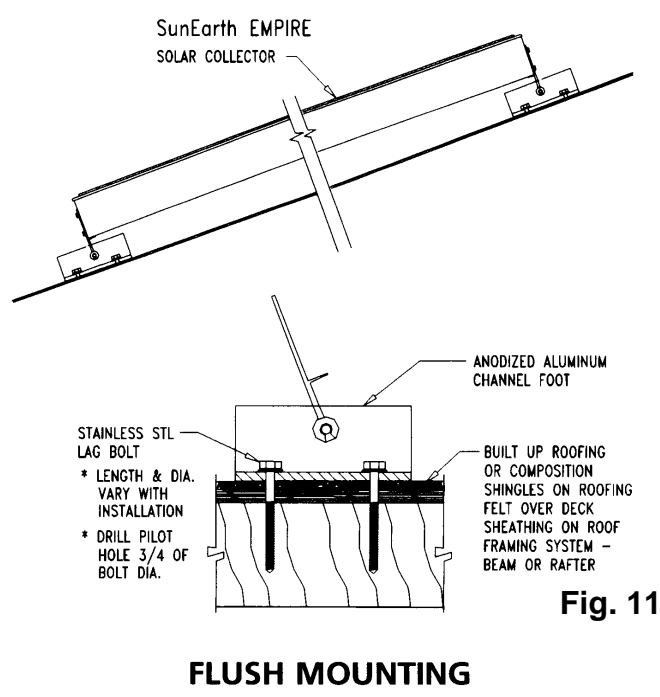
CAUTION: NEVER TOUCH COLLECTOR LOOP PIPING WITH BARE HANDS.

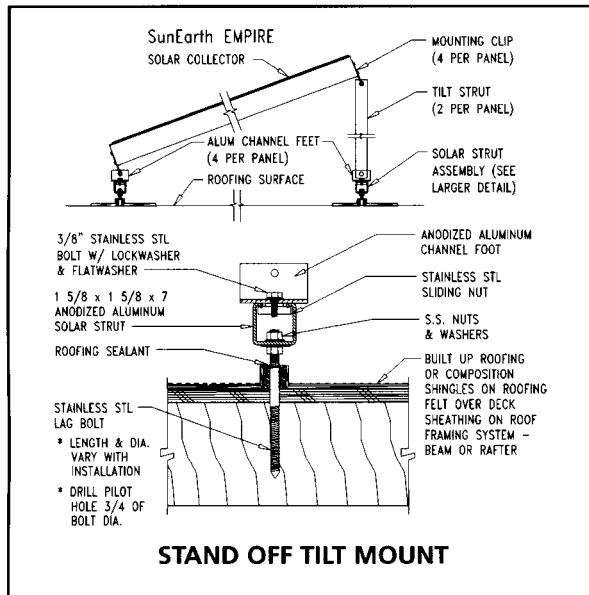
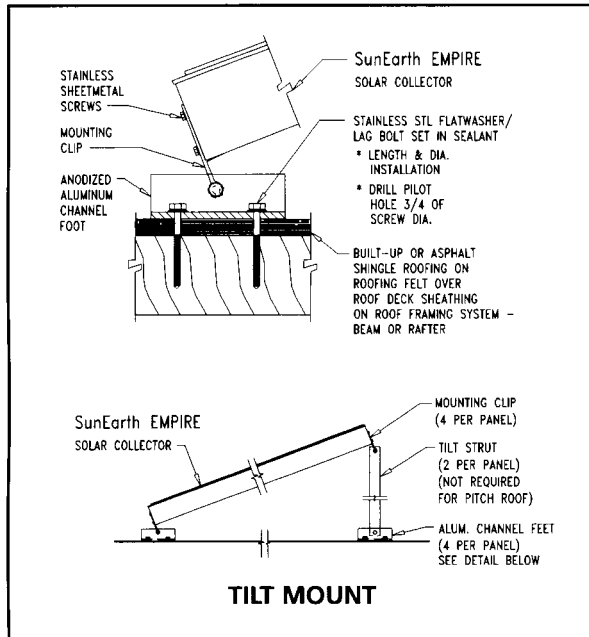
Collector Loop Pipe Insulation

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. The specified insulation material is Rubatex Insul-Tube 180 or equal.

