SunEarth

SolaRay AC

SRCC OG-300 Certified Solar Water Heating System

Type: AC Circulating Pump and Differential Control

Installation, Operation and Maintenance Manual

SOLARAY^{AC} DOMESTIC SOLAR WATER HEATER SYSTEM

INSTALLATION, OPERATION AND MAINTENANCE MANUAL

The SolaRay AC domestic solar water heating system has gone through an extensive design, technical and performance review by the Solar Rating & Certification Corporation (SRCC). The installation of your SolaRay AC system is intended to be executed by properly licensed and experienced professional contractors in accordance with SRCC Standard OG-300, "Operating Guidelines and Minimum Standards For Certifying", and shall conform to applicable federal, state and local regulations, codes, ordinances and standards governing the installation of solar water heating systems.

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

OG-300 system certification is granted to SunEarth by the SRCC. It may not be used for any commercial purpose without the prior written consent of SunEarth. SunEarth must approve any deviation from the materials and methods described in this manual in writing.

SunEarth SolaRay AC solar water heating systems can be protected against freeze damage to temperatures as low as -60°F (-51°C). This system should not be installed in any area that has experienced ambient air temperatures below -60°F. Use Table 4, Section 4 of this manual to determine the required concentration of propylene glycol and distilled water to provide adequate freeze protection in your specific climate.

Propylene Gycol heat transfer fluid shall be used in this system as the primary freeze protection agent. Unauthorized fluid substitutions can result in a threat to health, welfare and safety and may cause the system piping to freeze.

All component warranties, expressed or implied, are voided if uninhibited propylene glycol, potable or distilled water are substituted for the specified heat transfer fluid described in this manual, or if the heat transfer fluid is not maintained in accordance with the manufacturers specific instructions.

Freeze tolerance limits are based upon an assumed set of environmental conditions. Extended periods of cold weather, including ambient air temperatures above the specified limit may cause freezing in exposed parts of the system. It is the owner's responsibility to protect the system in accordance with SunEarth's instructions if the ambient air temperature approaches the specified freeze tolerance limit.

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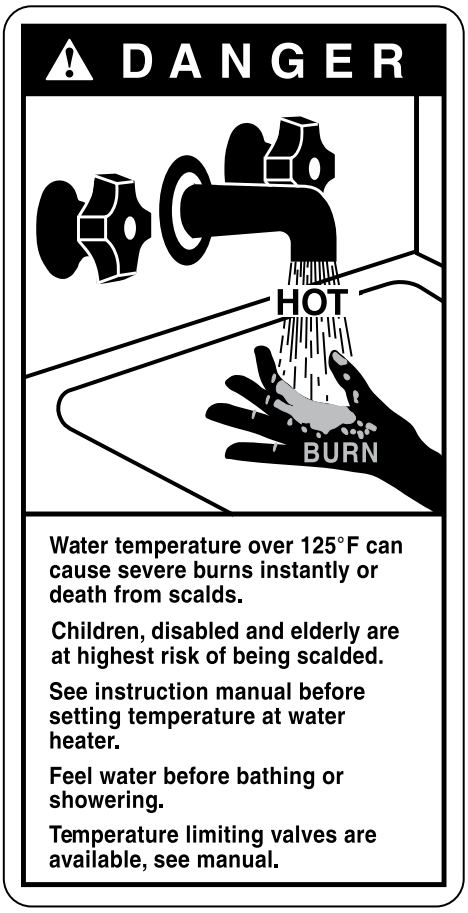
IMPORTANT SAFETY INFORMATION. READ ALL INSTRUCTIONS BEFORE USING.

⚠ DANGER!

WATER TEMPERATURE SETTING

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



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

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

Time/Temperature Relationship in Scalds

Temperature	Time To Produce a Serious Burn
120°F	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

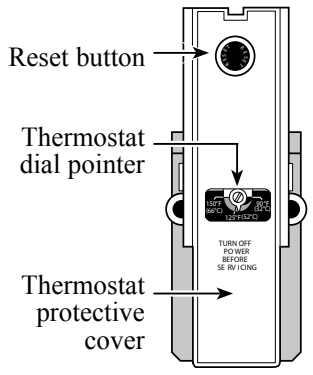
Table courtesy of Shriners Burn Institute

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: 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 Installation, Operation and Maintenance 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 Installation, Operations and Maintenance 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 your installing contractor or local SunEarth Distributor.

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. SunEarth 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.

Established in 1978, SunEarth is a leading U.S. solar equipment manufacturer. Our products include industry standard Empire, SunBelt, Imperial and ThermoRay solar water heating collectors, CopperHeart integral collector storage systems, SunSiphon packaged thermosiphon systems, SunBurst all copper absorber plates, SolarStrut and RexRack mounting hardware. We also build specialty collectors for unique architectural and building applications. SunEarth SRCC OG-300 certified solar water heating systems are sold by leading solar, plumbing and building contractors throughout the United States.

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

SunEarth maintains a policy of continuous review and improvement to ensure that SolaRay AC systems incorporate any appropriate technological advances. To ensure that products represent the current state of the art in solar water heating SolaRay AC systems are subject to change without notice. Please consult the SunEarth website at www.sunearthinc.com for current information and latest manual revisions.

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 SolaRay AC system will save on an annual basis.

Your SolaRay AC solar system is known as a "forced circulation" system because it utilizes a mechanical pump to efficiently circulate the 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 SolaRay AC solar water heating system to minus 60° 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 SolaRay AC 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 may void the manufacturer's warranty for specific component parts.

This manual covers installations utilizing one or two SunEarth solar collectors with a single solar storage tank and also two tank systems that include a solar storage tank and supplemental tank type or tankless 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

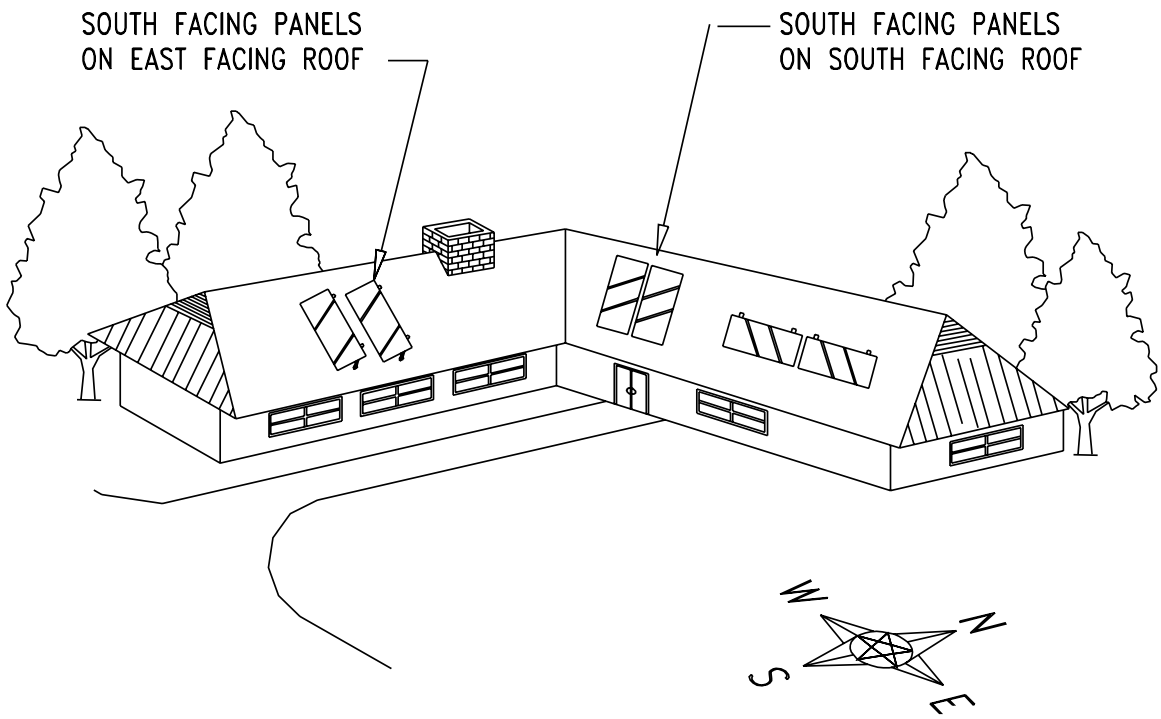


fig. 1 **COLLECTOR ORIENTATION**

manual to specific component parts. The placement of each component can be seen in system schematic Figures 15a to 17b . A description of each component and its function is found in Section 10.

2) SYSTEM DESCRIPTION AND OPERATIONAL PRINCIPLE

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

The SunEarth solar collector is the heart of the SolaRay AC system. Simply stated, when the sun is shining, heat energy is absorbed by the solar collector's 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. The heat exchanger consists of copper tubing wrapped around the solar storage tank. 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. This process is continuously repeated during the average sunny day as the temperature in your solar storage tank rises.

The differential temperature controller is the brain of the system. The controller uses temperature sensors to constantly monitor the temperatures at the collector and at the tank. The controller automatically turns the pump on when useful heat is available at the collector and turns the pump off when there is insufficient solar heat available or the tank has reached maximum temperature.

Both single and double tank SolaRay AC systems are designed to provide two modes of operation. The system will, (1) serve as a preheater to your solar storage tank or back-up water heater, or (2) bypass the solar collector and run 100% on utility energy or conventional

fuel. The installation of an optional water heater time switch allows you to control both the frequency and duration of supplemental electric resistance water heating. Supplemental electric heat may not be required for much of the year depending upon your specific requirements, thus providing an effective third mode of operation – 100% solar.

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

The propylene glycol HTF protects your SolaRay AC solar system against freezing. SunEarth suggests Dowfrost HD which can provide reliable freeze protection at temperatures as low as minus 60° Fahrenheit if properly applied and maintained.

Use of uninhibited propylene glycol, ethylene glycol, plain water or any mixture of these 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. SunEarth's collector warranty specifically excludes freeze damage for any reason and absorber plate damage resulting from the oxidation of the propylene glycol HTF.

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 60° Fahrenheit. (See Sections 8.1 and 8.2)

3) INSTALLATION

REQUIREMENTS - GENERAL

3.1 Permits:

The contractor shall obtain all required permits and approvals.

3.2 Codes, Ordinances and Standards:

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

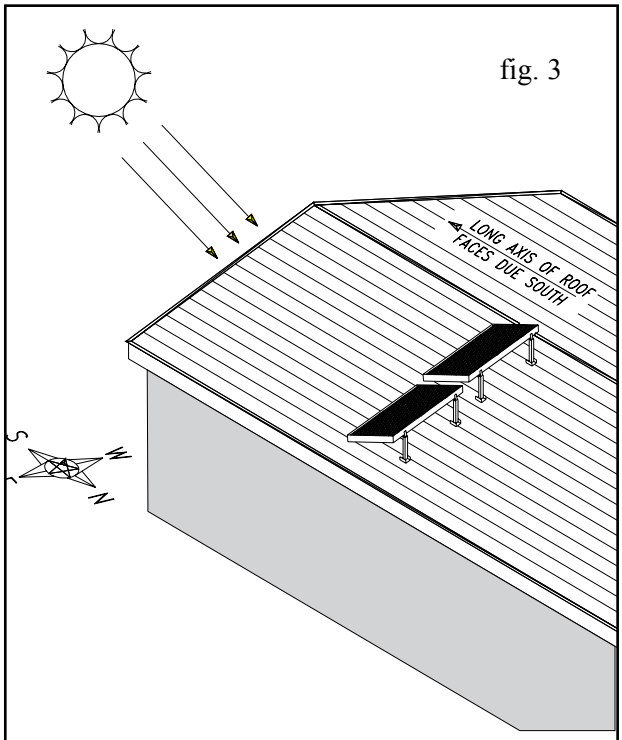
3.3 Shading Considerations:

The collectors must be located in an area of the roof that will not be shaded for the majority of the day all year round. Adjacent buildings and trees should be checked for possible winter shading. The collector should not be shaded by any permanent obstacle between 9:00 a.m. and 3:00 p.m. on any day of the year. An instrument such as the Solar Pathfinder can be used for solar site analysis.

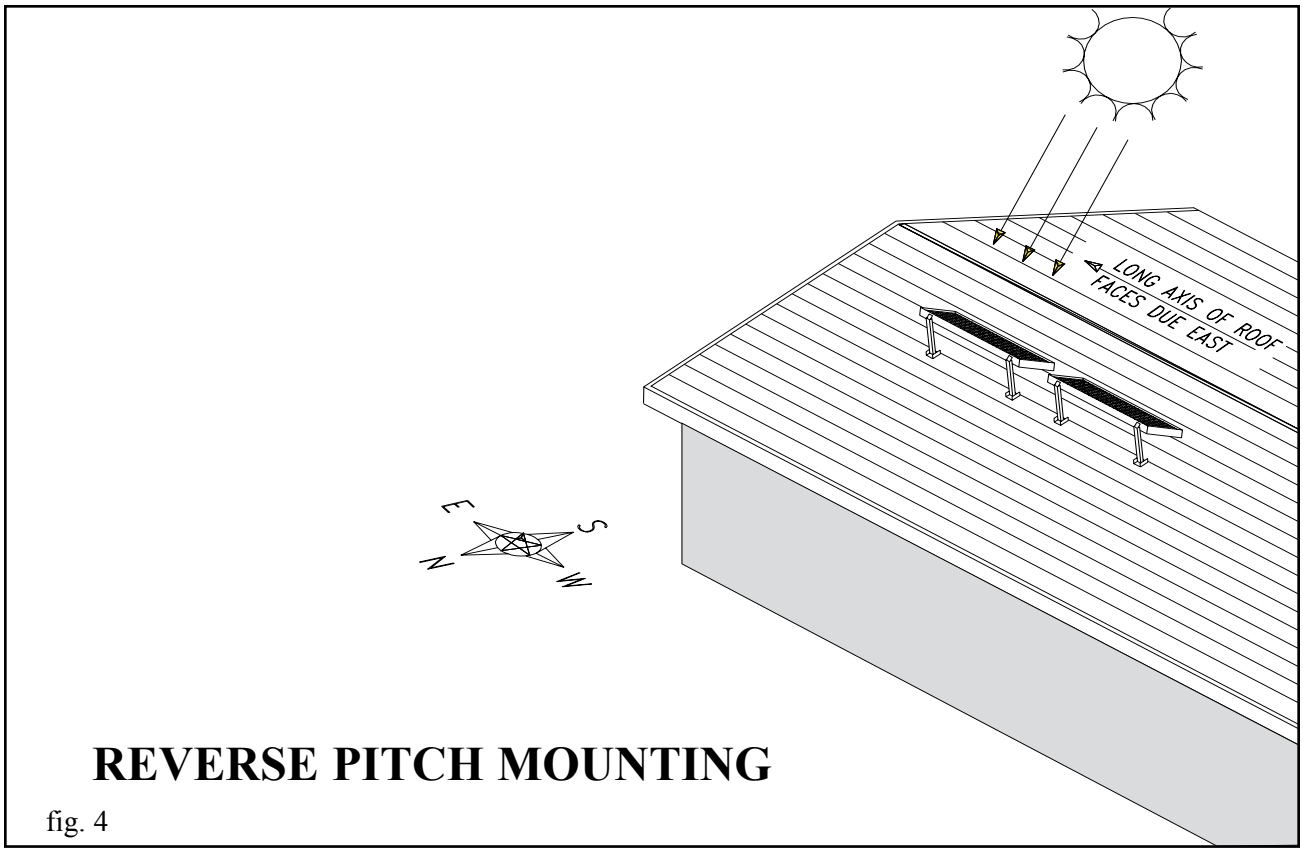
3.4 Roof and Site Inspection:

Before the installation, the contractor shall

fig. 3



SIDE PITCH MOUNTING



REVERSE PITCH MOUNTING

fig. 4

inspect the condition of the roof and notify the homeowner of any existing roof damage or necessary repairs.

3.5 Structural Considerations:

The collectors must be located in a structurally sound area of the roof. Penetrations into structural members must not compromise the structural properties of the member.

ENSURE THAT ALL STRUCTURAL MEMBER PENETRATIONS COMPLY WITH APPLICABLE CODES.

The collector mounting method must be capable of maintaining the required tilt and azimuth of the collector under the expected dead loads, wind loads and snow loads for the location.

3.6 Building Envelope:

Penetrations through the building envelope (including roof, walls or floor penetrations) must not impair the enclosure function and must meet applicable codes and best practices.

Roof penetrations whether for structural mounts or pipe penetrations must be sealed and leak proofed as per applicable codes and National Roofing Contractors Association practices.

Building penetrations must not allow vermin intrusion.

3.7 Fire-Rated Assemblies:

Penetrations through fire-rated components must not reduce the fire resistance of the assembly below code.

3.8 Building Materials:

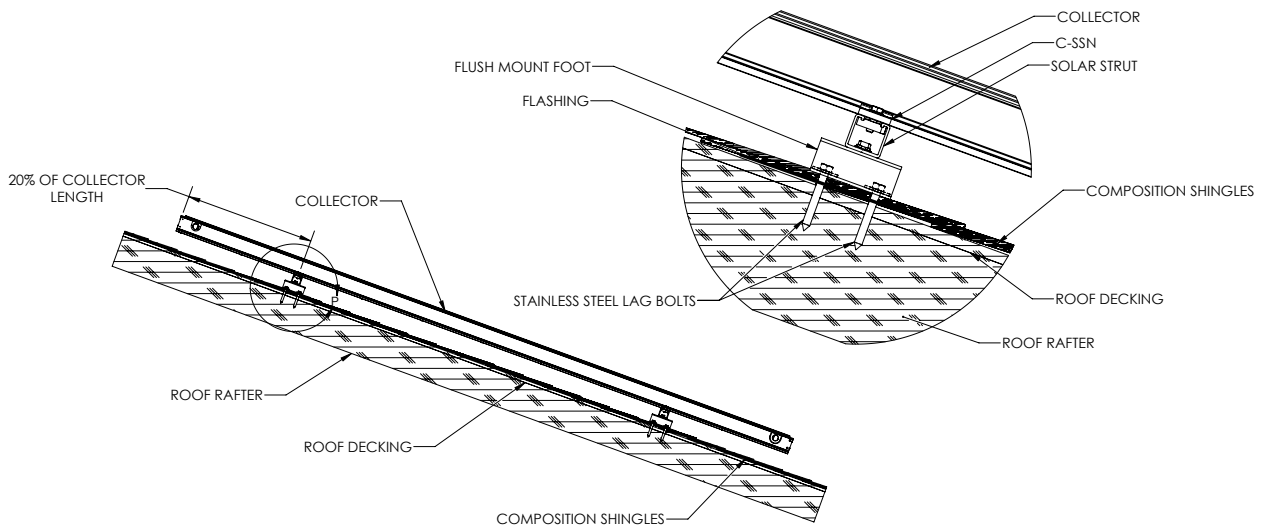
Building materials adjacent to solar components must not be exposed to elevated temperatures.