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.

Any above ground exterior pipe insulation is subject to ultra-violet (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. Rubatex UV Protective Coating or its equal is the required coating material.





Figures 13 & 14

Collector Plumbing

Solar Energy Inc. 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. The minimum size for To an From collector piping is 5/8" OD copper.

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

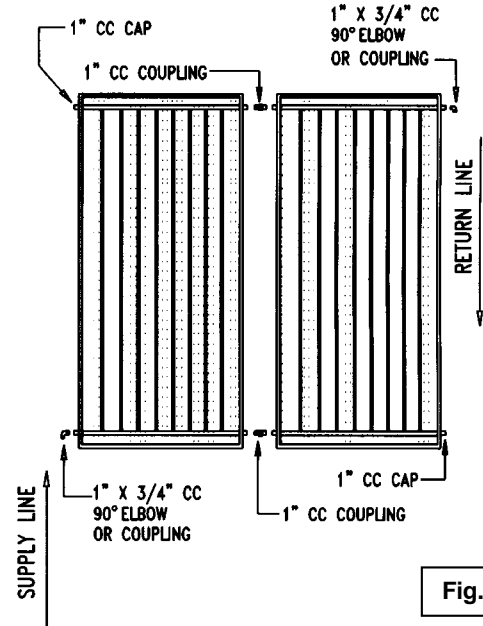


Fig. 15
COLLECTOR PLUMBING - VERTICAL MOUNT

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

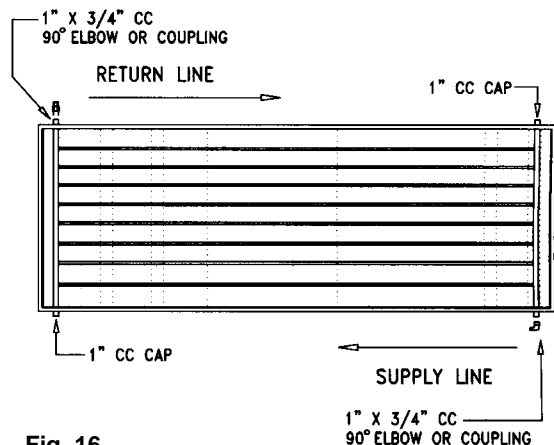
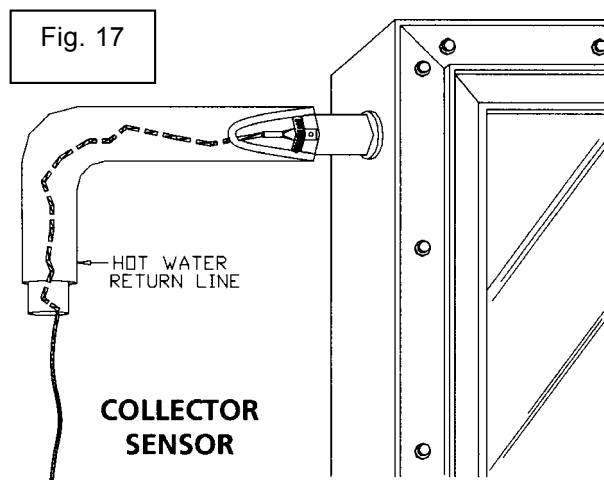


Fig. 16
COLLECTOR PLUMBING - HORIZONTAL MOUNT

THIS IS A DRAINBACK SYSTEM. ALL PLUMBING TO AND FROM COLLECTORS AND THE COLLECTORS THEMSELVES MUST BE SET SO THEY WILL DRAIN COMPLETELY WHEN THE PUMP IS OFF.

It is not recommended that collectors be mounted with the parallel flow tubes in the horizontal position. In the event this is the only option, the collectors must slope downward toward the collector inlet by no less than $\frac{1}{4}$ " per foot. The To and From Collector plumbing lines should also slope $\frac{1}{4}$ " per foot from the collectors back to the tank.

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.



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 $\pm 1/2^\circ\text{F}$ if properly installed and weatherized. To maximize sensor accuracy, attach the flanged portion of the sensor to the SunEarth, Inc. collector header pipe, as close as possible to the collector outlet, 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 17 for collector sensor installation detail.

Low Voltage Wiring:

The low voltage wiring used to connect the collector sensor 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. The system comes pre-wired for the tank sensor. Do not attempt to install a tank sensor.

Interconnect Plumbing:

Piping to and from the solar collector array is called the interconnect plumbing. Because the SUN HoM system is a Drainback Type it requires minimal plumbing. The main issue in Drainback systems is that the interconnect plumbing must slope from the collectors back to the drainback reservoir with no change in the slope that would cause water to stay in the lines when the pump is not running.

From the two collector interconnect fittings on the tank system assembly only $\frac{3}{4}$ " hard copper piping should be used. The proper unions are supplied with the system. Measure the distance from the top of these two fittings to a point inside the attic spaces that is $1\frac{1}{4}$ " above the level of the top of the bottom cord of the roofing trusses. Cut two pieces of hard copper tubing to this length. Sweat the unions provided with the system to two pieces of copper tubing. Using Rubatex pipe insulation cut two pieces the length of the distance from top of the unions to the ceiling where the tubes will penetrate. Install the Rubatex and insert the two pieces of tubing into holes cut directly above the **To** and **Return** Collector fittings on the tank system assembly. Refer to Figure 1 and 2 for the location of these fittings.

From these two pieces of copper tubing, soft copper tubing can be run in the attic spaces to the point where the piping must transition through the roof. The entire length of the piping should be insulated.

Charging the System:

Once the components are plumbed you are ready to charge the collector loop. This is done at the Drainback tank on the tank system assembly. It is recommended that the collector loop be flushed to insure all solder fluxes and any other contaminants are not present when the final distilled water charge is put in. A pre-charge of regular tap water can be run through the collector loop for several minutes prior to the final operating charge being installed. If there is evidence of severe contamination in the piping, tri-sodium phosphate(TSP) can be added to the tap water charge.

If a pre-flush is determined to be needed the Drainback Tank should be filled with regular tap water to the FILL Line on the side of the tank. At this point ¼ to ½ cup of TSP can be added if necessary. When ready, plug in the controller. The pump should be turned on and off several times at 5 minute intervals to flush the system piping. The pump can be turned off and on with the manual switch located inside the controller front panel. When this is completed drain the solar loop using the System Drain Valve below the pump (On DBSA systems the System Drain Valve is behind the shroud). When the tank is fully drained use a hose to continue flushing out the drainback tank for 5 minutes. Turn off the hose and let the system drain fully. Make sure the controller is set back to the automatic position. Unplug the controller when finished.

After flushing and the drainback tank is completely drained, fill the drainback tank to the Fill Line on the side of the tank with pure clean distilled water. If the election is made to add a gallon of propylene glycol to the system, leave room for this when filling the tank. **Use of inhibited propylene glycol, plain water or a concentration of these two fluids as the Heat Transfer Fluid (HTF) in this system is strictly prohibited.**

If propylene glycol is added to the solar loop a method of checking the heat transfer fluid for PH must be implemented. See "Service" and "System Parts List" Sections in this manual for instruction.

Flat plate collectors can reach temperatures over 300°F under the right conditions. Always be cautious when working around flat plates that are exposed to sun light. Water passing through tube incorporated in the plate picks up heat to transfer to the water heater.

This completes the system installation procedure.

OPERATING INSTRUCTIONS

Refer to Figures 1 and 2 or the system schematics at the end of this manual for references in operating this system.

System Start Up:

Drainback type systems are the simplest of the active type systems to start up. At this point all that remains is for the controller to be plugged into an outlet. A red light (First one on the left) on the front of the controller should indicate power is present. If not check to see power is present at the outlet.