3.9 Confirmation of Installation Site:

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

3.10 Fluid Identity and Toxicity:

The Solaray AC system uses a mixture of water and non-toxic buffered propylene glycol based heat transfer fluid, this is heated in the collec-



STRUT ON FOOT MOUNT FOR COMPOSITION ROOF

fig. 5

tor and indirectly heats the domestic hot water through the integral heat exchanger in the solar tank. Use of toxic heat transfer fluids is prohibited.

3.11 Maintenance and Servicing

When installing the system, make sure that all the components are accessible and easy to reach. Provide for clear access to the storage tank, pump, expansion tank, mixing valve and other key components. If a component in the potable water side of the system may require future service or maintenance make the connections with brass unions or other approved methods.

4) INSTALLATION

REQUIREMENTS - SPECIFIC

4.1 Collector Orientation

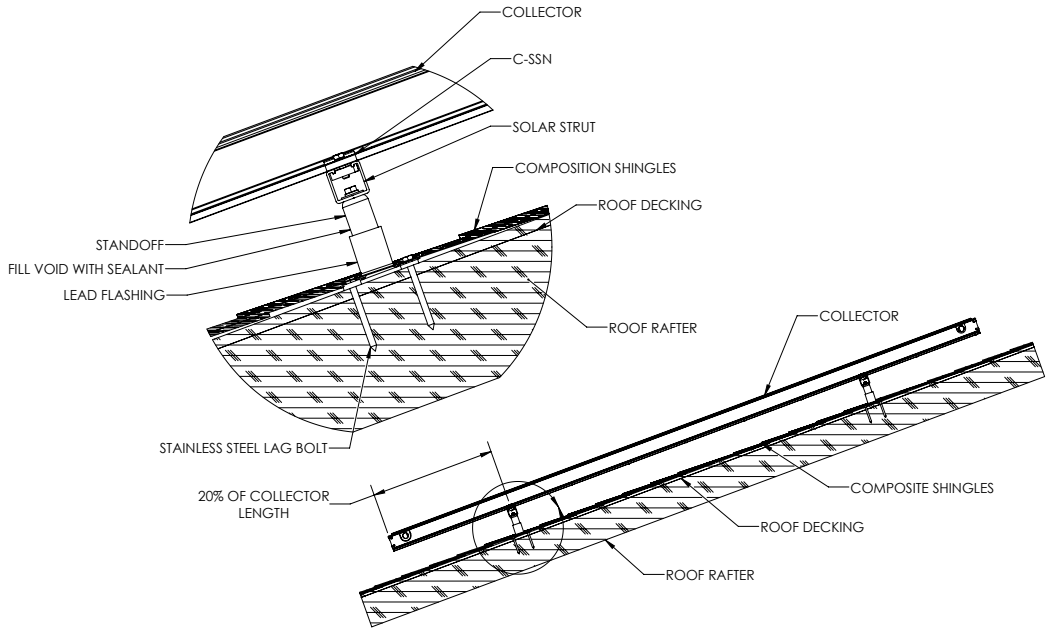
The performance of solar water heating systems in the Northern Hemisphere is optimized when the collector is mounted facing True South. Performance, however, suffers very little when the collector is oriented no more than 45° East or West of True South. The collector should not be shaded by any permanent 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.

To ensure proper water drainage from the glazing the collector must be sloped from horizontal. Never mount the collector parallel to a flat roof. Use SunEarth RexRack, Landscape Rack or Universal tilt mount kit products to raise the unit to the proper angle. The minimum acceptable tilt angle from horizontal is 10°.

The solar collectors in a two collector staggered mount installation must be spaced far enough apart to prevent winter shading when the sun is at its lowest angle on the winter solstice.



STRUT ON STANDOFF FOR COMPOSITION SHINGLE ROOF

fig. 6

4.3 Basic Mounting Procedures

The SunEarth solar collector in your SolaRay AC solar system may 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 propylene glycol HTF and does not normally need to be drained, it is still important to slope the collectors slightly to allow for complete drainage if necessary. The recommended slope is ¼" per foot of collector horizontal run.

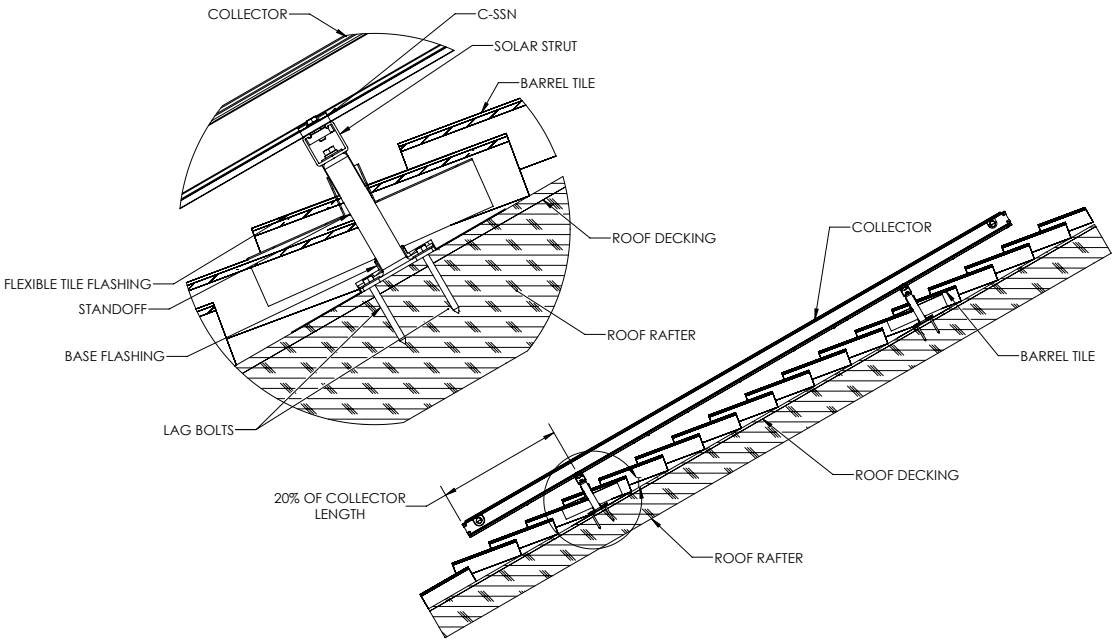
The collector should be mounted as close to the storage tank as possible to minimize heat loss in the piping runs. If the home has attic access, mounting the collectors near the roof peak provides for additional attic workspace.

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

4.3.1 The most important structural consideration is to securely anchor the solar collector and the SunEarth mounting hardware to the structural members of the roof with stainless steel hanger bolts, lag bolts, standoff mounts or other approved roof attachment methods. The solar collector shall be attached to the mounting hardware as detailed in Figures 5–10. (Note: The drawings in this manual detail mounting hardware for the SunEarth Empire, Imperial, SunBelt and ThermoRay series collectors).

4.3.2 The collector should 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 ½" of clearance between the roof surface and the bottom of the solar collectors. Local codes may require greater clearance for snow shedding, etc.

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



STRUT ON STANDOFF FOR CURVED TILE ROOF

fig. 7

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 and in compliance with all local codes and ordinances.

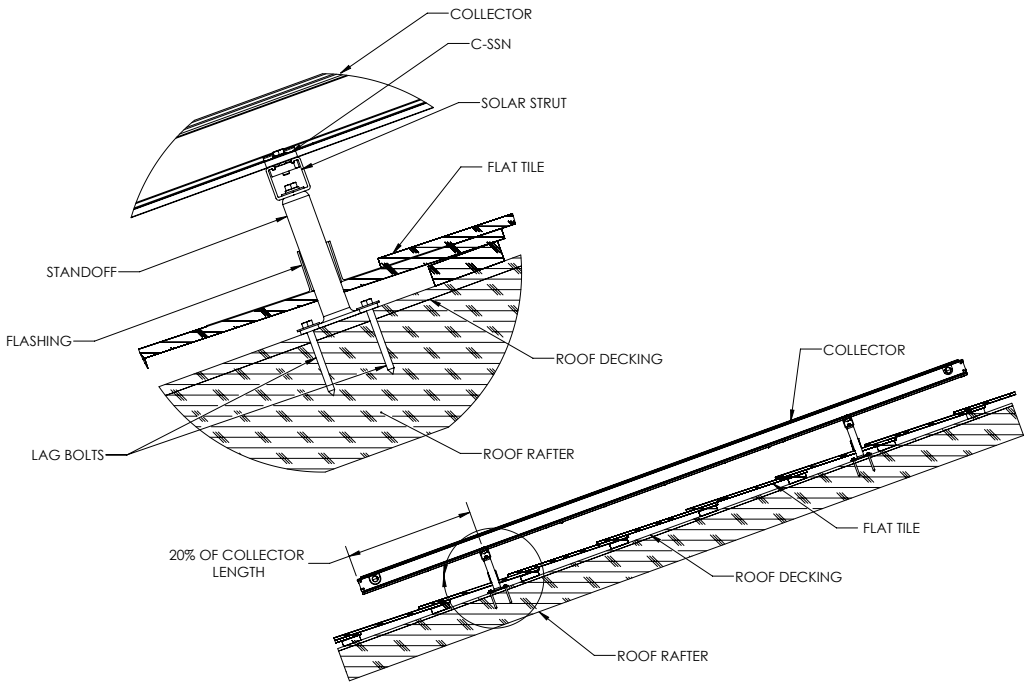
4.3.5 If the region is subject to hurricane conditions, additional steps may be required to secure the collector and mounting hardware to the structural members. In certain areas of the country, local building codes may require collector wind load testing or prescribe specific mounting procedures. Consult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

4.4 Collector Loop Plumbing

The collector loop must be plumbed using copper or stainless steel piping and copper, brass, bronze or stainless steel fittings. Lead-free solder shall be used. Use of galvanized steel, CPVC, PVC, PEX or any other type of plastic pipe is prohibited. The collectors can produce temperatures that will melt plastic piping.

The collector loop pipe sizing must be adequately sized to handle the design flow rates for the collector(s). SunEarth recommends ½" nominal diameter pipe sizes for single collector systems and ¾" nominal diameter pipe for two collector systems. It may be necessary to increase the pipe size for longer pipe runs or reduce the pipe size for shorter runs or higher efficiency pumps. The pipe must be large enough that the velocity of the HTF does not exceed 4 ft/s. Hot HTF flowing at over 4 ft/s in a pipe will erode the pipe and reduce system life. When more than one collector is used in the system, the collectors should be plumbed in a reverse return piping arrangement in order to maintain equal flow through all collectors in the array. Where reverse return piping is not possible flow balancing valves must be installed to ensure that the difference in flow rates between collectors is no more than +/- 10%.

Piping in new solar installations can be covered with dirt, grease, solder flux or other impurities that over time affect the quality of the propylene



STRUT ON STAND OFF FOR FLAT TILE ROOF

fig. 8

glycol HTF. A thorough cleaning is required before charging the system with propylene glycol. Carefully review the cleaning procedures in "Charging the System" outlined in section 4.14.

All vertical piping between the storage tank and the collector shall be supported at each story or at maximum intervals of ten feet (10'). Horizontal pipe runs should be supported to allow complete drainage of the system if necessary, the recommended slope is ¼" per foot sloped to drain.

Horizontal roof runs shall be secured and supported providing at least 1 ½ inches clearance from the roof. Standard best piping practices shall be followed as described in the Uniform Plumbing Code, International Plumbing Code or other recognized code or standard. Plumbers tape or tube strap is required. The pipe insulation should not be compressed or crimped by the strapping material.

Only Solder Fluxes meeting the criteria of ASTM B 813 should be utilized for joining by soldering any copper and copper alloy tube and fittings in the entire solar system.

Allowance should be made for expansion and contraction of piping due to changes in temperature of the HTF and piping. Use flexible pipe supports and avoid long straight piping runs. Soft copper coils or other flexible piping is recommended, if hard copper is used include bends and elbows to allow for expansion such as swing joints at the collector inlet & outlet.

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

4.5 Pipe Insulation

WARNING: HOT PIPES MAY CAUSE BURNS IF TOUCHED. ENSURE THAT ALL PIPES AND FITTINGS ACCESSIBLE TO THE PUBLIC ARE WELL INSULATED. COMPONENTS ACCESSIBLE TO PUBLIC TRAFFIC MUST BE KEPT BELOW 140ºF OR CLEARLY LABELLED WITH AN APPROPRIATE WARNING.

The collector loop piping, plus any interconnecting hot water piping shall be well insulated with a high quality flexible closed cell insulation to minimize heat loss. The insulation shall have a maximum operating temperature of 220°F or higher. The wall thickness of the pipe insulation should not be less than ½". 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.

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 UV degradation and must be jacketed, wrapped with aluminum foil tape, or painted with two coats of high quality water-based acrylic resin coating as supplied by the insulation manufacturer.

4.6 Control System

4.6.1 Differential Controller

The differential controller must be installed in an accessible location so that the user interface, typically an LCD screen, can be seen. Switches on the controller must be labeled and accessible. Always follow the controller manufacturers wiring instructions when installing differential controllers. Control system inputs; such as signals from temperature sensors or flow meters shall be connected to the appropriate low voltage terminals. Controller output to the pump will be medium voltage, 110 VAC or 220 VAC. Medium voltage power to the pump may be supplied by a line cord from the pump to an outlet in the controller or hard wired from the controller medium voltage terminals to the pump. Wiring must comply with standard electrical practice and all applicable electrical codes for the jurisdiction having authority, this may require the use of conduit for medium voltage wiring.

The differential controller must have a provision to manually turn the pump on and off (manual override) so that pump operation can be checked at any time and the pump can be manually stopped if required for maintenance or troubleshooting purposes.

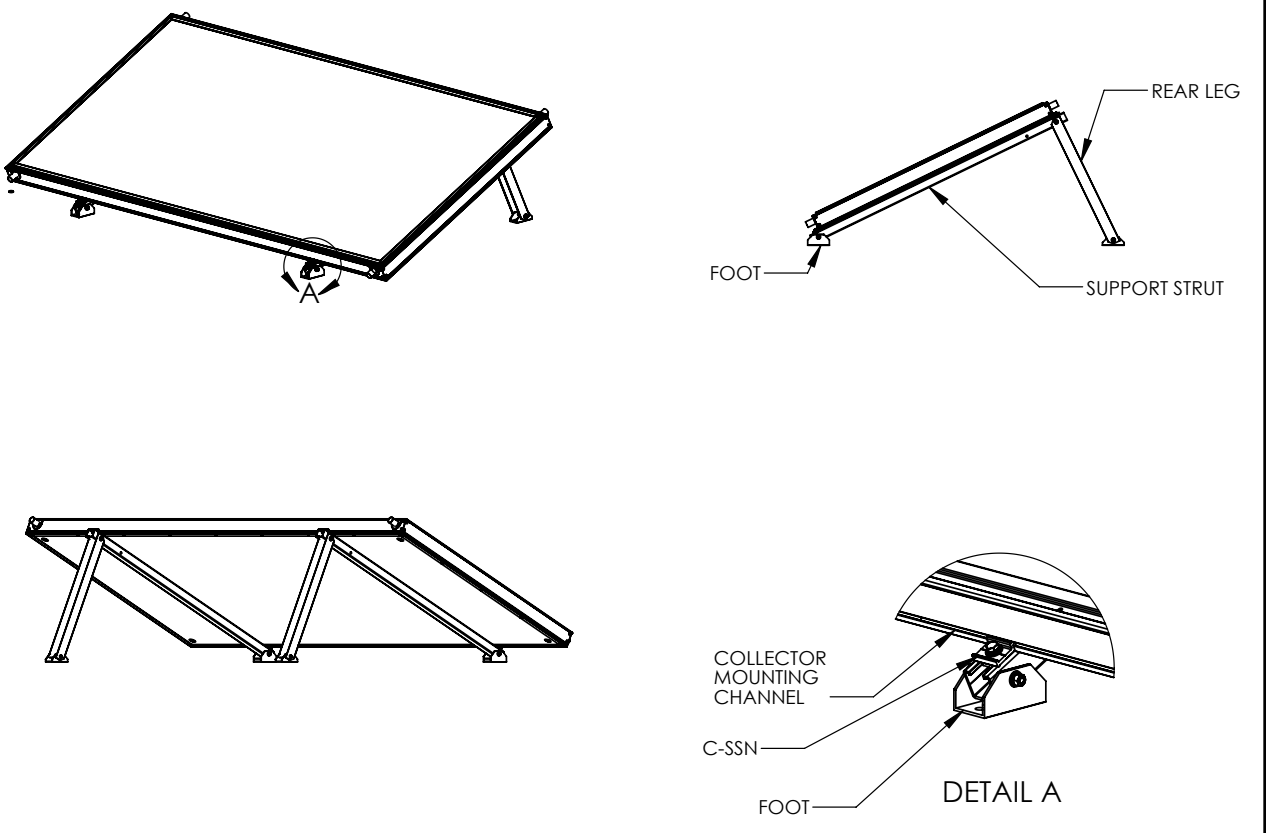
Set the maximum tank temperature to the desired maximum temperature, this temperature must be lower than the rated maximum temperature of the tank and associated components. When the solar loop heats the tank to this temperature, the pump will shut off preventing further heat gains to the solar tank.

4.6.2 Collector Sensor Placement

The collector sensor shall be located on the solar loop return line as close to the collector as possible. Sensors are typically accurate to +/- ½°F if properly installed and weatherized. The collector probe sensor shall be attached to the SunEarth collector header pipe either with a stainless steel hose clamp or by inserting the probe sensor into a thermal well in contact with the fluid near the outlet header pipe.

It is recommended that the connection between the silicon sensor lead and low voltage sensor wiring be made inside the attic, a NEMA 4X junction box or some other indoor space. When using wire nuts to make the connection, the crimped brass cap on the end of the sensor wire should be removed and the wire striped before inserting into the wire nut. Where connections from the sensor lead to the low voltage wiring is made at an exposed location the connection should be by crimp and heat shrink or solder and heat shrink butt connections. Wire nuts or screw connectors should not be used in exposed locations due to the likelihood of corrosion which will result in a compromised electrical connection.

Thoroughly wrap and weatherize the insulation with electrician's tape or insulation tape as provided by the manufacturer. See Figure 12 for collector sensor installation detail.