If sufficient solar energy is present the system will begin to operate automatically. When the collector is hotter than the tank by 12°F or more the Number One light (Center one) on the controller will come on indicating that power is supplied to the pump. Water is lifted by the pump to the collector where it picks up heat and is returned to the drainback tank. The drainback tank supplies the water to the heat exchanger where it gives up heat energy to the water heater tank and is then sent back to the collector by the pump. This cycle continues as long as the collector is hotter than the tank. In "DB" type systems the heat exchanger is wrapped around the steel water heater tank so heat energy is transferred by conduction through the tank wall to the water. In "DBSA" type systems the solar heated fluid is sent to a "Side Arm" heat exchanger located outside the tank jacket. In this type heat exchanger the solar heat fluid passes around the outside of a bundle of vertical tubes that have the potable water inside them. The heat causes the potable water to rise where it moves back into the main tank. When this happens, cold water flows in from the bottom where it is heated. This is called a thermo-syphon cycle and it will continue as long as long as heat is available from the collectors.

With the pump running, check all lines, fittings and joints for leaks. If leaks are present, unplug the controller, wait for the HTF to drain back and then make repairs. To start up again, plug in the controller.

Explanation of Major Components and Their Function.

COLLECTOR:

The SunEarth collectors in your SUN HoM system are flat plate type. They are designed to maximize the capture of solar energy in the temperature ranges required for domestic hot water. Flat plate collectors accomplish this by employing the green house effect. The glass covering permits up to 90% of the visible sunlight to enter the collector. When the light passes through the glass it's frequency is changed slightly to a lower energy level. When the light strikes the absorbing surface of the flat plate inside the light is absorbed as heat. The combination of the glass frequency change and the solar absorbing surface of the plate capture the maximum amount of energy. As the absorber plate heats up it begins to radiate energy as infrared (IR) or heat radiation. Glass is essentially opaque to IR wavelengths so the heat is trapped increasing the temperature.

TANK SYSTEM ASSEMBLY:

Unlike most other solar systems your SUN HoM Drainback system comes pre plumbed and wired as a complete assembly. This is called the Tank System Assembly or TSA. The TSA contains the water heater tank, the heat exchanger, pump controller, drainback tank, tank sensor, drain valve, system drain valve and the wiring and piping to make all connections. The TSA, the collectors and the interconnect piping make up the complete system.

TANK SYSTEM ASSEMBLY: (cont.)

- Pump: The system is equipped with a single TACO 009 or 008 Bronze circulator pump. It uses 115V regular AC power which is supplied from the controller. When heat is available in the collector the pump is energized to lift the heat transfer fluid (distilled water) through the interconnect piping to the collectors where it gains heat. The water then returns to the drainback tank, then to the heat exchanger where it heats the potable water. The cycle continues until the collector can no longer contribute heat energy.
- Controller: The controller is powered by 115V house current and is the device that determines if solar energy is available. The controller, through the sensors, constantly measures the temperature of the water heater tank and the collector, comparing them to see if the collector is hotter than the tank. When the collector reaches a 12⁰F higher temperature than the water heater tank the controller energizes the pump. As stated above the pump will continue to run until the differential temperature (the difference between the collector and the tank) drops to 4⁰F. When this happens the pump is turned off and the heat transfer fluid drains back into the drainback tank.
- Sensors: The system contains 2 sensors, one at the outlet of the collector and one on the bottom of the water heater tank. The controller uses these 2 sensors to measure tank and collector temperatures. They are simple thermistor (thermal resistors) type sensors that have an inverse reaction to temperature. As the temperature goes, up the resistance goes down. The controller is calibrated to read this as temperature changes. As the collector heats up the resistance goes down and at the right point the controller turns on the pump. The reverse happens when the collector cools off.
- Water Heater Tank: This is standard glass lined steel tank that is constructed just like any other water heater. The only difference is that it has a heat exchanger wrapped around the outer steel or it has extra ports to make connections to. In the DBHE series systems the heat exchanger is a copper coil wrapped around the lower half of the tank before it is insulated. In the DBSA series, the tank has side ports and the heat exchanger is external to the tank. In either system the heat exchanger is used to transfer solar heat energy to the potable water.
- Heat Exchanger: An all copper device used to transfer solar heat to the potable water. See "System Start Up" section above for more detail on how this works.
- Temperature and Pressure Relief Valve: This device is inserted into the water heater tank for safety. It is located on top of the tank. The T&P relief valve is preset to open and discharge if either a high pressure or high temperature situation occurs in the water heater. All water heaters regardless of whether they are solar power or not, must have this safety device which is required by national building codes. There is no T&P valve required in the collector loop as it is a non-pressurized type.
- Isolation Valve: Also called "Shut Off Valve", this valve is installed in the cold water service

line to the water heater. It is used to isolate the system for maintenance, repairs and service. THIS VALVE SHOULD ALWAYS BE OPEN IF ELECTRIC POWER IS ON TO THE HEATING ELEMENT IN THE WATER HEATER TANK. Other types of solar water heating systems have collector isolation valves. Since this system employs Drainback freeze protection, the system does not have collector loop isolation valves.

- Drainback Tank: This is a vented reservoir tank attached to the side of the water heater tank that holds the collector loop heat transfer fluid (HTF). (The vent is in the cap supplied with the system) This system uses distilled water for the HTF. When the pump is turned on water is drawn from the drainback tank and supplied to the collectors. When the water returns it enters the drainback tank through a copper dip tube that is inserted into the top of the drainback tank. This copper dip tube is a very important part of the systems and cannot be replaced by a simple tube. It has been pre-cut and drilled to perform a precise function. **It is extremely important for the water to enter the drainback tank below the water level in the tank. If it does not, serious damage or injury can occur.**
- Freeze Prevention: The system uses the principle of draining water from the collectors to prevent freezing. No other valves, control functions or devices are required to prevent freezing of the collectors. When the pump is de-energized the water in the collector loop drains back to the Drainback Tank thereby preventing collector freeze damage. Proper installation is key to insuring this type freeze protection works.
- Heat Transfer Fluid: This is the liquid added to and stored in the Drainback Tank. Distilled water is the recommended fluid. Use of potable tap water is prohibited. As described earlier, propylene glycol can be added at a ratio of 8:1, (8 parts water to one part propylene glycol). This is not required.

SERVICE:

START UP PROCEDURE: At this point the water heater tank should already be filled and on line for hot water. This includes the electric element connections.

1. Fill the Drainback Tank to the level indicated on the side of the cover.
2. Insure all connections, both plumbing and electrical have been made. Plumbing connections include the To and From piping to the collector. The electrical connection is the sensor wire from the collector sensor to the controller.
3. Plug in the controller.

If sufficient solar energy is available the pump should come on right away.

DO NOT TEST THE RETURN LINE FOR HEAT BY TOUCHING IT WITH YOUR BARE HAND.

This is the end of the start up procedure.

SHUT DOWN PROCEDURE: Depending on the requirement, not every step needs to be followed.

1. Unplug the controller.
2. If required, attach a hose to the System Drain Valve. See Figures 1 and 2.
3. Open the System Drain Valve and drain HTF to a container if it has the propylene glycol additive. If not discharge the HTF to a drain or ground.

SYSTEM HTF CAN BE HOT. USE CAUTION!!!

If the water heater tank is to be shut down follow these steps only after the Shut Down Procedure for the solar system has been completed.

1. Disconnect electric power to the water heater. (Throw the breaker.)
2. Close the Shut Off Valve.
3. If the water heater tank needs to be drained: Attach a hose to the Drain Valve on the bottom of the water heater.
4. Open the drain valve.
5. Open the T&P relief valve to allow the tank to vent. The T&P valve can be opened by lifting the lever on top to the vertical position.

To recharge the water heater tank follow the instructions contained in the Installation section.