LANDSCAPE RACK

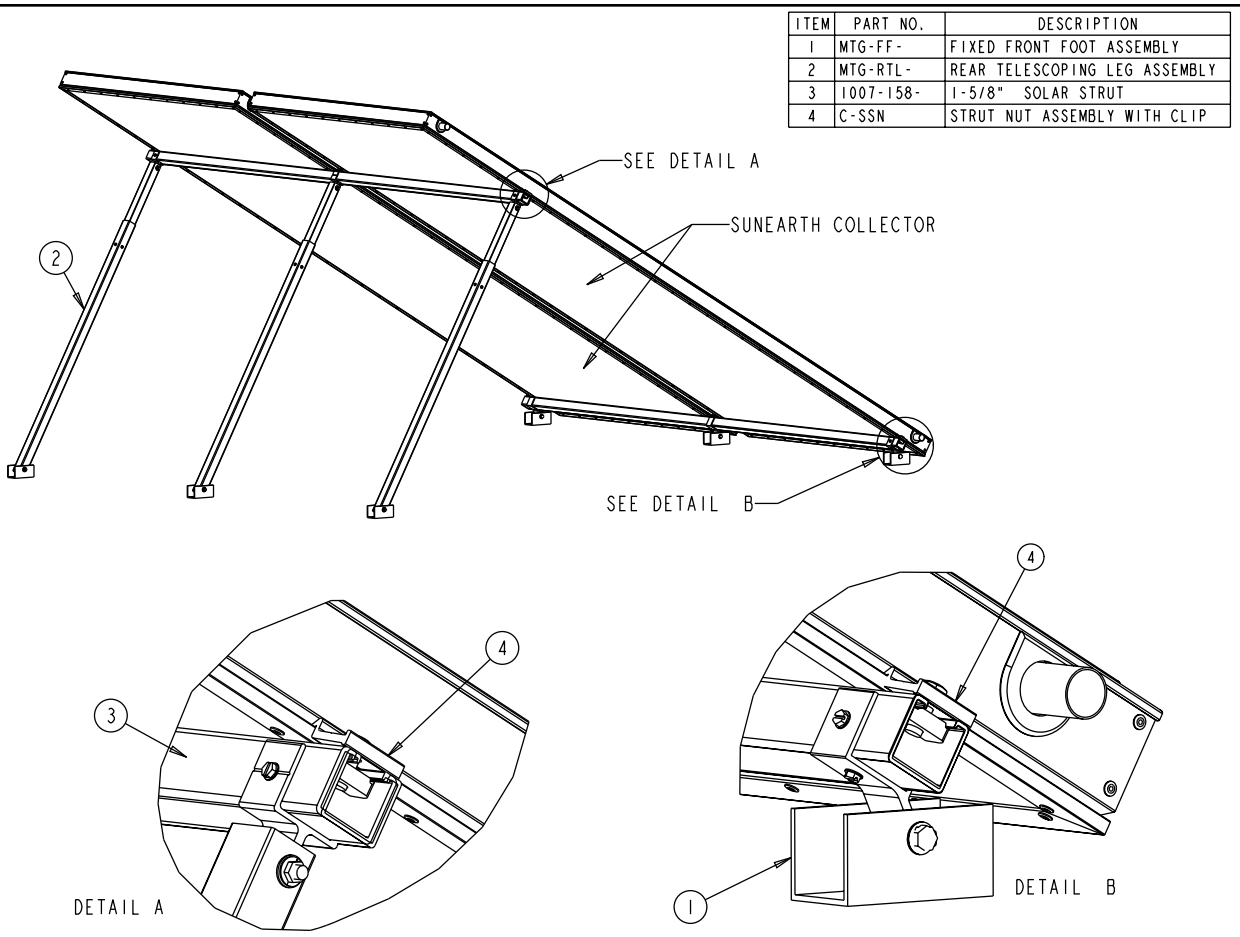
fig. 10

If an electrical potential exists between the roof and ground, this may induce current in the collector sensor wire. This current will result in a false signal being received by the controller and hence incorrect temperature readings. To prevent such current the copper plate and piping should be independently grounded. This will provide a separate path to ground from the roof which does not interfere with the sensor readings.

Grounding can be achieved by running a separate ground wire to the collectors or ensuring that the copper pipe in the closed loop is grounded and there are no electrical discontinuities between the grounding point and the collector. Grounding of the collector & roof piping is especially important in locations that often experience electrical storms and electrical atmospheric activity.

4.6.3 Low Voltage Wiring

The low voltage wiring used to connect the sensor lead to the controller shall be a minimum18 AWG. The wiring should be bare or tinned copper, two conductor, stranded, PVC insulated, with a PVC UV rated jacket suitable for exterior use. In locations that often experience electrical storms and electrical atmospheric activity the low voltage sensor wire should also be shielded and the shielding connected to ground.



REXRACK
(FOR MULTIPLE COLLECTORS WITH PORTRAIT TILT)

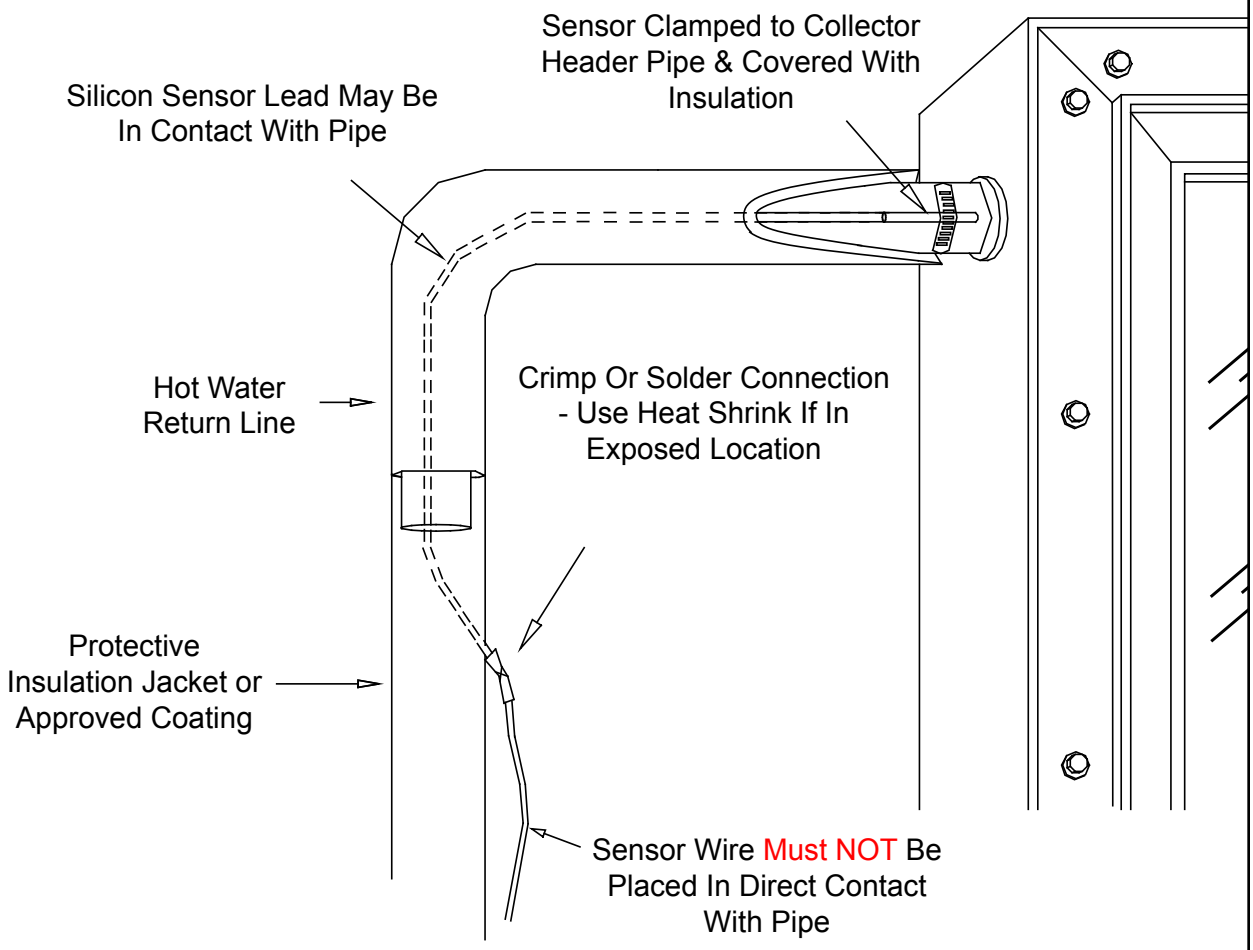
fig. 11

Low voltage wire shall be rated for the full range of temperatures expected in the location, typically wire is rated up to 160°F. The low voltage sensor wire must not be in direct contact with the pipe as the wire insulation may melt when in contact with a hot pipe. Low voltage sensor wire must be run OUTSIDE the pipe insulation. Where the low voltage wire is run in an exposed location, it should be run OUTSIDE the pipe insulation but UNDER the insulation jacket or wrap to protect the wire from UV exposure.

4.7 Installing the Solar Tank

The solar tank is heated indirectly through a double wall heat exchanger that is integral to the tank. The heat exchanger wraps around the tank shell and under the insulation and tank jacket. Any leak in the heat exchanger will be seen as fluid will leak out from the bottom tray of the tank jacket.

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



COLLECTOR SENSOR fig. 12

copper and stainless steel fittings in plumbing the solar storage tank and expansion tank. The use of galvanized fittings, CPVC, PVC or other plastic pipe is prohibited. Di-electric nipples may be required by the (Authority Having Jurisdiction) AHJ on the potable side.

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 (COMPONENT #23, FIGURES 15A; 15B; 16A; 16B; 17A; 17B).

The differential temperature controller shall have a screen readout to show temperatures of the collector and storage tank. Otherwise, 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°F – 12°F warmer than the water in the collector supply line. Compare the temperature readings in the two line thermometers (COMPONENT #3, FIGURES 15A; 15B; 16A; 16B; 17A; 17B).

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 (COMPONENT #32, FIGURES 15A; 15B; 16A; 16B; 17A; 17B). The mixing valve shall be standard ASSE 1017 approved.

The temperatures generated by your SolaRay AC 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 expected from November through March. On sunny days the end of day solar tank temperatures may range between 110ºF to 180ºF depending upon the season and hot water demand. The mixing valve refrenced above blends the hot and cold water supplies to deliver hot water to your fixtures at a safe, controlled temperature.

WARNING: SCALDING CAN OCCUR WITHIN FIVE SECONDS WHEN WATER TEMPERATURES APPROACH 140ºF. THE MIXING VALVE SHALL BE ADJUSTED BY YOUR CONTRACTOR TO PROVIDE WATER TO YOUR FIXTURES AT NO MORE THAN 122ºF.

The ¾" cold water supply line to the solar storage tank shall be insulated with minimum ⅞" X ½" pipe insulation to a minimum distance of 5' behind the storage tank, or to the wall if closer than 5'.

4.8 Tank Sensor Placement

Figure 18 details the proper placement of the solar storage tank sensor. Tank sensor shall have good thermal contact with the tank wall in order to accurately measure the temperature of the water at the bottom of the tank. It is recommended that the sensor be installed in a brass or copper thermalwell screwed into the lower sensor port in the tank.

Thoroughly weatherize the wire connections in accordance with section 4.6.2.

4.9 Tank Insulation

SunEarth heat exchanger tanks have an insulation value of approximately R-17.3.

Conventional back-up electric water heaters have insulation values between R-12 and R-20. The R value expresses the thermal resistance of the tank insulation. The higher the "R-value" value the more effective the insulation material is at preventing heat loss. The use of any solar storage tank with and R value below R12 is prohibited.

The storage tank should not be placed directly on an uninsulated floor or concrete slab. In order to prevent moisture damage to the base of the tanks and reduce heat loss to the floor slab, the tank should be raised off the floor on a pad.

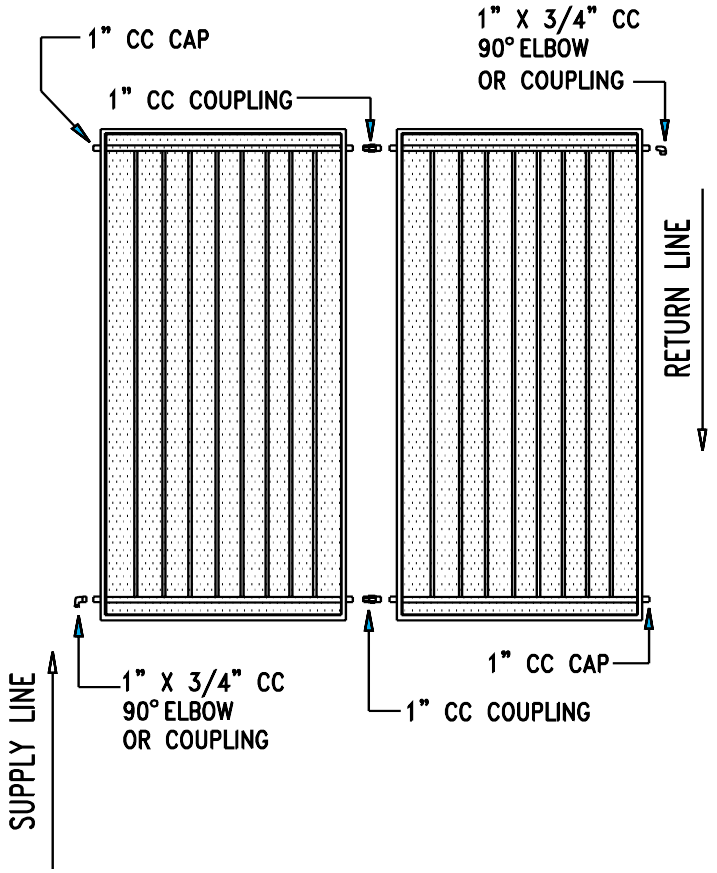
4.10 Expansion Tank

The collector loop expansion tank shall be rated for propylene glycol based HTF and rated to operate up to 180ºF and at a pressure not less than the discharge pressure setting of the pressure relief valve in the collector loop.

The collector loop expansion tank should be sized so that the acceptance volume of the expansion tank exceeds the volume of fluid in the collector(s); this will allow the entire contents of the collectors to boil without resulting in the pressure relief valve discharging (this is sometimes referred to as a "steam back" system). If the system design prevents the HTF from boiling, even during conditions with no hot water load, the expansion tank may be sized for liquid expansion only (non-boiling systems). When the stagnation temperature* of the collector(s) is lower than the boiling point of the HTF (at the initial charge pressure of the system) the system design will prevent the HTF from boiling and therefore a smaller expansion tank (sized for liquid expansion only) may be used for these systems (this design methodology is referred to as "low stagnation protection").

WARNING: WHEN USING THE LOW STAGNATION PROTECTION METHOD THE HTF MUST BE RATED TO OPERATE

fig. 13



COLLECTOR PLUMBING - VERTICAL MOUNT

AT TEMPERATURES ABOVE THE STAGNATION TEMPERATURE* OF THE COLLECTORS.

* The stagnation temperature is calculated by extrapolating the second order collector performance equation (at 317 Btu/hr.ft2 insolation and 100ºF ambient temperature) to the x-axis intercept. Stagnation temperatures for various SunEarth collectors are listed at www.SunEarthinc.com

NOTE: In addition to the collector loop expansion tank a POTABLE EXPANSION TANK **MAY BE REQUIRED** by the plumbing code on the potable piping to the solar tank if there is a backflow preventer between the household piping and the street mains.

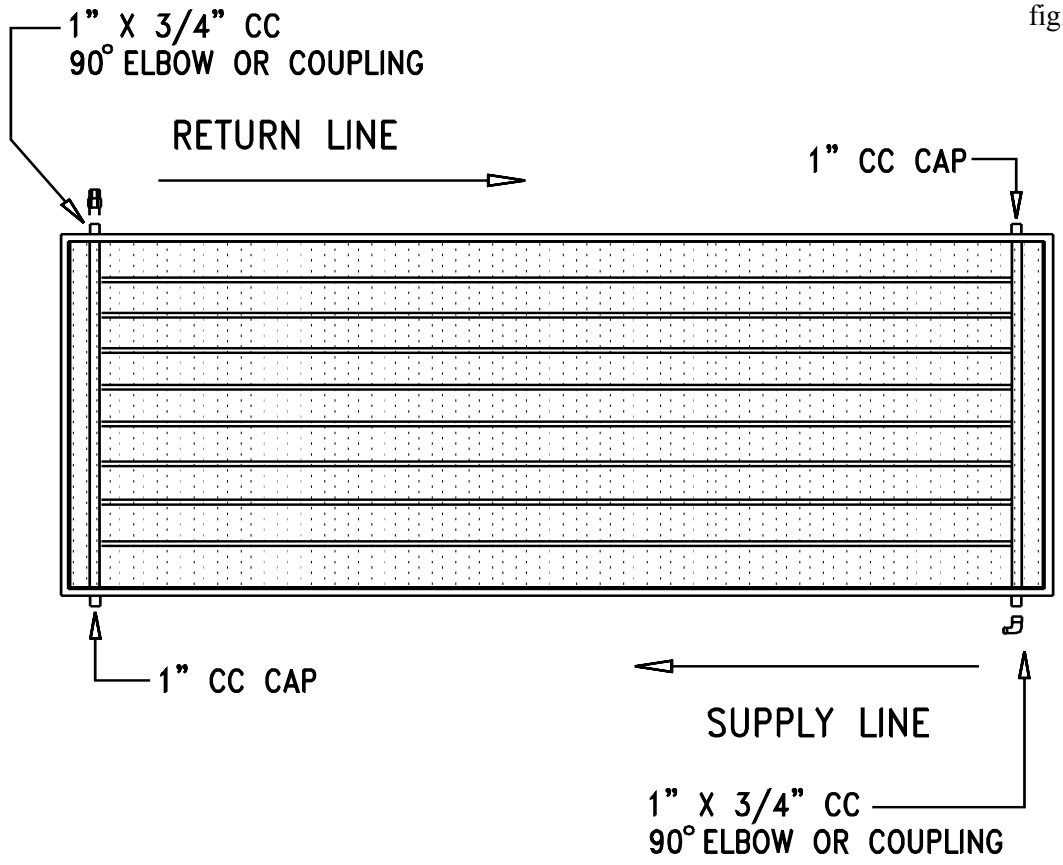
4.12 Electrical and Wiring Requirements

When the electric element is used as the auxiliary heat source a properly licensed contractor shall make the 230 VAC electrical connection to the water heater or solar storage tank. 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.

SunEarth recommends the use of a 115 VAC differential control with a factory installed six foot line cord. The installation requires one 115 VAC outlet to be installed near the solar storage tank. Plug the control into the outlet. The

fig. 14



COLLECTOR PLUMBING - HORIZONTAL MOUNT

circulation pump line cord is plugged into the receptacle on the controller. A 230 VAC control and circulation pump may be substituted.

4.13 Heat Transfer Fluid (HTF)

The HTF must be a non-toxic fluid that meets FDA Generally Recognized as safe (GRAS) Classification. This requirement can be met by using a proprietary inhibited propylene glycol HTF such as DowFrost HD. To ensure maximum effectiveness for corrosion protection, the glycol inhibitor package is designed for a minimum 25-30 percent concentration of propylene glycol in distilled 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 propylene glycol to water concentration than necessary, as this will adversely impact the relative heat transfer efficiency of the solution.

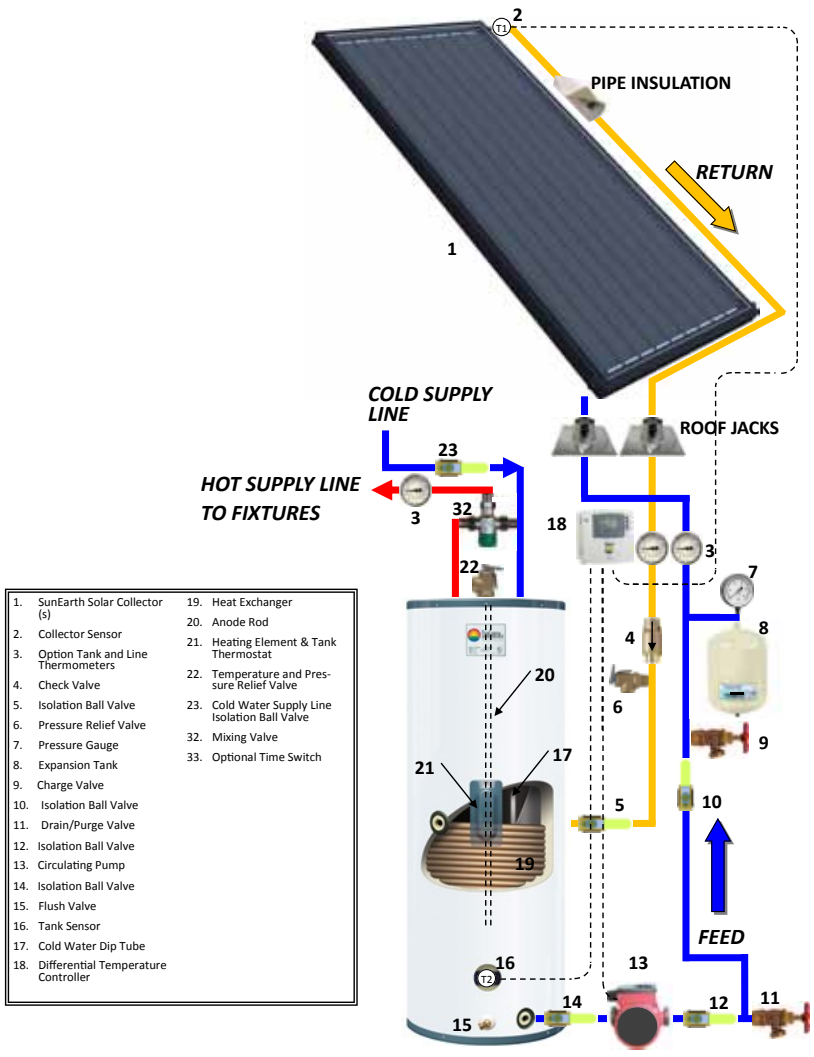
Generally, for an extended margin of protection, you should select a temperature that is at least 5°F lower than the expected lowest ambient temperature. These figures are examples only and should not be regarded as specifications. End use conditions are not within SunEarth control. SunEarth does not guarantee that freeze damage may not occur at temperatures other than shown.

Water used to dilute the HTF must meet 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 shall be used.

The HTF pH level must be maintained between 8

fig. 15a



1. SunEarth Solar Collector (s)
2. Collector Sensor
3. Option Tank and Line Thermometers
4. Check Valve
5. Isolation Ball Valve
6. Pressure Relief Valve
7. Pressure Gauge
8. Expansion Tank
9. Charge Valve
10. Isolation Ball Valve
11. Drain/Purge Valve
12. Isolation Ball Valve
13. Circulating Pump
14. Isolation Ball Valve
15. Flush Valve
16. Tank Sensor
17. Cold Water Dip Tube
18. Differential Temperature Controller
19. Heat Exchanger
20. Anode Rod
21. Heating Element & Tank Thermostat
22. Temperature and Pressure Relief Valve
23. Cold Water Supply Line Isolation Ball Valve
32. Mixing Valve
33. Optional Time Switch

SINGLE TANK SYSTEM SCHEMATIC

and 10 to minimize corrosion and glycol oxidation in the piping system.

4.14 Flushing and Charging the System

Once the components are plumbed you are ready to fill the solar storage tank with water and to charge the collector loop with a mixture of heat transfer fluid (HTF) and water. Due to variations in municipal water quality throughout the country, distilled or deionized water shall be used to mix with the propylene glycol HTF.

Proceed as follows:

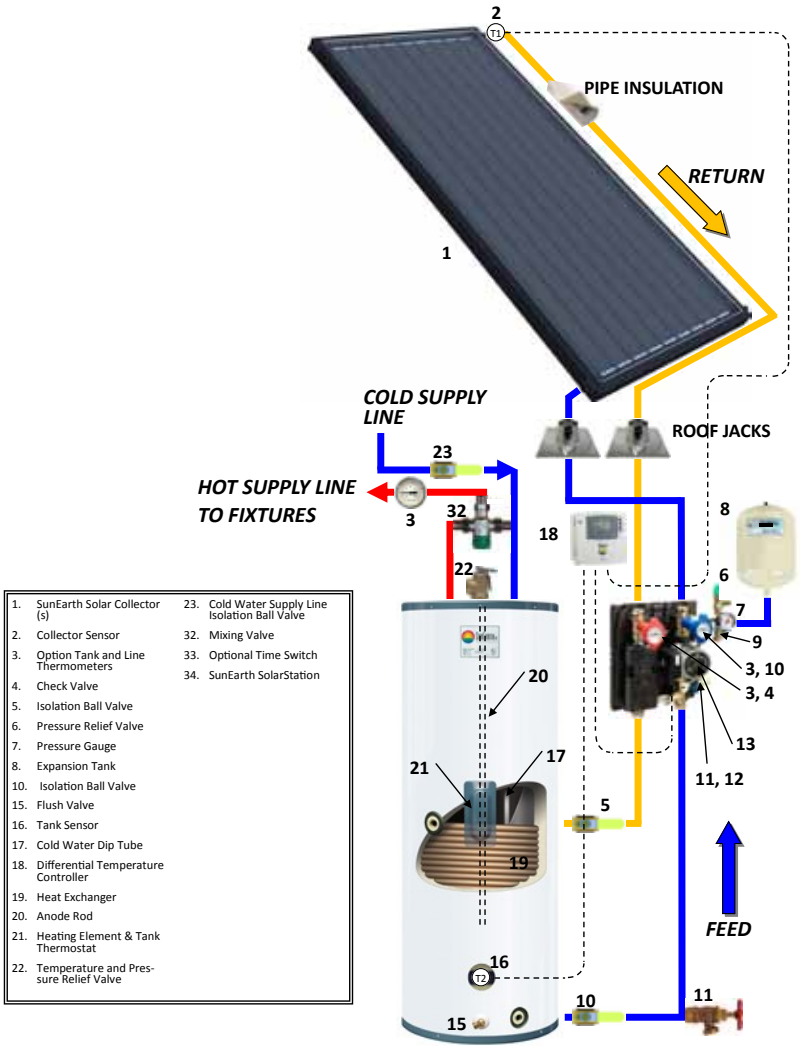
4.14.1 ***STEP 1*** - fill the solar tank with water and check that there are no leaks on the potable side of the system.

Do this by opening the cold water isolation ball valve to the solar tank (COMPONENT #23, FIGURES 15A; 15B; 16A; 16B; 17A; 17B) and opening a hot water outlet, such as a faucet, until the water runs freely. When the tank is filled, inspect all threaded connections and solder joints for leaks.

4.14.2 ***STEP 2*** - Thoroughly flush all impurities out of the collector loop and check collector loop for leaks.

Begin by connecting a washing machine type hose to the upper charge valve (COMPONENT

fig. 15b



1. SunEarth Solar Collector (s)
2. Collector Sensor
3. Option Tank and Line Thermometers
4. Check Valve
5. Isolation Ball Valve
6. Pressure Relief Valve
7. Pressure Gauge
8. Expansion Tank
10. Isolation Ball Valve
15. Flush Valve
16. Tank Sensor
17. Cold Water Dip Tube
18. Differential Temperature Controller
19. Heat Exchanger
20. Anode Rod
21. Heating Element & Tank Thermostat
22. Temperature and Pressure Relief Valve
23. Cold Water Supply Line Isolation Ball Valve
32. Mixing Valve
33. Optional Time Switch
34. SunEarth SolarStation

SINGLE TANK W/SOLAR STATION SYSTEM SCHEMATIC

#9, FIGURES 15A; 15B; 16A; 16B; 17A; 17B) and fill the collector loop with water. The isolation ball valve (COMPONENT #10, FIGURES 15A; 15B; 16A; 16B; 17A; 17B) 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 (COMPONENT #11, FIGURES 15A; 15B; 16A; 16B; 17A; 17B) 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. Water soluble flux should be used when soldering pipe joints in the collector loop in order to facilitate system flushing. Run the water long enough to eliminate any air bubbles that may be trapped in the system.

Install the solar expansion tank and confirm that the precharge pressure is 3-5psig less than the desired system pressure. The non-potable expansion tank should not be connected to the collector loop during flushing to prevent debris from lodging inside the expansion tank chamber.

Close the lower purge/drain valve. The collector loop now has been subjected to city pressure. The PRV should not discharge provided it is set to a higher pressure than of the typical mains pressure at the location. Close the fill valve and allow the pressure in the loop to sta-

bilize, if the city water pressure is higher than the PRV open the purge valve slightly to allow the loop pressure to drop to about 60 PSI. Once stabilized, the collector loop pressure should remain fairly constant. A continuous drop in pressure is an indication of a leak in the system. Make a final inspection of the collector plumbing connections to ensure that there are no leaks anywhere in the collector loop piping.

4.14.3 ***STEP 3*** – Run circulator pump to check pump operation, good flow and air has been eliminated from collector loop.

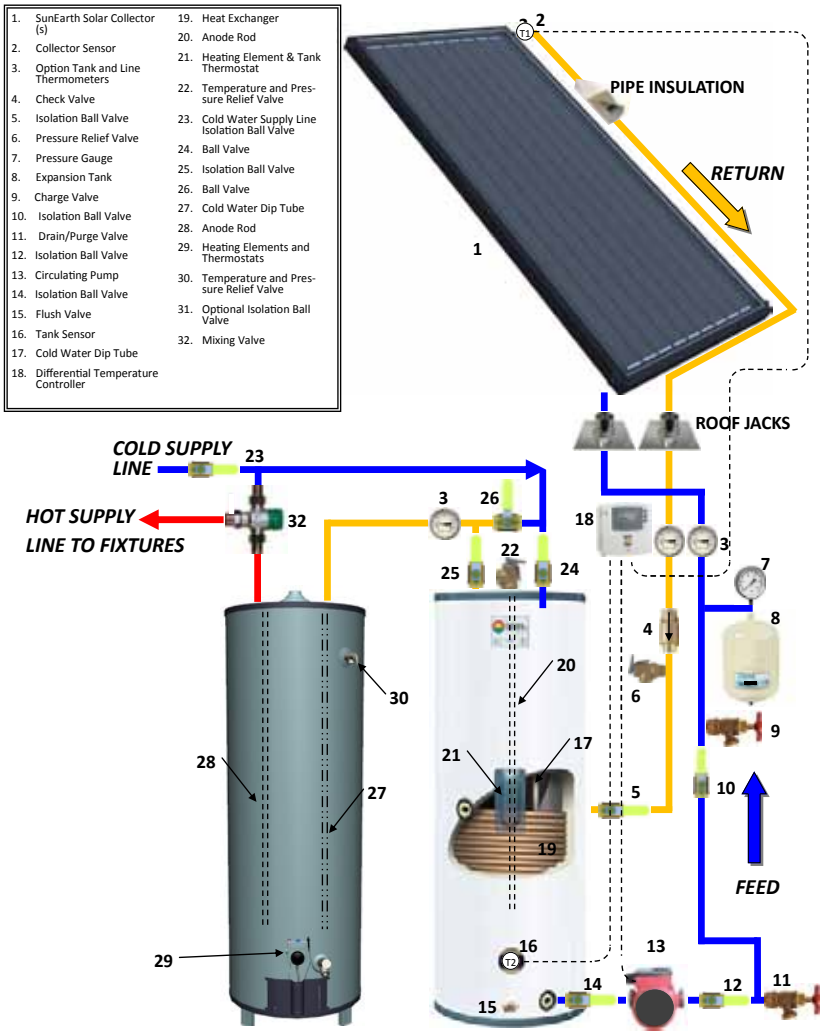
After you have determined the integrity of the entire piping system, turn on the circulating pump. Do this by setting the manual switch within the controller to the "on" position. Run the pump for a full five minutes and carefully check to ensure there is proper fluid flow and that all the air has been purged from the 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.

WARNING: THE NEXT STEP MUST BE

fig. 16a

1. SunEarth Solar Collector (s)
2. Collector Sensor
3. Option Tank and Line Thermometers
4. Check Valve
5. Isolation Ball Valve
6. Pressure Relief Valve
7. Pressure Gauge
8. Expansion Tank
9. Charge Valve
10. Isolation Ball Valve
11. Drain/Purge Valve
12. Isolation Ball Valve
13. Circulating Pump
14. Isolation Ball Valve
15. Flush Valve
16. Tank Sensor
17. Cold Water Dip Tube
18. Differential Temperature Controller
19. Heat Exchanger
20. Anode Rod
21. Heating Element & Tank Thermostat
22. Temperature and Pressure Relief Valve
23. Cold Water Supply Line Isolation Ball Valve
24. Ball Valve
25. Isolation Ball Valve
26. Ball Valve
27. Cold Water Dip Tube
28. Anode Rod
29. Heating Elements and Thermostats
30. Temperature and Pressure Relief Valve
31. Optional Isolation Ball Valve
32. Mixing Valve



TWO TANK SYSTEM SCHEMATIC

CARRIED OUT THE SAME DAY. DO NOT LEAVE THE COLLECTOR LOOP FILLED WITH WATER OVER NIGHT OR YOU RISK FREEZING THE LOOP AND BURSTING THE PIPES.

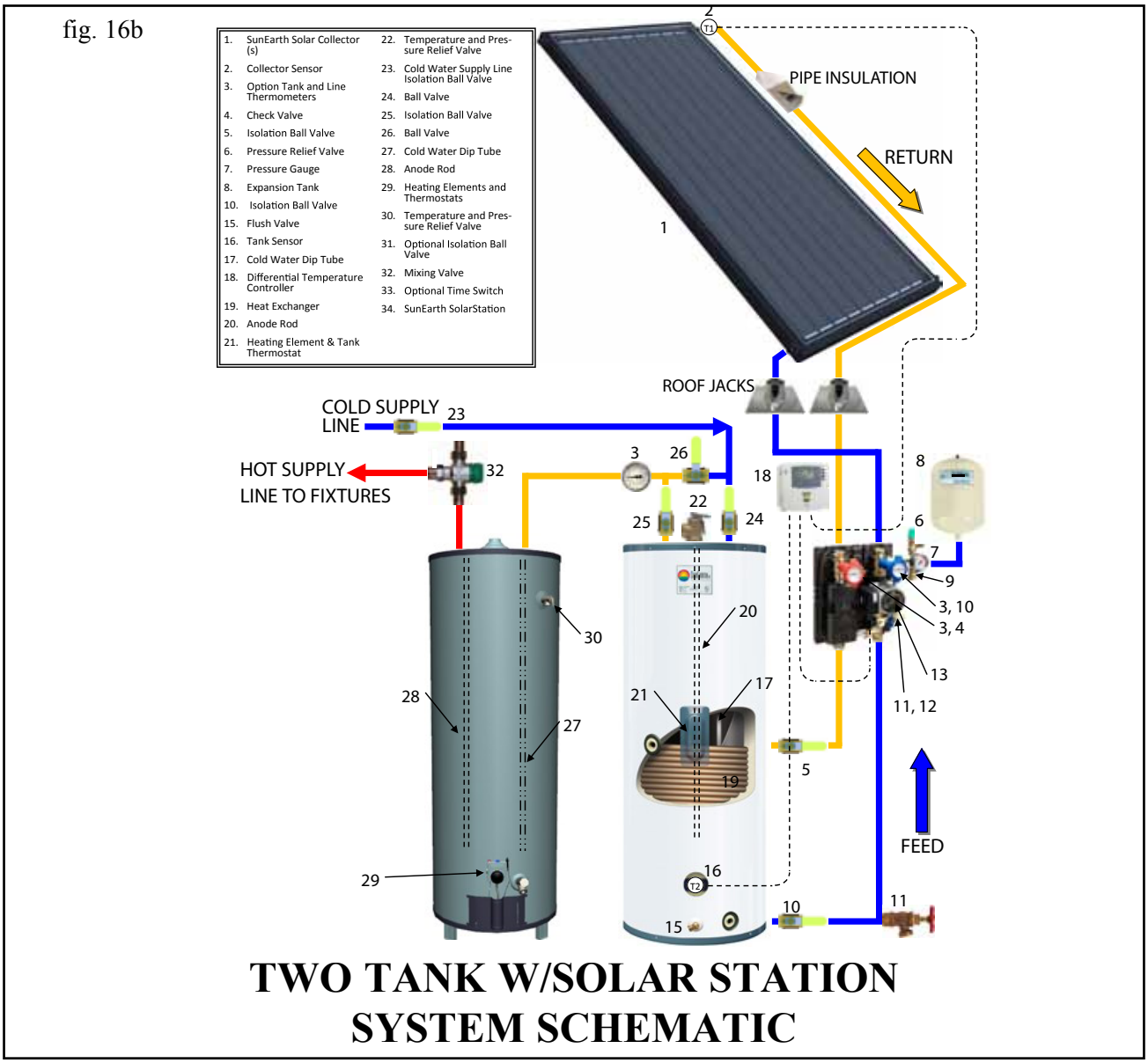
4.14.4 ***STEP 4*** replace water in the collector loop with HTF mixture.

Mix the propylene glycol HTF and distilled water mixture in a accordance with Table 4 and Table 5 in a large clean bucket. You will need a second empty bucket as well. The charging process will require a high head pressure pump capable of producing 50 PSI (115ft. head) pressure to charge the system.