OPERATIONAL CHECK: If hot water is being supplied the system is obviously producing it. It may not be clear whether the heat is being supplied by the electric element, or by the solar collectors. Follow this procedure to check for solar system operation.

1. During bright sunlight check to see if the Number "1" indicator light on the controller is on. (This is the center red light in the lower right hand corner.) If it is the pump should be running and the drainback reservoir should be warm or hot to the touch. This step only shows the controller and pump are working.
2. Check to see the pump is not running at night. If it is consult the troubleshooting guide. When finished locating problem and repairs have been made, repeat this step.
3. In the morning, disconnect power to the electric backup element in the water heater. (DO THIS BY THROWING THE BREAKER).
4. At the end of the day check to see if quantities of hot water are available.

During summer months it may be possible to completely turn off power to the back up element. This is done by throwing the breaker. This is recommended only after it is determined the solar systems is supplying hot water.

SYSTEM FLUID CHECK: A periodic inspection of the system to check the HTF level is recommended. Every month the level should be checked to see it is within 2" of the Fill Line. If the level drops simply add distilled water to bring it back up to the Fill Line. If the option of adding propylene glycol to the HTF is elected, a monthly check of the PH of the HTF is required. Using PH strips such as those used for swimming pools, or by using a digital PH meter are acceptable methods for performing the PH check. If the PH drops below "7", follow the Shut Down Procedure and drain the HTF. Then, repeat the Start Up Procedure. (See also Charging Procedure.)

MAINTENANCE:

WATER HEATER TANK: Once each year it is recommended that the water heater tank be purged. To do this, follow the steps below.

1. Disconnect power to the electric element. (DO THIS BY THROWING THE CIRCUIT BREAKER)

2. Attach a hose to the Drain Valve on the bottom of the water heater tank.
3. See Figures 1 and 2. Open the Drain Valve slowly to allow water under line pressure to purge the tank for a few minutes.
4. Close the "Shut off Valve".
5. Let the system set for 10 minutes, This allows the sediment to fall back to the bottom of the tank.
6. Now open the T&P relief valve to allow sediment particles to drain out by gravity.
7. Let this continue until the discharge at the end of the hose is clear water. When finished follow the next series of steps exactly.

-
1. Close the T&P Valve.
 2. Close the Drain Valve and remove the hose.
 3. Open the system Shut Off Valve.
 4. Open a hot water faucet in the highest part of the home.
 5. Wait until a stream of clear water runs for several minutes with no air escaping.
 6. Return power to the backup element.

SOLAR SYSTEM MAINTENANCE: Drainback type systems are the most trouble free systems available. The only maintenance required is to check and insure the level and PH of the heat transfer fluid in the Drainback Tank are kept within proper limits. See "SYSTEM FLUID CHECK" under SERVICE.

COLLECTOR MAINTENANCE: Collectors operate best when the glass is clean and unobstructed. If they become dirty wash them with mild soapy water and rinse. Remove any branches or leaves that do not naturally fall off or are blown away by the wind. Collectors installed at the proper angle anywhere in the continental United States should not have either of these problems. Dust and dirt build can be a problem in dry desert climates where there is little rain to wash the glass.

TROUBLESHOOTING:

Follow the chart below for problem identification and resolution:

SYMPTOM	CHECK	REPAIR
No hot water	Check to see power is on to backup element	Re-engage power. If power is on replace element.
	Perform solar system operational checks	If pump does not function, replace it. If controller is not working, Check sensors and replace if necessary. If controller does not work, replace it.
	If election is made to operate on "Solar Only"	Check to insure sufficient sunlight has been available.
	Check HTF level in drainback tank	If low, add distilled water.
Pump "On" light is lit, pump does not run.	Unplug pump power line from controller and plug into 115V extension cord	If pump runs, replace controller, if not replace pump cartridge or capacitor.
Pump and controller work but no hot water.	Check for sufficient sun light.	If no sun light is available, reapply power to electric backup element.
	Check to insure proper flow in solar loop.	If HTF water is not flowing call solar contractor who installed the system for service
	If solar loop is working properly but sunlight is not available then check electric backup element.	Replace electric element.
Water is too HOT.	Check high limit setting on solar controller.	Reduce setting if too high.
	If solar supplied water is at preferred temperature	Install optional tempering valve between cold and hot lines on water heater.