Place the hose for the discharge side of the pump in the empty bucket. Place the hose for the suction side of the pump in the bucket with the HTF. Run the charge pump and allow a small amount of HTF to transfer to the empty bucket this step flushes the pump and hoses. Stop the pump and transfer the hose for the discharge side of the pump to the bucket with the HTF. Run the charge pump for approximately 30 seconds or long enough to ensure priming of the pump.

Connect the discharge side of the charging pump to the upper charge faucet (COMPONENT #9, FIGURES 15A; 15B; 16A; 16B; 17A; 17B). Close the isolation ball valve (COMPONENT

fig. 16b



TWO TANK W/SOLAR STATION SYSTEM SCHEMATIC

Table 4		
Percent (volume) Dow Frost HD 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

#10, FIGURES 15A; 15B; 16A; 16B; 17A; 17B) and connect a second hose to the lower charge faucet (COMPONENT #11, FIGURES 15A; 15B; 16A; 16B; 17A; 17B). Place the other end of the second hose in the empty bucket.

Slowly open the lower charge faucet (COMPONENT #11, FIGURES 15A; 15B; 16A; 16B; 17A; 17B) to depressurize the collector loop. Run the charge pump and immediately open the upper charge faucet (COMPONENT #9, FIGURES 15A; 15B; 16A; 16B; 17A; 17B). Run the charge pressure pump until the glycol mixture begins flowing into the empty bucket. Once you see this, quickly switch the hose from the empty/return bucket to the bucket containing the glycol mixture. Continue to circulate the fluid through the collector loop and bucket using the pressure pump until the bubbling has stopped and the air has been purged.

NOTE: The level of HTF in the bucket may reduce and if so additional HTF must be added to protect the pump from cavitation.

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

4.13.5 ***STEP 5*** - pressurize the collector loop to required pressure.

After charging the collector loop, shut the lower charge valve and let the pressure pump drive up the loop pressure to the appropriate level (Generally in the range of 30 – 40 PSIG). To more accurately calculate the minimum pressure required in the loop, measure the height of the solar collector above the solar storage tank, divide this number by 2.31, then add 20 PSIG to this number. As a word of caution, the pressure in the propylene glycol loop should not exceed the setting of the PR valve when the system is operational on a good sunny day. Contact your solar contractor if the charged collector loop pressure exceeds this threshold.

Your SolaRay AC 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 propylene glycol HTF provides the freeze protection for your system and must be properly maintained. An experienced contractor should periodically check the HTF fluid quality.

5) SYSTEM START-UP PROCEDURES

Throughout the installation procedures outlined in Section 4 above, emphasis has been placed on the correct method for plumbing and wiring the components, checking for plumbing leaks, pressurizing the collector 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 SolaRay AC solar water heating system.

When the solar loop has been fully charged and the pressure is 35 to 40 psig (check the pressure gauge, (COMPONENT #7, FIGURES 15A; 15B; 16A; 16B; 17A; 17B), set the differential controller to the “Automatic” setting. This will activate your circulating pump when the temperature differential between collector and tank is sufficient to provide useful heat. The

SunEarth controller will switch the pump on when the differential is 16°F. The controller will switch the pump back off when the differential falls to 8°F. The controller also allows you to limit the finished solar storage tank temperature if desired.

The SunEarth controller maximum tank default setting is 140°F; this setting can be adjusted as described in the control manual.

Adjust the valve settings in accordance with Section 6 below.

6) TWO MODES OF SYSTEM OPERATION

Both single and two tank SolaRay AC systems are designed to accommodate two separate modes of operation. Your solar water heating system can, (1) serve as a pre-heater to your conventional water heater adding solar energy when and as available, or (2) completely bypass the solar collector loop and solar storage tank and run 100% on utility energy during inclement weather or when the solar system is shut down for maintenance.

SINGLE TANK SYSTEM MODES OF OPERATION

6.1 Solar Preheat

Set the tank thermostat to the lowest acceptable temperature setting. If the solar heated water entering the tank is warmer than the thermostatic set point, the electric heating elements will not come on. If your system has an optional time switch on the heating element, you may preset the timer to turn the heating element on and off at specified times throughout the day if desired. The timer is usually set to only allow the element to come on in the late afternoon and night after the solar collectors are no longer able to provide significant heat. The time switch also can be overridden so that you operate on 100% solar power when conditions allow.

6.2 100% Utility Power

Leave the circuit breaker to your solar storage tank on and close the isolation ball valves in the collector loop (COMPONENT #5 & 14, FIGURES 15A; 15B; 16A; 16B; 17A; 17B). In this mode of operation you must turn off the circulation pump. To turn the pump off, 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

6.3 Solar Preheat

Follow the instructions for the single tank system for setting the thermostat, gas or electric heater for automatic operation. The ball valves going to and from the solar storage tank (VALVE # 24 & 25, FIGURES 15A; 15B; 16A; 16B; 17A; 17B) must be open while the bypass ball valve (VALVE # 26) must be closed. See Figure 19a, Solar Preheat.

6.4 100% Utility Power

Follow the instructions for the single tank system for setting the thermostat, gas or electric heater for automatic operation. The ball valves going to and from the solar storage tank (VALVE # 24 & 25, FIGURES 15A; 15B; 16A; 16B; 17A; 17B) must be closed while the bypass ball valve (VALVE # 26) must be open. See Figures 19b 100% Utility Power.

7) SYSTEM SHUT DOWN AND ISOLATION PROCEDURES

Your SolaRay AC 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 (COMPONENT #23, FIGURES 15A; 15B; 16A; 16B; 17A; 17B). 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 (COMPONENT #5 & 14 FIGURES 15A; 15B; 16A; 16B; 17A; 17B .) If the pressure in this loop drops or you find a Propylene Glycol leak

shut these valves and contact your installation contractor. Turn the circulating pump off by setting the controller to the "off" position.

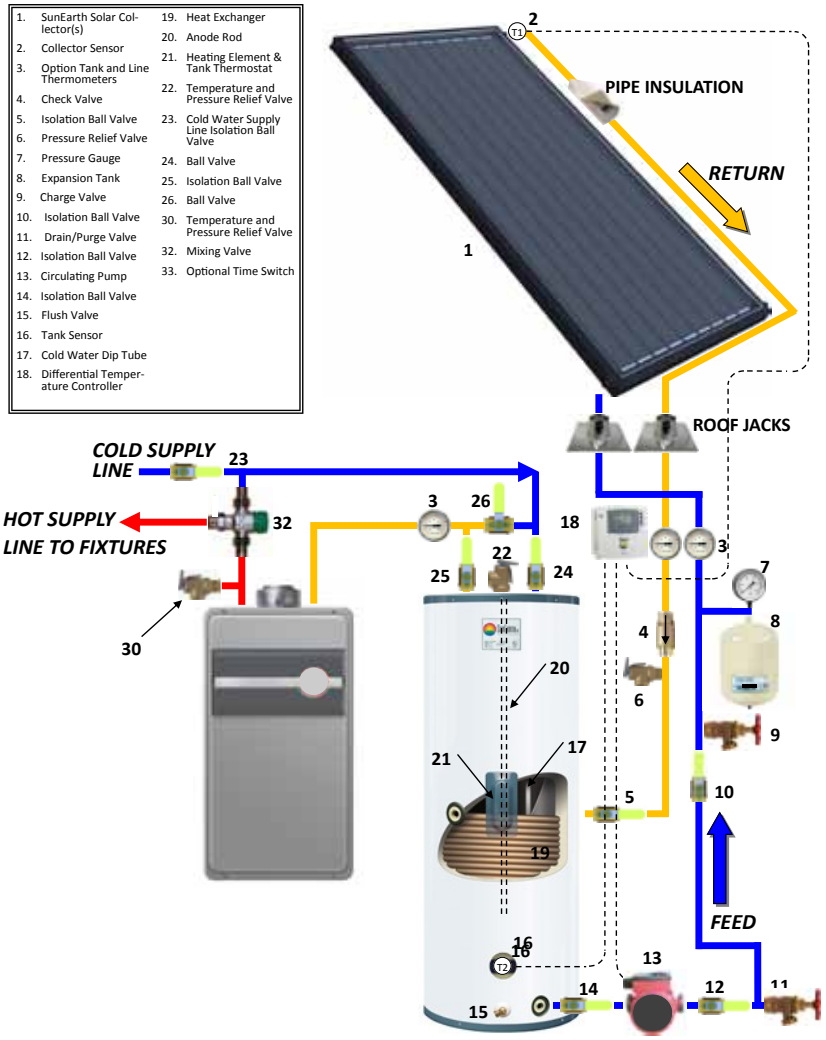
In two tank systems the solar storage tank can be isolated from the back-up water heater by closing the two ball valves to the solar tank (COMPONENT #24 & 25, FIGURES 15A; 15B; 16A; 16B; 17A; 17B) and opening the solar bypass ball valve (COMPONENT #26, FIGURES 15A; 15B; 16A; 16B; 17A; 17B). By bypassing the solar tank, it can be serviced or replaced. The operation of the back-up water heater will not be affected.

8) SUMMER VACATION RECOMMENDATIONS AND PROCEDURES

Solar water heating systems can reach very high temperatures when there is no daily hot water usage on the system. If a short summer vacation is planned, the SunEarth differential temperature controller has a vacation function which, when activated, will dissipate heat at night. See the control manual to activate this function. Remember to deactivate this function upon your return!

During extended summer vacations (4 weeks or more) it is advisable to either cover the solar

fig. 17a



TANKLESS BACKUP SYSTEM SCHEMATIC

collectors with an opaque material or to manually drain the collector loop HTF. SunEarth recommends that you cover the collectors if practical.

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

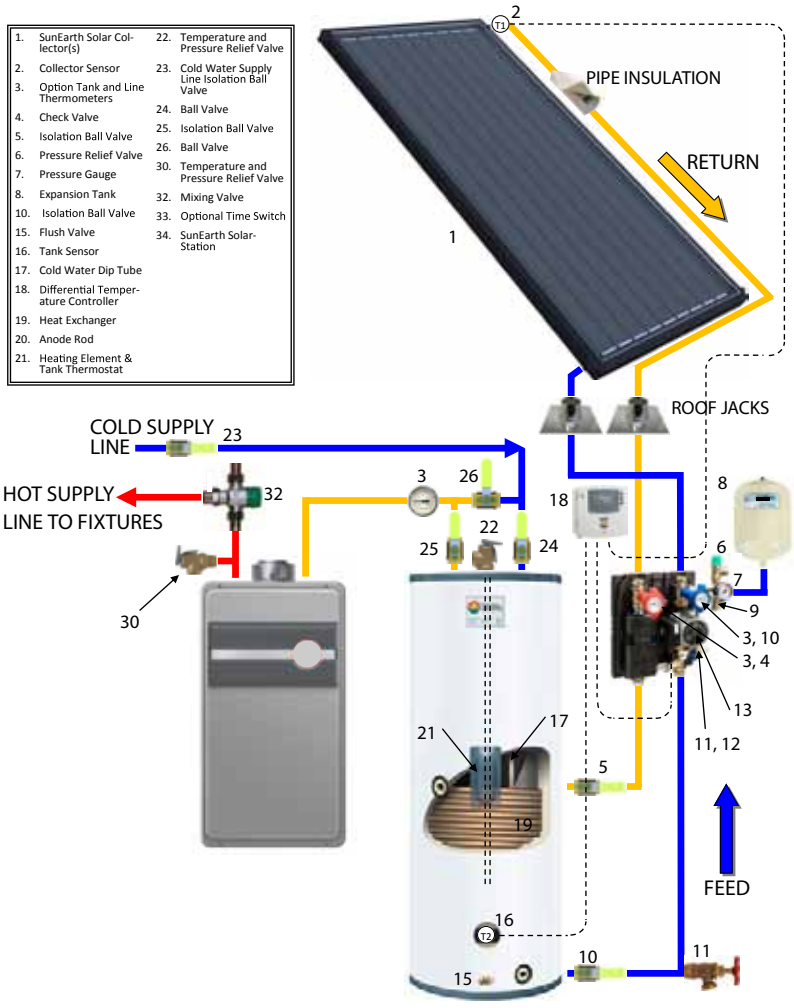
8.1 Turn the controller to the "off" position (COMPONENT #18, FIGURES 15A; 15B; 16A; 16B; 17A; 17B).

8.2 Connect one end of a garden hose to the purge/drain valve (COMPONENT #11 FIGURES 15A; 15B; 16A; 16B; 17A; 17B) and place the other end in a five gallon bucket. Open both the purge/drain valve and the upper fill valve and gravity will drain the heat transfer fluid into the bucket. If the HTF is being disposed of, a licensed recycler, reclaimer or incinerator must dispose of the HTF.

WARNING: 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!

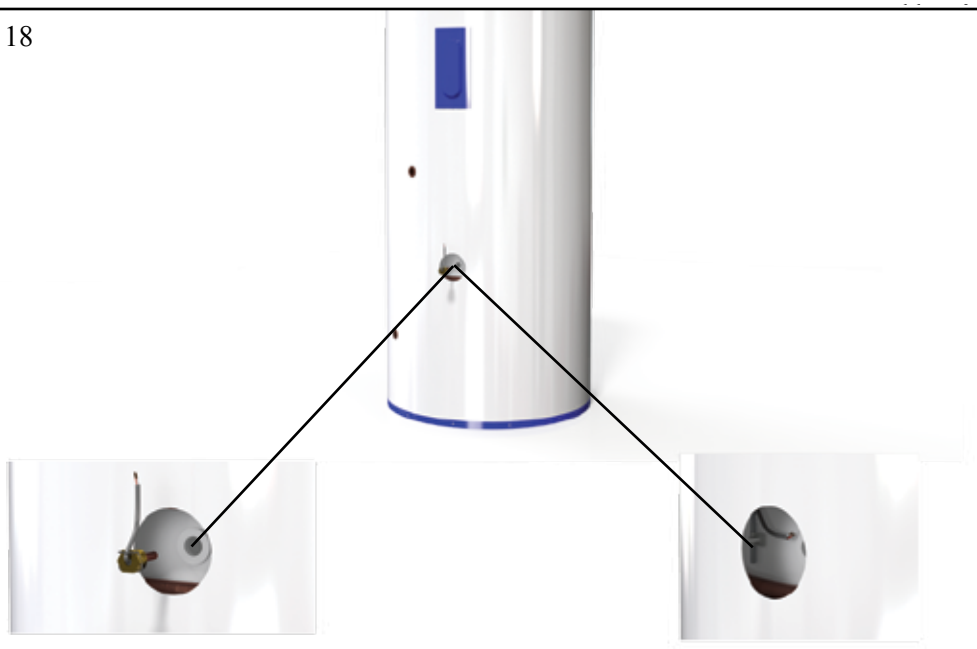
8.3 If the electric water heater is installed with an optional time clock controlling the element make sure the clock is not preset to go "ON" during your absence. If you have a time switch, deactivate per clock's instruction manual.

fig. 17b



TANKLESS BACKUP W/ SOLAR STATION SYSTEM SCHEMATIC

fig. 18



Thermowell

JIFFY CLIP

TANK SENSOR OPTIONS

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 if necessary.

9) MAINTENANCE AND TROUBLESHOOTING

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

9.1 It is extremely important to monitor the quality of the heat transfer fluid (HTF) on a periodic basis. The chemical composition of the HTF may change over time. A high quality propylene glycol HTF capable of operating at high temperatures should be used. The water used to dilute the HTF is equally important, water containing salts, acids, calcium or other potential precipitates should not be used to dilute the HTF initially or during subsequent re-charges; de-ionized water is recommended. The recommended propylene glycol HTF is Dow Chemical "Dowfrost HD". Technical and engineering data for Dowfrost HD is available at www.Dow.com.

A high quality HTF diluted with pure water and properly maintained will prevent: appearance of deposits on the piping; corrosion of components; and loss of freeze protection. System pH must be maintained between 8 and 10 to avoid damage to the collector loop and absorber plate piping Ask your installation contractor to establish a maintenance schedule to inspect, balance or replace the glycol HTF as needed.

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 (COMPONENT #20, FIGURES 15A; 15B; 16A; 16B; 17A; 17B). Typically constructed from magnesium, anode rods are installed in "glass lined" water heaters

and storage tanks to inhibit corrosion.

As the name implies, the "sacrificial" anode rod is consumed so that the tank lining is not. At a certain point in the process, the anode rod is no longer completely effective and the corrosive processes begin to eat away 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.

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 (COMPONENT #15, FIGURES 15A; 15B; 16A; 16B; 17A; 17B) 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. Note: Be sure the collector glass is cool before cleaning. When the collector glass is clean it 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 with high quality exterior latex paint.

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 HTF or water leak, or the collector 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, 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 VAC 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

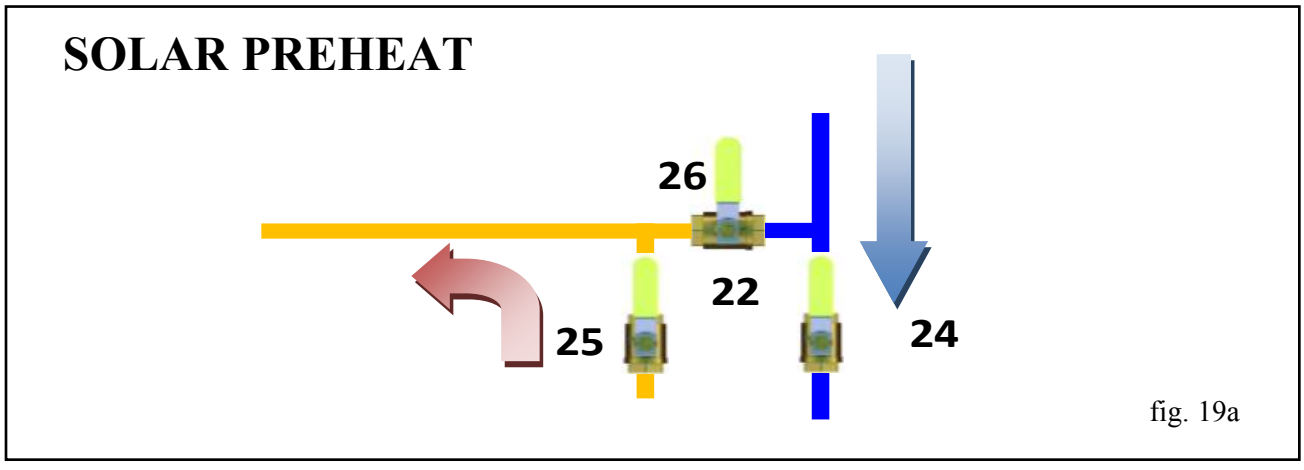


fig. 19a

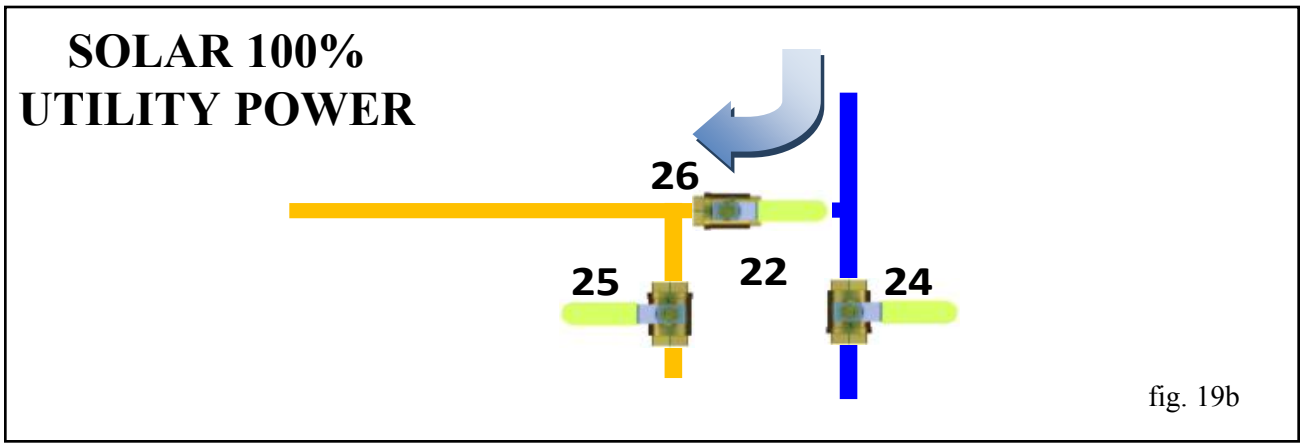


fig. 19b

of the temperature 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 (COMPONENT #4, FIGURES 15A; 15B; 16A; 16B; 17A; 17B) may not be seating correctly and should be cleaned or replaced. Also make sure that the circulating pump is not running at night. If the pump is running and the controller displays questionable temperatures at the collector or tank (i.e. 180°F tank and 45°F collector), check both sensors using a resistance meter to see if they are correctly calibrated. If you find a defective sensor replace it immediately.

Note that in a two tank system night time heat loss will be harder to detect, especially if you are operating in the solar preheat mode. Check the line thermometers (if installed) 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 (COMPONENT #29, FIGURE 16).

DANGER: NEVER REMOVE THE PROTECTIVE ACCESS PLATE ON THE EXTERIOR OF THE SOLAR STORAGE TANK OR CONVENTIONAL WATER HEATER WITHOUT DISCONNECTING THE 230 VAC POWER SUPPLY AT THE CIRCUIT BREAKER.

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

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

10) SYSTEM COMPONENT PARTS

See Figures 15a; 15b; 16a; 16b; 17a and 17b for the location of the specific components numbered below.

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

2. Collector Sensor (T1): 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.

3. Optional Tank and Line Thermometers: Used to determine proper system operation. Line thermometers will show an approximate 5°F - 12°F 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.

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 or non-return valves. A separate check valve is not required if there is an integral check valve within the pump.

5. Isolation Ball Valve: Used in conjunction with component No. 14 to isolate the solar collector loop from the solar storage tank.

6. Pressure Relief Valve: Will discharge heat transfer fluid from the collector closed loop at the PR Valve pressure setting (typically 75 - 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 and may be used to manually purge air from the collector loop.

The PRV protects the collector and all components in the collector loop from pressures in excess of the PRV pressure setting.

WARNING: THE PRESSURE RELIEF VALVE SETTING MUST NOT BE HIGHER THAN THE MAXIMUM WORKING PRESSURE OF THE COMPONENTS IN THE COLLECTOR LOOP.

7. Pressure Gauge: Indicates the pressure in the charged Propylene Glycol collector loop.

8. Expansion Tank: Pre-charged with air to allow for the expansion and contraction of the HTF as it heats and cools, thus maintaining the entire collector loop pressure within the design parameters.

9. Charge Valve: Used to charge the collector loop with Propylene Glycol and also to eliminate air from the system.

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).

11. Drain/Purge Valve: Used to charge the collector loop with glycol, purge air from the loop and drain the heat exchange fluid.

12. Isolation Ball Valve: When closed in conjunction with No. 14 will isolate the circulation pump for repair or replacement.

13. Circulating Pump: Circulates the HTF through the collector loop.

14. Isolation Ball Valve: Used in conjunction with component No. 5 to isolate the solar collector loop from the solar storage tank.

15. Flush Valve: Used to drain the solar storage tank and to flush sediment from the tank on an annual basis.

16. Tank Sensor (T2): Wired to your controller. Works in conjunction with the collector sensor to turn your circulating pump on and off at preset temperature differentials.

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.

18. Differential Temperature 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.

19. Heat Exchanger: Transfers heat from the solar collector loop to the potable water in the solar storage tank. The heat exchanger is double walled and vented. If a leak in the heat exchanger piping occurs there is no possibility that the potable water in your solar storage tank

can be contaminated with the glycol HTF.

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.

21. Heating Element & Tank Thermostat: The solar storage tank is equipped with an auxiliary 4500 watt, 230 VAC electrical heating element. The thermostat controls the temperature setting of the auxiliary heating element.

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.

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 back-up water heater from the pressurized city cold water supply line.

24. Ball Valve: Used in conjunction with component Nos. 25 & 26 to establish the desired mode of system operation.

25. Ball Valve: Used in conjunction with component No. 24 to completely isolate the solar storage tank for repair or replacement as necessary.

26. Solar Bypass Ball Valve: Used in conjunction with components No. 24 & 25 to establish the desired mode of system operation.

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.

30. Temperature and Pressure Relief Valve: See No. 22 above.

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 SolaRay AC solar water heating system.

11) ESTIMATED COMPONENT LIFE

You can expect a long useful life from the primary components in your SolaRay AC solar water heating system by adhering to the routine service and maintenance tips provided above.

The SunEarth solar collectors have a design life of twenty-five to thirty years. The HTF must be maintained as specified in this manual to maximize collector life. The solar storage tank should last twelve to twenty years in most areas provided the anode rod is periodically replaced. The circulating pump and differential control should last 10 to 15 years before needing to be replaced. Like EPA mileage estimates for automobiles, these component design lives represent average figures for system components installed in the United States. The life of your components may vary.

To obtain warranty service, please see the completed Appendix F on the back of this manual with your installation contractor contact information or contact SunEarth for the name of an authorized service agent near you.

12) SYSTEM OPERATING PARAMETERS

12.1 Collector Loop Pressure

The pressure in the collector loop will normally increase as the HTF heats up and expands during the day and cools down and contracts at night. The amount of pressure variation will depend on the degree of temperature swings and the size of the expansion tank. Larger expansion tanks allow more fluid expansion and contraction with less pressure variation.

Recommended initial system charge:

25 PSI – 60 PSIG

Normal operating pressure: 20 PSI – 100 PSIG

Operating pressures below the normal operating pressure may indicate a system leak; air venting or that the system was not sufficiently charged on installation. It is not always possible to expel all the air from the system at the time of initial charge, small bubbles entrained in the fluid will take a few days to a week to collect so that the air can be vented. If system pressure drops below normal operating pressure after air has been vented, the installer must top up the HTF and re-pressurize the system.

12.2 Temperature Differential

The temperature difference between the collector outlet sensor (T1) and the solar tank sensor (T2) is a good indicator that the system is operating correctly. During the middle of the day, when the pump is running the normal operating differential will be 4ºF – 40ºF.

If the solar tank reaches its maximum temperature the pump will stop. If this happens during the middle of the day the collector temperature will rise rapidly while the tank temperature will remain static. In this case a temperature differential of up to 300°F is not unusual.

12.3 HTF Acidity

The propylene glycol HTF should be slightly alkaline at all times, the pH can be checked periodically by bleeding a few drops from the collector loop and testing with pH strip paper or other pH tester.

Normal operating pH: 8 - 10

Acidic HTF will attack metals in the collector loop and result in decreased system life and poor operation. If the pH of the HTF falls outside the normal range, contact your installer, drain the system and replace the HTF.

Propylene Glycol Maintenance Schedule	
Date Of Installation:	
Date Of Service:	
Date Of Service:	
Date Of Service:	
Date Of Service:	

Appendix A

Solar Collectors – SunEarth Liquid Flat Plate Collectors

Make	Series	Model Numbers
SunEarth	Empire, Paint	EP-21 EP-24 EP-24-0.75 EP-24-1.5 EP-32 EP-32-0.75 EP-32-1.5 EP-40 EP-40-0.75 EP-40-1.5
SunEarth	Empire, Chrome	EC-21 EC-24 EC-24-0.75 EC-24-1.5 EC-32 EC-24-0.75 EC-32-1.5 EC-40 EC-40-0.75 EC-40-1.5
SunEarth	SunBelt	SB-24-0.75 SB-32-0.75 SB-40-0.75
SunEarth	Imperial, Chrome	IC-32 IC-40
SunEarth	Imperial, Selective	IS-32 IS-40
SunEarth	ThermoRay	TRB-32 TRB-40

Collector Mounting Hardware

Make	Series
SunEarth	SolarStrut RexRack Flush Mount Kit Universal Tilt Kit Landscape Rack

Install mounting hardware per SunEarth manuals, standard residential drawings, and/or plan sets.

Storage Tank with Integral Double Wall Heat Exchanger

Make	Series	Model Numbers
SunEarth	SunEarth	SU80HE-1* SU65HE-1* SU120HE-1*
Rheem	Solaraide	81V80HE-1* 81V80HE-T 81V120HE-1* 81V120HE-T 81V65HE-1*
Ruud	Solar Servant	RSPE80HE-1* RSPE80HE-T RSPE120HE-1* REPE120HE-T RSPE65HE-1*

**Includes auxiliary 4.5 kW heating element, suitable for one or two tank systems.*
Does not include auxiliary heating element, suitable for two tank systems only.

Differential Temperature Controller

Make	Series	Model Numbers
SunEarth		SETR0301U SETR0502U SETR0603mcU SETR A501 T SETR A502 TT SETR A503 TTR
Steca		TR0301U TR0502U TR0603mcU TR A501 T TR A502 TT TR A503 TTR
Independent Energy	Goldline	GL-30-X216 GL-30-X217
or Approved Equal		

Appendix A

Circulator Pump

The circulator pump shall be a wet rotor small circulator with a cast iron, stainless steel, brass or polymer body and a metal or polymer impeller. The pump motor shall be induction or permanent magnet ECM driven. The pump shall be rated for: maximum fluid temperatures of no less than 180°F and pressures of no less than 125 PSI. The maximum rated amperage shall be no more than 1.5 Amps and the maximum rated power draw shall be no more than 135 Watts.

Expansion Tank

The expansion tanks shall be rated for non-potable propylene glycol based heat transfer fluids. The maximum working temperature shall be no less than 180°F and the maximum working pressure shall be no less than 75 psi. The expansion tank volume shall be not less than 2.0 gallons and the acceptance volume shall be not less than 1.0 gallon.

Heat Transfer Fluid

The heat transfer fluid shall be buffered propylene glycol based and shall have a maximum operating temperature of no less than 280°F. If the HTF has a measurable flash point, at the concentrations used in the system, the HTF shall have a flash point of 400°F or higher.

Thermostatic Mixing Valve

The thermostatic mixing valve shall have a bronze, brass or stainless steel body with a rated maximum working temperature no less than 200°F and a rated maximum working pressure no less than 125psi. The range of temperature set points shall be at least 18ºF (10ºC) and shall include a set point of 120ºF (50ºC). The Thermostatic Mixing valve shall be third party listed and certified to one of the following ASSE standards: ASSE 1016; ASSE 1017; ASSE 1070.

Ball Valves

Ball valves shall be of bronze, brass or stainless steel construction. Maximum working temperature shall be no less than 200°F and maximum working pressure shall be no less than 125 psi.

Three-Way Valves (Optional)

Three-Way valves shall be of bronze, brass or stainless steel construction. Maximum working temperature shall be no less than 200°F and maximum working pressure shall be no less than 125 psi.

Boiler Drains (A.K.A. Charge Valves; Fill Valves; Drain Valves; Purge Valves)

Boiler Drains shall be of bronze, brass or stainless steel construction. Maximum working temperature shall be no less than 200°F and maximum working pressure shall be no less than 125 psi.

Pressure Relief Valve

The pressure relief valve shall be of bronze, brass or stainless steel construction with a pressure setting between 30psi and 150psi. The pressure relief valve shall be set to discharge at a pressure below the maximum design pressure of all other components in the collector loop.

Check Valve (A.K.A. Non-Return Valve)

The check valve may be a stand alone component or may be integral to the circulator pump. The check valve shall be spring type of bronze, brass or stainless steel or polymer construction. Maximum working temperature shall be no less than 200°F and maximum working pressure shall be no less than 125 psi.

Air Vent

The air vents shall be of bronze, brass or stainless steel construction. Maximum working temperature shall be no less than 200°F and maximum working pressure shall be no less than 125 psi.

Appendix A

Thermometers (Optional)

Thermometers shall be dial or scale type and shall have a metallic body and casing and a glass lens. The range of measurement shall be not less than 30°F to 200°F with an accuracy of +/- 2%. An electronic temperature sensing system may be used in place of dial or scale thermometers (see below).

Temperature Sensors (Electronic)

An electronic temperature sensing system may be used in place of dial or scale thermometers. Temperature sensors shall be shall be of metallic construction and have a maximum temperature rating not less than 200°F. Temperature reading may be via digital readout, LCD screen, internet or other electronic device. The temperatures may be read at the differential controller screen. The range of measurement shall be not less than 30°F to 200°F with an accuracy of +/- 2%.

Sensor Wire:

Sensor wire for temperature sensors or other electronic sensors must be no less than 18/2 AWG. Sensor wire must be insulated; in locations where the sensor wire is exposed to the elements it must be UV resistant and rated for outdoor use.

Piping and Hoses

Piping and Hoses shall be copper tube or corrugated stainless steel with a maximum operating temperature of not less than 220°F and maximum working pressure of not less than 125 psi.

Pipe Insulation

Pipe insulation shall have a maximum operating temperature of no less than 220°F. All pipes shall be insulated to R2.6 or greater, typically this will require a wall thickness of ¾" or greater. When located in exposed areas, pipe insulation shall be protected with a UV resistant coating or jacket.

Auxiliary Water Heaters

The auxiliary water heater shall be listed by an accredited listing organization.

The acceptable range of water heater sizes and capacities are listed in the table below. The specific auxiliary water heater selected for a system should be adequately sized to meet the full hot water load at the residence taking into account the delivered hot water temperature; the mains cold water temperature and the expected hot water usage as per standard water heater sizing guidelines.

Type	Storage Volume	Minimum Power Rating
Electric Tank Water Heater	30 – 240 gallons	2,400W to 9,000W
Gas Tank Water Heater	30 – 240 gallons	10,000Btu/h to 200,000Btu/h
Tankless Gas Water Heater	na	95,000Btu/h to 200,000Btu/h

Appendix B

SU80HE-1 Cast Iron Pump Sizing Chart

1/2" Type L Copper Tubing

	Component	Friction Pressure Loss	
Example System #1	SU80HE-1	2.2	Pump Sizing Conditions: 1.39 GPM | 8' Head Loss; GRUNDFOS UPS 15-58FC; Speed 1
	1- 4' X 10'	0.009	
	100' 1/2" Type L	4.5	
	misc	1	
	Total	7.709	
	Rounding	8	Ft of pressure loss
Example System #2	Component	Friction Pressure Loss	Pump Sizing Conditions: 2.2 GPM | 17' Head Loss; GRUNDFOS UPS 15-58FC; Speed 3
	SU80HE-1	5.25	
	2- 4' X 8'	0.009	
	100' 1/2" Type L	10.5	
	misc	1.25	
	Total	17.012	
	Rounding	17	Ft of pressure loss

3/4" Type L Copper Tubing

	Component	Friction Pressure Loss	
Example System #3	SU80HE-1	2.2	Pump Sizing Conditions: 1.39 GPM | 3' Head Loss; GRUNDFOS UPS 15-58FC; Speed 1
	1- 4' X 10'	0.009	
	100' 3/4" Type L	0.7	
	misc	1	
	Total	2.909	
	Rounding	3	Ft of pressure loss
Example System #4	Component	Friction Pressure Loss	Pump Sizing Conditions: 2.2 GPM | 8' Head Loss; GRUNDFOS UPS 15-58FC; Speed 1
	SU80HE-1	5.25	
	2- 4' X 8'	0.009	
	100' 3/4" Type L	1.6	
	misc	1.25	
	Total	7.862	
	Rounding	8	Ft of pressure loss

SU120HE-1 Cast Iron Pump Sizing Chart

1/2" Type L Copper Tubing

	Component	Friction Pressure Loss	
Example System #1	SU120HE-1	6.5	Pump Sizing Conditions: 2.2 GPM | 18' Head Loss; GRUNDFOS UPS 15-58FC; Speed 3
	2- 4' X 8'	0.012	
	100' 1/2" Type L	10.5	
	misc	1	
	Total	18.012	
	Rounding	18	Ft of pressure loss

3/4" Type L Copper Tubing

	Component	Friction Pressure Loss	
Example System #2	SU120HE-1	6.5	Pump Sizing Conditions: 2.2 GPM | 9' Head Loss; GRUNDFOS UPS 15-58FC; Speed 1
	2- 4' X 8'	0.012	
	100' 3/4" Type L	1.6	
	misc	1	
	Total	9.112	
	Rounding	9	Ft of pressure loss
Example System #3	Component	Friction Pressure Loss	Pump Sizing Conditions: 2.2 GPM | 15' Head Loss; GRUNDFOS UPS 15-58FC; Speed 2
	SU120HE-1	10.5	
	2- 4' X 10'	0.018	
	100' 3/4" Type L	2.5	
	misc	1.5	
	Total	14.518	
	Rounding	15	Ft of pressure loss

Appendix C

SOLARAY AC OG-300 SYSTEM LABELS

Labels containing the text below shall be attached to the appropriate valves on all SRCC OG-300 certified systems.

FLUID IDENTIFICATION:

THE HEAT TRANSFER FLUID USED IN THIS SYSTEM IS INHIBITED PROPYLENE GLYCOL. IT MUST BE HANDLED AND DISPOSED OF IN ACCORDANCE WITH THE MANUFACTURERS RECOMMENDATIONS.