SYMPTOM	CHECK	REPAIR
	Check for thermostat failure on electric element.	If bad replace it.
NO lights on, on controller	Check to insure unit is plugged in.	If plugged in replace unit or call technician
Unsure of system performance.		Call system installer.

Additional Troubleshooting procedures for solar systems can be found at the Florida Solar Energy Center web site:

<http://www.fsec.ucf.edu/solar/apps/sdhw/trouble.htm>

SYSTEM PARTS LIST:

System Part Number:

Each SUN HoM system is identified by a system part number, i.e.: DBSA 80-40. The letters refer to:

DrainBack Type / Heat Exchanger type:
 "DB" only means Heat Exchange Tank
 "DBSA" stands for Side Arm Heat Exchanger

The first two or three number designators, (i.e.: 80 or 120) stand for the tank size in gallons. The second two number designators indicate collector square footage, (i.e.: 40).

The table below indicates collector type based on the square footage number. Collectors are manufactured and supplied by SunEarth, Inc.

Designator	BRAND	Sq. Ft.	Part #	NO.
40	Empire	40	EP-40	1
42	Empire	21	EP-21	2
48	Empire	24	EP-24	2
63	Empire	21	EP-21	3
64	Empire	32	EP-32	2
72	Empire	24	EP-24	3
80	Empire	40	EP-40	2

Parts Number List:

All parts available through SolarDirect.com, or Solar Direct, 5919 21st Street E, Bradenton, Florida 34203. Ph: 941-359-8228

Water Heater Tank: RUUD, RSPE-80-1 for DBSA models, RSPER-HE-1 for DB models.

Collectors: See table above.

Pump: TACO 009B or 008B Circulator

Drainback Tank: Solar Energy, Inc., DB-Tank

Controller: Goldline, GL-30 LC.

Sensors: Goldline, SB sensor.

Propylene Glycol: Dow Frost (R)

Other parts have multiple options for replacement.

number it will NOT BE HONORED. If it is an emergency and the part is needed right away, you may call the company at 1-941-359-8228 to file a claim. The original system serial number must be available at the time the claim is made. All other claims should be sent by mail.

This system is provided by:

Solar Direct
5919 21st Street East
Unit A
Bradenton, Florida 34203
Phone: 800—333- 9276
FAX: 941-359-8228
<http://www.SolarDirect.com>

LIMITED WARRANTY:

This system is covered under Limited Warranty by Solar Energy, Inc. Its coverage only extends to the limits of coverage of materials and workmanship of system components that **are not** covered by Warranty from or by the OEM manufacturer of the individual components. Individual Warranties for the components are supplied with the system when it is delivered. Please consult the individual warranty cards before making a claim to Solar Energy, Inc.

Limits of Coverage: Solar Energy, Inc. will replace or repair any part in the system for a period of five (5) years from the date of initial purchase subject to the following Terms and Conditions.

1. The part does not have a Warranty supplied by another company that covers the part.
2. The part was installed in the initial assembly.
3. The part became defective as result of normal use.

This Limited Warranty does not extend any Warranty, written or implied by others with respect to time or limits of coverage. This Limited Warranty does not cover valves.

“The solar system described by this manual, when properly installed and maintained, meets the 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.”

For Service Call:**How To File a Claim:**

A Warranty Card is supplied with the system when it is sold. **THIS CARD MUST BE FILLED OUT AND RETURNED AT THE TIME OF SALE.** The Warranty Card has two sections. Fill out both sections and separate the two halves. Mail the half that has the address on the back side and keep the other for your records.

When filing a claim with Solar Energy, Inc., use the system serial number on the retained part of the Warranty Card. If a claim does not have this