BE EXTREMELY CARFUL WHEN DRAINING THIS FLUID. IT MAY BE DISCHARGED AT A VERY HIGH TEMPERATURE AND PRESSURE.

THE HEAT TRANFER FLUID USED IN THIS SYSTEM SHALL BE FDA GENERALY RECOGNIZED AS SAFE (GRAS). NO OTHER FLUID SHALL BE USED THAT WOULD CHANGE THE ORIGINAL CLASSIFICATION OF THIS SYSTEM. UNAUTHORIZED ALTERATIONS TO THIS SYSTEM COULD RESULT IN A HAZARDOUS HEALTH CONDITION.

PLEASE CONSULT SECTION 8 OF YOUR INSTALLATION MANUAL FOR INSTRUCTION ON SHUTTING DOWN AND DRAINING THE SYSTEM.

HEAT EXCHANGER

THE HEAT EXCHANGER USED IN THIS SYSTEM IS DOUBLE WALL VENTED TO ATMOSPHERE. THE HEAT EXCHANGER IS INTEGRAL TO THE SOLAR STORAGE TANK.

FREEZE LABEL:

A 60% CONCENTRATION OF PROPYLENE GLYCOL AND DISTILLED WATER CAN PROTECT YOUR SOLARAY SYSTEM TO TEMPERATURES AS LOW AS -60 F. LESSER CONCENTRATIONS OF DOWFROST HD AND DISTILLED WATER WILL PROVIDE A LOWER LEVEL OF FREEZE PROTECTION.
PLEASE CONSULT SECTION 4.13.4 OF YOUR INSTALLATION MANUAL FOR SPECIFIC FREEZE TOLERANCE INFORMATION.

VALVE NO. 23 - COLD WATER SUPPLY ISOLATION VALVE

THIS VALVE IS NORMALLY OPEN AND ALLOWS POTABLE WATER TO FILL THE SOLAR STORAGE TANK. WHEN CLOSED THE SOLAR STORAGE TANK IS ISOLATED FROM THE PRESSURIZED CITY COLD WATER SUPPLY LINE PIPING.

VALVE NO. 5 – TANK ISOLATION VALVE

VALVE 5 IS NORMALLY OPEN. WHEN CLOSED IN CONJUNCTION WITH VALVE 14 THE SOLAR COLLECTOR LOOP PIPING IS ISOLATED FROM THE SOLAR STORAGE TANK.

Appendix C

VALVE NO. 14 – TANK AND PUMP ISOLTATION VALVE

VALVE 14 IS NORMALLY OPEN. WHEN CLOSED IN CONJUNCTION WITH VALVE 5 THE SOLAR COLLECTOR LOOP PIPING IS ISOLATED FROM THE SOLAR STORAGE TANK. WHEN CLOSED IN CONJUNCTION WITH VALVE 12 THE CIRCULATOR PUMP IS ISOLATED FROM THE SOLAR STORAGE TANK. **NEVER** SHUT THESE VALVES WHILE THE CIRCULATING PUMP IS IN OPERATION.

VALVE NO. 12 – PUMP ISOLATION VALVE

VALVE 12 IS NORMALLY OPEN. WHEN CLOSED IN CONJUNTION WITH VALVE 14 THE CIRCULATING PUMP IS ISOLATED FROM THE SOLAR COLLECTOR LOOP PIPING. **NEVER** SHUT THESE VALVES WHILE THE CIRCULATING PUMP IS IN OPERATION.

VALVE NOS. 9 – SYSTEM FILL VALVE

VALVE 9 IS NORMALLY CLOSED. WHEN OPEN IT IS USED TO CHARGE AND DRAIN THE SOLAR COLLECTOR LOOP PIPING.

BE EXTREMELY CARFUL WHEN DRAINING THIS FLUID. IT MAY BE DISCHARGED AT A VERY HIGH TEMPERATURE AND PRESSURE.

VALVES NOS. 11 – SYSTEM PURGE VALVE

VALVE 11 IS NORMALLY CLOSED. WHEN OPEN IT IS USED TO CHARGE AND DRAIN THE SOLAR COLLECTOR LOOP PIPING.

BE EXTREMELY CARFUL WHEN DRAINING THIS FLUID. IT MAY BE DISCHARGED AT A VERY HIGH TEMPERATURE AND PRESSURE.

ADDITIONAL TWO TANK SYSTEM VALVES

VALVE NO. 24 – COLD FEED TO SOLAR TANK ISOLATION VALVE

THIS VALVE IS NORMALLY OPEN. WHEN CLOSED IN CONJUNCTION WITH VALVE NO. 25 IT WILL ISOLATE THE SOLAR STORAGE TANK FROM THE POTABLE WATER SYSTEM.

VALVE NO. 25 – HOT OUTLET FROM SOLAR TANK ISOLATION VALVE

THIS VALVE IS NORMALLY OPEN. WHEN CLOSED IN CONJUNCTION WITH VALVE NO. 24 IT WILL ISOLATE THE SOLAR STORAGE TANK FROM THE POTABLE WATER SYSTEM.

VALVE NO. 26 – SOLAR TANK BYPASS VALVE

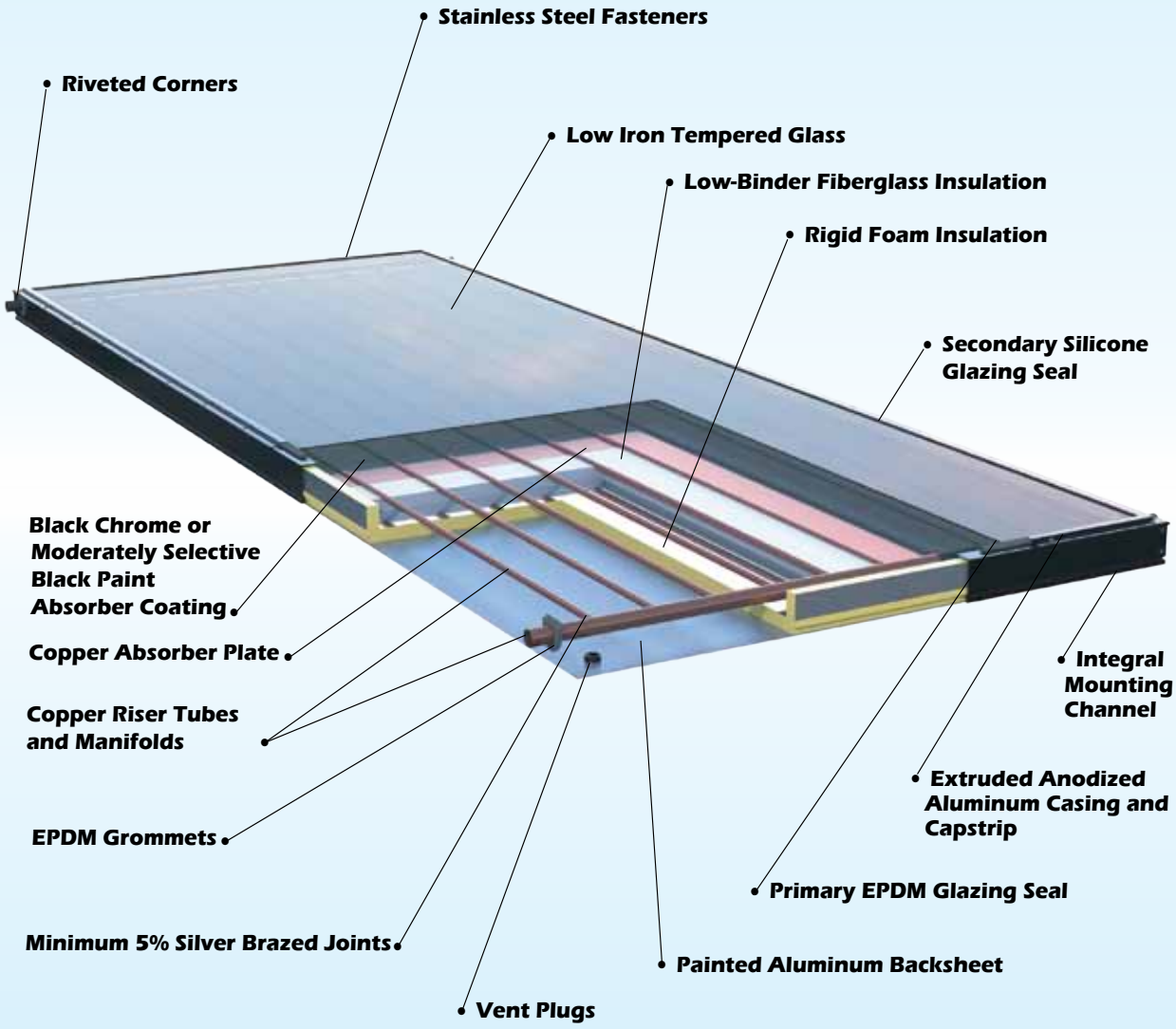
THIS VALVE IS NORMALLY CLOSED. WHEN OPENED IN CONJUNCTION WITH CLOSING VALVES NO. 24 & 25 IT WILL ALLOW COLD WATER TO BYPASS THE SOLAR SYSTEM AND FEED DIRECTLY INTO THE AUXILLIARY WATER HEATER.

SUNEARTH INC.®

THE EMPIRE SERIES

GLAZED FLAT PLATE SOLAR COLLECTORS
Models EC and EP SPECIFICATION SHEET

THE STANDARD IN SOLAR WATER HEATING TECHNOLOGY



PROTECTING OUR ENVIRONMENT—SINCE 1978

Appendix D

SUNEARTH INC. EMPIRE SERIES SPECIFICATIONS

SunEarth Model No.	Width Inches	Length Inches	Depth Inches	Gross Area Sq Ft	Net Aperture Sq Ft	Dry Weight, Lbs.	Fluid Capacity U.S. Gallons	Water Design Flow Rate GPM	40% Propolyne Glycol Design Flow Rate GPM	Pressure Drop at Design Flow Rate in PSIG	Max Flow Rate GPM	Std. Header Width, Inches	Std. Header Diameter, Inches Nominal	Header, Center to Center, Inches
EC/EP-21	40.2	76.2	3.25	21.8	18.8	70	0.72	0.62	0.71	0.003	12	43.38	1	71.63
EC/EP-24	36.2	98.2	3.25	24.7	21.9	80	0.78	0.73	0.84	0.005	12	39.38	1	93.63
EC/EP-24-0.75	36.2	98.2	3.25	24.7	21.9	80	0.65	0.73	0.84	0.005	6	39.38	0.75	93.63
EC/EP-32	48.2	98.2	3.25	32.8	29.7	106	1.00	0.97	1.11	0.006	12	51.38	1	93.63
EC/EP-32-0.75	48.2	98.2	3.25	32.8	29.7	106	0.83	0.97	1.11	0.006	6	51.38	0.75	93.63
EC/EP-40	48.2	122.2	3.25	40.9	37.2	141	1.20	1.20	1.39	0.009	12	51.38	1	115.63
EC/EP-40-0.75	48.2	122.2	3.25	40.9	37.2	141	1.03	1.20	1.39	0.009	6	51.38	0.75	115.63

ASTM E330 Maximim Test Load ±90 psf - Apply the appropriate factors of safety according to the test standards and local building code requirements when designing a solar thermal system

THERMAL PERFORMANCE RATINGS*

MODEL EC

Category (Ti-Ta)	BTU/ft²·Day High Radiation 2000 BTU/ft²·Day	Medium Radiation 1500 BTU/ft²·Day	Low Radiation 1000 BTU/ft²·Day
A(-9°F)	1,360	1020	690
B(9°F)	1,250	910	580
C(36°F)	1,070	745	420
D(90°F)	700	400	120
E(144 °F)	330	95	-

MODEL EP

Category (Ti-Ta)	BTU/ft²·Day High Radiation 2000 BTU/ft²·Day	Medium Radiation 1500 BTU/ft²·Day	Low Radiation 1000 BTU/ft²·Day
A(-9°F)	1,290	965	645
B(9°F)	1,210	890	570
C(36°F)	1,035	720	410
D(90°F)	600	315	70
E(144 °F)	150	-	-

Ti = inlet fluid temp; Ta = ambient air temp. Category A/B-Pool Heating; C-Water Heating (Warm Climate); D-Water/Space Heating (Cool Climate); E- Process Heat.
Thermal performance is obtained by multiplying the collector output for the appropriate application and insolation level by the total gross collector area
*Collector ratings are derived from the Solar Rating & Certification Corp (SRCC) Document RM-1 and Standard OG-100, tested with water at design flowrate.

ENGINEERING SPECIFICATIONS

(Performance specifications subject to testing error of **+**/- 3%)

The following shall be the specifications for the solar collectors. Collectors shall be SunEarth Empire model _____, and shall be of the glazed liquid flat plate type. Collectors shall be tested in conformance with ASHRAE 93-2003 and Solar Rating and Cerification Corporation (SRCC)100-10, ISO 9806-1 & 9806-2 and have their thermal performance rated according to SRCC Document RM-1. The collectors shall be certified by SRCC and the Florida Solar Energy Center (FSEC), and listed by the International Association of Plumbing and Mechanical Officials (IAPMO).

GENERAL

The dimensions of the collector shall be _____ inches in length, _____ inches in width and 3.25 inches in depth. The collector casing shall be an anodized aluminum extrusion (alloy 6063 T6), minimum thickness 0.060 inch, with an architectural dark bronze finish. The casing shall have notched framewalls for ease of plate removal and reinstallation. Sheet metal screwed fasteners shall be stainless steel (18-8 #10). The backsheet shall be painted textured aluminum not less than 0.014 inch thickness. A 1 inch vent plug shall be installed in each of the four corners of the backsheet to minimize condensation. An integral mounting channel shall allow the solar collector to be mounted without penetration of the extruded aluminum casing.

GLAZING

The collector glazing shall be one sheet of low iron tempered glass, with a minimum of 0.125 inch thickness (0.15625 inch on EC/EP-40, EC/EP-40-0.75), and a minimum transmissivity of 91 percent (89 on EC/EP-40, EC/EP-40-0.75). The glazing shall be thermally isolated from the casing by a continuous EPDM gasket. There shall be a continuous secondary silicone seal between the glass and casing capstrip to minimize moisture from entering the casing.

INSULATION

The insulation shall be foil-faced polyisocyanurate foam sheathing board of a minimum 1 inch thickness, siliconed in place to the aluminum backsheet, covered by low-binder fiberglass of a minimum 1 inch thickness, providing thermal isolation of the foam from the absorber plate. Total thermal resistance shall be a minimum of R-12. The sides and ends of the collector shall be insulated with a minimum of 1 inch foil-faced polyisocyanurate foam sheathing board.

ABSORBER PLATE AND PIPING

The absorber shall consist of a roll-formed copper plate of no less than 0.008 inch thickness. Risers shall be a minimum of 0.50 inch O.D. Type M copper tubing on no more than 4.56 inch centers continuously soldered to the plate utilizing a non-corrosive solder paste with a melting point of 460°F. The risers shall be brazed to 1.125" O. D. Type M copper manifolds (0.875" O.D. Type L on EC/EP-24-0.75, EC/EP-32-0.75 and EC/EP-40-0.75) utilizing a copper phosphorous brazing alloy with no less than a minimum 5 percent silver content, and conforming to the American Welding Society's BCuP-3 classification. EPDM grommets shall isolate the manifold from the aluminum casing. The absorber plate shall be designed for 160 psig maximum operating pressure.

ABSORBER COATING AND PERFORMANCE CURVE

A) Black Chrome (EC Series): The absorber coating shall be black chrome on nickel with a minimum absorptivity of 95 percent and a maximum emissivity of 12 percent. The instantaneous efficiency of the collector shall be a minimum Y-intercept of 0.735 and a slope of no less than -0.730 BTU/ft²·hr·°F.

B) Moderately Selective Black Paint (EP Series): The absorber coating shall be a moderately-selective black paint with a minimum absorptivity of 94 percent and a maximum emissivity of 56 percent. The instantaneous efficiency of the collector shall have a minimum Y-intercept of 0.726 and a slope of no less than -0.910 BTU/ft²·hr·°F.

Note Please refer to the SRCC website at www.solar-rating.org for the actual y-intercept and slope for each collector.

Due to SunEarth's policy of continuous product improvement, specifications are subject to change without notice.

MANUFACTURED BY:

SUNEARTH INC.
8425 Almeria Ave. • Fontana, CA 92335
(909) 434-3100 • Fax (909) 434-3101
www.sunearthinc.com

AVAILABLE FROM:

RECYCLED PAPER–SOY BASED INK

ES 4/13

Appendix E

Material Safety Data Sheet

1. CHEMICAL PRODUCT & COMPANY IDENTIFICATION Page: 1

24-Hour Emergency Phone Number: 989-636-4400

Product: DOWFROST* HD HEAT TRANSFER FLUID, DYED

Product Code: 04632

Effective Date: 08/03/04 Date Printed: 08/04/04 MSD: 002239

The Dow Chemical Company, Midland, MI 48674

Customer Information Center: 800-258-2436

2. COMPOSITION/INFORMATION ON INGREDIENTS

Propylene glycol	CAS# 000057-55-6	94%
Dipotassium phosphate	CAS# 007758-11-4	<5%
Deionized water	CAS# 007732-18-5	<5%

3. HAZARDS IDENTIFICATION

EMERGENCY OVERVIEW

****

* Clear yellow liquid. Odorless. Avoid temperatures above 450F, 232C. *

****

POTENTIAL HEALTH EFFECTS (See Section 11 for toxicological data.)

EYE: May cause slight transient (temporary) eye irritation. Corneal injury is unlikely. Mists may cause eye irritation.

SKIN CONTACT: Prolonged contact is essentially nonirritating to skin. A single prolonged exposure is not likely to result in the material being absorbed through skin in harmful amounts. Repeated exposures may cause flaking and softening of skin.

INGESTION: Single dose oral toxicity is considered to be extremely low. No hazards anticipated from swallowing small amounts incidental to normal handling operations.

INHALATION: At room temperature, vapors are minimal due to physical properties. Mists may cause irritation of upper respiratory tract (nose and throat).

(Continued on page 2 , over)

SYSTEMIC (OTHER TARGET ORGAN) EFFECTS: Repeated excessive exposure to propylene glycol may cause central nervous system effects.

CANCER INFORMATION: Did not cause cancer in laboratory animals.

TERATOLOGY (BIRTH DEFECTS): Birth defects are unlikely. Exposures having no adverse effects on the mother should have no effect on the fetus.

REPRODUCTIVE EFFECTS: In animal studies, has been shown not to interfere with reproduction.

4. FIRST AID

EYES: Flush eyes with plenty of water.

SKIN: Wash off in flowing water or shower.

INGESTION: No adverse effects anticipated by this route of exposure incidental to proper industrial handling.

INHALATION: Remove to fresh air if effects occur. Consult a physician.

NOTE TO PHYSICIAN: No specific antidote. Supportive care. Treatment based on judgment of the physician in response to reactions of the patient.

5. FIRE FIGHTING MEASURES

FLAMMABLE PROPERTIES
FLASH POINT: 214 F, 107 C (based on a similar material)
METHOD USED: PMCC
AUTOIGNITION TEMPERATURE: Not determined

FLAMMABILITY LIMITS
LFL: Not determined
UFL: Not determined

HAZARDOUS COMBUSTION PRODUCTS: During a fire, smoke may contain the original material in addition to unidentified toxic and/or irritating compounds. Hazardous combustion products may include and are not limited to carbon monoxide and carbon dioxide.

(Continued on page 3)

OTHER FLAMMABILITY INFORMATION: Violent steam generation or eruption may occur upon application of direct water stream to hot liquids. Flammable concentrations of vapor can accumulate at temperatures above 214F. Liquid mist of this product can burn. Spills of these organic liquids on hot fibrous insulations may lead to lowering of the autoignition temperatures possibly resulting in spontaneous combustion. Container may rupture from gas generation in a fire situation.

EXTINGUISHING MEDIA: Water fog or fine spray, carbon dioxide, dry chemical, foam. Alcohol resistant foams (ATC type) are preferred if available. General purpose synthetic foams (including AFFF) or protein foams may function, but much less effectively. Do not use direct water stream. May spread fire.

MEDIA TO BE AVOIDED: Do not use direct water stream.

FIRE FIGHTING INSTRUCTIONS: Keep people away. Isolate fire area and deny unnecessary entry. Burning liquids may be moved by flushing with water to protect personnel and minimize property damage. Burning liquids may be extinguished by dilution with water. Do not use direct water stream. May spread fire. Fight fire from protected location or safe distance. Consider use of unmanned hose holder or monitor nozzles. Use water spray to cool fire exposed containers and fire affected zone until fire is out and danger of re-ignition has passed. Immediately withdraw all personnel from area in case of rising sound from venting safety device or discoloration of the container. Move container from fire area if this is possible without hazard.

PROTECTIVE EQUIPMENT FOR FIRE FIGHTERS: Wear positive-pressure self-contained breathing apparatus (SCBA) and protective fire fighting clothing (includes fire fighting helmet, coat, pants, boots and gloves). If protective equipment is not available or not used, fight fire from a protected location or safe distance.

6. ACCIDENTAL RELEASE MEASURES (See Section 15 for Regulatory Information)

PROTECT PEOPLE: Use appropriate safety equipment. For additional information, refer to Section 8, Exposure Controls/Personal Protection.

PROTECT THE ENVIRONMENT: Avoid contamination of all waterways.

(Continued on page 4 , over)

CLEAN-UP: See Section 13, Disposal Considerations.

7. HANDLING AND STORAGE

SPECIAL PRECAUTIONS TO BE TAKEN IN HANDLING AND STORAGE: No special handling requirements data available.

HANDLING: See Section 8, Exposure Controls/Personal Protection.

STORAGE: See Section 10, Stability and Reactivity.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

ENGINEERING CONTROLS: Provide general and/or local exhaust ventilation to control airborne levels below the exposure guidelines.

PERSONAL PROTECTIVE EQUIPMENT

EYE/FACE PROTECTION: Use safety glasses. Safety glasses should be sufficient for most operations; however, for misty operations wear chemical goggles.

SKIN PROTECTION: Use gloves impervious to this material.

RESPIRATORY PROTECTION: Atmospheric levels should be maintained below the exposure guideline. When respiratory protection is required for certain operations, use an approved air-purifying respirator. In misty atmospheres, use an approved mist respirator.

EXPOSURE GUIDELINES: Propylene glycol: AIHA WEEL is 10 mg/m3 for total vapor and aerosol.

9. PHYSICAL AND CHEMICAL PROPERTIES

APPEARANCE/PHYSICAL STATE: Clear yellow liquid
ODOR: Odorless
VAPOR PRESSURE: 0.22 mmHg @ 20 C
VAPOR DENSITY: 2.6
BOILING POINT: 320 F, 160 C
SOLUBILITY IN WATER/MISCIBILITY: Complete
SPECIFIC GRAVITY OR DENSITY: 1.058 @ 25/25 C

10. STABILITY AND REACTIVITY

(Continued on page 5)

Appendix E

CHEMICAL STABILITY: Thermally stable at typical use temperatures.

CONDITIONS TO AVOID: Avoid use temperatures above 450F, 232C. Product can degrade at elevated temperatures. Generation of gas during decomposition can cause pressure in closed systems.

INCOMPATIBILITY WITH OTHER MATERIALS: Avoid contact with oxidizing materials. Avoid contact with strong acids.

HAZARDOUS DECOMPOSITION PRODUCTS: Hazardous decomposition products depend upon temperature, air supply and the presence of other materials.

HAZARDOUS POLYMERIZATION: Will not occur.

11. TOXICOLOGICAL INFORMATION (See Section 3 for Potential Health Effects. For detailed toxicological data, write or call the address or non-emergency number shown in Section 1)

SKIN: The LD50 for skin absorption in rabbits is >10,000 mg/kg.

INGESTION: The oral LD50 for rats is 20,000 - 34,000 mg/kg.

MUTAGENICITY: In vitro mutagenicity studies were negative. Animal mutagenicity studies were negative.

12. ECOLOGICAL INFORMATION (For detailed Ecological data, write or call the address or non-emergency number shown in Section 1)

ENVIRONMENTAL FATE

MOVEMENT & PARTITIONING: Based largely or completely on data for major component(s). Bioconcentration potential is low (BCF less than 100 or Log Pow less than 3). Potential for mobility in soil is very high (Koc between 0 and 50).

DEGRADATION & PERSISTENCE: Based largely or completely on data for major component(s). Material is readily biodegradable. Passes OECD test(s) for ready biodegradability. Degradation is expected in the atmospheric environment within minutes to hours.

ECOTOXICITY: Based largely or completely on data for major component(s). Material is practically non-toxic to aquatic organisms on an acute basis (LC50/EC50 >100 mg/L in most

(Continued on page 6 , over)

sensitive species).

13. DISPOSAL CONSIDERATIONS (See Section 15 for Regulatory Information)

DISPOSAL: DO NOT DUMP INTO ANY SEWERS, ON THE GROUND OR INTO ANY BODY OF WATER. All disposal methods must be in compliance with all Federal, State/Provincial and local laws and regulations. Regulations may vary in different locations. Waste characterizations and compliance with applicable laws are the responsibility solely of the waste generator. THE DOW CHEMICAL COMPANY HAS NO CONTROL OVER THE MANAGEMENT PRACTICES OR MANUFACTURING PROCESSES OF PARTIES HANDLING OR USING THIS MATERIAL. THE INFORMATION PRESENTED HERE PERTAINS ONLY TO THE PRODUCT AS SHIPPED IN ITS INTENDED CONDITION AS DESCRIBED IN MSDS SECTION 2 (Composition/Information On Ingredients).

FOR UNUSED & UNCONTAMINATED PRODUCT, the preferred options include sending to a licensed, permitted: recycler, reclaimer, incinerator or other thermal destruction device.

As a service to its customers, Dow can provide names of information resources to help identify waste management companies and other facilities which recycle, reprocess or manage chemicals or plastics, and that manage used drums. Telephone Dow's Customer Information Center at 800-258-2436 or 989-832-1556 for further details.

14. TRANSPORT INFORMATION

DEPARTMENT OF TRANSPORTATION (D.O.T.): For D.O.T. regulatory information, if required, consult transportation regulations, product shipping papers, or contact your Dow representative.

CANADIAN TDG INFORMATION: For TDG regulatory information, if required, consult transportation regulations, product shipping papers, or your Dow representative.

15. REGULATORY INFORMATION (Not meant to be all-inclusive--selected regulations represented)

NOTICE: The information herein is presented in good faith and believed to be accurate as of the effective date shown above. However, no warranty, express or implied is given. Regulatory requirements are subject to change and may differ from one location to another; it is the buyer's responsibility to ensure that its activities comply with federal, state or provincial, and local laws. The following

(Continued on page 7)

specific information is made for the purpose of complying with numerous federal, state or provincial, and local laws and regulations. See other sections for health and safety information.

U.S. REGULATIONS
==========

SARA 313 INFORMATION: To the best of our knowledge, this product contains no chemical subject to SARA Title III Section 313 supplier notification requirements.

SARA HAZARD CATEGORY: This product has been reviewed according to the EPA "Hazard Categories" promulgated under Sections 311 and 312 of the Superfund Amendment and Reauthorization Act of 1986 (SARA Title III) and is considered, under applicable definitions, to meet the following categories:

Not to have met any hazard category

TOXIC SUBSTANCES CONTROL ACT (TSCA):

All ingredients are on the TSCA inventory or are not required to be listed on the TSCA inventory.

STATE RIGHT-TO-KNOW: The following product components are cited on certain state lists as mentioned. Non-listed components may be shown in the composition section of the MSDS.

CHEMICAL NAME	CAS NUMBER	LIST
1,2-PROPANEDIOL	000057-55-6	PA1

PA1=Pennsylvania Hazardous Substance (present at greater than or equal to 1.0%).

OSHA HAZARD COMMUNICATION STANDARD:

(Continued on page 8 , over)

REGULATORY INFORMATION (CONTINUED)

This product is not a "Hazardous Chemical" as defined by the OSHA Hazard Communication Standard, 29 CFR 1910.1200.

CANADIAN REGULATIONS
==========

WHMIS INFORMATION: The Canadian Workplace Hazardous Materials Information System (WHMIS) Classification for this product is:

This product is not a "Controlled Product" under WHMIS.

CANADIAN ENVIRONMENTAL PROTECTION ACT (CEPA):

This product contains one or more substances which are not listed on the Canadian Domestic Substances List (DSL). Contact your Dow representative for more information.

16. OTHER INFORMATION

MSDS STATUS: Revised Section 8 (Exposure Guidelines).

Appendix F

SUNEARTH INC.
Quality Solar Energy Products

TEN-YEAR LIMITED PRODUCT WARRANTY

This warranty only applies to the following SunEarth products (hereinafter SunEarth Products):

COLLECTORS: Empire, Imperial, SunBelt, SunWise, and Custom Collectors
ABSORBERS: SunBurst and Custom Absorber Plates used in any glazed application
ICS AND DRAINBACK: CopperHeart ICS, CopperHeart Tanks, and CopperStor DrainBack Tanks

Under conditions of normal use and service the above SunEarth Products are warranted to the original, or subsequent users, for a period of **10 years** from the date of sale to be free of defects in material and workmanship pursuant to the exclusions detailed in this written warranty statement. SunEarth's liability for these products shall be limited to repairing or replacing at SunEarth's option, without charge, F.O.B. SunEarth's factory or an authorized SunEarth distributor or service center. SunEarth will not be liable for any costs of transportation, inspection, removal, reinstallation, or any other labor or freight charges that may arise in connection with a warranty claim, except as expressly set forth in this warranty.

The use of **ANY** of the above SunEarth Products for pool or spa heating is **NOT** covered by this warranty, **UNLESS** the pool or spa water is isolated from the above SunEarth Products through the use of a heat exchanger.

FIELD LABOR

Field labor to repair or replace any defective SunEarth Product is reimbursable as follows:

Year 1	$100/collector
Year 2 ~ 5	$75/collector
Year 6 ~ 10	$50/collector

FREIGHT AND SHIPPING EXPENSES

In the event of a valid warranty claim approved by SunEarth, SunEarth will pay for freight and shipping expenses as follows:

Year 1 of Warranty: SunEarth will pay the freight and shipping costs for the new or repaired SunEarth Product between SunEarth and the nearest local distributor, dealer, authorized service center, city, or shipping terminal.

After Year 1 of Warranty: Freight and shipping costs are the responsibility of the owner.

THIS WARRANTY DOES NOT APPLY

This warranty **does not apply** to the following: **(1)** conditions resulting from a failed component or part that is not part of the above listed SunEarth Products; **(2)** to damage caused by freezing conditions; **(3)** to conditions resulting from misuse, abuse, neglect, accident, or alteration; **(4)** to cosmetic discoloration of the collector framewall, absorber plate, or glazing over time; **(5)** to glass breakage; **(6)** to conditions resulting from the introduction of harmful chemicals, caustic fluids, or liquids deleterious to copper tubing, including improperly applied or maintained heat transfer fluids or chlorinated pool or spa water; **(7)** to SunEarth Products in which heat transfer fluids other than potable water or propylene glycol (DowFrost HD

Appendix F

recommended) was used; **(8)** to propylene glycol pH levels above 10 or below 8; **(9)** to periods of stagnation in excess of 30 days; **(10)** to excessive pressure; **(11)** to erosion corrosion of the copper tubing resulting from excessive flow rates; **(12)** to improper plumbing configurations that do not conform to SunEarth's manifolding requirements; **(13)** to clouding or condensation naturally resulting from temporary intrusions of moisture into the collector; **(14)** to conditions resulting from floods, earthquakes, winds, fire, lightning, or circumstances beyond SunEarth's control; **(15)** to damage caused by installation methods, including mounting, that do not conform to relevant national, state or local codes and ordinances, good industry practices, or to current applicable SunEarth manuals, diagrams, technical bulletins, or written installation instructions; **(16)** or to applications other than medium temperature (110 - 160F) domestic water heating.

If one of the above SunEarth Products is purchased outside the United States certain conditions of this warranty may **NOT** apply. Please contact your local SunEarth distributor or dealer for details.

LIMITED WARRANTY

EXCEPT AS EXPRESSLY PROVIDED IN THIS WARRANTY, THE ABOVE SUNEARTH PRODUCTS ARE PROVIDED WITHOUT WARRANTY OF ANY KIND, EITHER EXPRESS OR IMPLIED, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE OR ANY WARRANTY OR NON-INFRINGEMENT. SOME STATES DO NOT ALLOW THE EXCLUSION OF IMPLIED WARRANTIES, SO THE ABOVE EXCLUSION MAY NOT APPLY TO YOU.

LIMITATIONS OF REMEDIES

IN NO EVENT SHALL SUNEARTH BE LIABLE FOR ANY DAMAGES FOR LOST PROFITS, LOST SAVINGS OR OTHER INCIDENTAL OR CONSEQUENTIAL DAMAGES, ARISING OUT OF THE USE OR INABILITY TO USE THE ABOVE SUNEARTH PRODUCTS, OR FOR ANY CLAIM BY A THIRD PARTY. SOME STATES DO NOT ALLOW THE LIMITATION OR EXCLUSION OF LIABILITY FOR INCIDENTAL OR CONSEQUENTIAL DAMAGES, SO THE ABOVE LIMITATION MAY NOT APPLY TO YOU.

EXCLUSIVE AGREEMENT

THIS WARRANTY CONSTITUTES THE ENTIRE, COMPLETE, FINAL, AND EXCLUSIVE AGREEMENT FOR THE SUNEARTH PRODUCTS LISTED ABOVE. THIS WARRANTY SUPERSEDES ANY PROPOSAL, AGREEMENT, OR REPSRESENTATION, OR ANY OTHER COMMUNICATION, EITHER WRITTEN OR ORAL, MADE BETWEEN SUNEARTH AND SUNEARTH'S DISTRIBUTORS OR DEALERS, OR BETWEEN SUNEARTH AND THE END CONSUMER.

TO MAKE A CLAIM

To obtain service under this warranty, the product in question must be returned to the distributor or dealer of SunEarth products nearest you, or an authorized SunEarth service center. Each claim must be accompanied by documentation providing the following:

1) Owner's name, address, email address, and phone number
2) Installation contractor's name, email address, and phone number
3) Original sales receipt
4) Product model and serial number(s)
5) Date of installation
6) Date of failure
7) Reason for failure
8) Pictures of the suspected manufacturing defect – digital pictures of the suspected manufacturing defect also need to be submitted

If you have any warranty questions, contact your installation contractor or SunEarth at (909) 434-3100.

Effective 01/17/11 Protecting Our Environment – Since 1978
www.sunearthinc.com

Appendix G

Solar Rating & Certification Corporation™
The Industry Standard Since 1980.

OG-300 Certification Page Artwork

The Supplier is responsible for having a page in the installation and operation manual(s) with only the following table on it. It can be anywhere in the manual. SRCC will provide the artwork and no changes are allowed.

The solar system installer is to indicate (circle, check, etc.) the system that was actually installed.

	This product certified by: Solar Rating & Certification Corporation™ www.Solar-Rating.org	SunEarth, Inc. 8425 Almeria Avenue Fontana, CA 92335 USA
Solar Energy Factor (SEF_D)	SRCC Cert. No.	System Model:
1.20	2001001C	TE48P-80-2G
1.40	2001003R	TE80P-120-2G-PV
1.60	2001001F	TE64C-80-2G
1.40	2001001M	TE64C-120-2G
1	2001001P	TE40P-120-2G
1.10	2001003A	TE40P-80-2G-PV
1.10	2001003B	TE40C-80-2G-PV
1.10	2001001K	TE40C-120-2G
1.80	2001001N	TE80C-120-2G
1.30	2001001R	TE64P-120-2G
2	2008024G	TE48P-80-TLG
1.50	2001003M	TE80C-120-2G-PV
2.50	2008024Q	TE64P-120-TLG
1.80	2008024B	TE40C-80-TLG
4.60	2008024M	TE80C-120-TLG
3.50	2008024R	TE80P-120-TLG
1.70	2008024F	TE40P-80-TLG
1.10	2001001B	TE40C-80-2G
1.50	2001001E	TE64P-80-2G
1	2001001J	TE32C-120-2G
1.60	2001001S	TE80P-120-2G
1.20	2001001D	TE48C-80-2G
The installed system is marked above.		

Appendix G

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The Industry Standard Since 1980.

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The solar system installer is to indicate (circle, check, etc.) the system that was actually installed.

	This product certified by: Solar Rating & Certification Corporation™ www.Solar-Rating.org	SunEarth, Inc. 8425 Almeria Avenue Fontana, CA 92335 USA
Solar Energy Factor (SEF_D)	SRCC Cert. No.	System Model:
2.10	2000004D	TE40P-80-PV
3.30	1996001P	TE80P-120-2
1.10	2001001A	TE40P-80-2G
4.50	1993001R	TE80P-120-1
2	1993001T	TE40P-120-1
1.70	1996001A	TE32P-80-2
1.70	1996001B	TE32C-80-2
1.90	1996001C	TE40P-80-2
2	1996001D	TE40C-80-2
3	1996001E	TE64P-80-2
3.40	1996001F	TE64C-80-2
2.20	1996001I	TE48P-80-2
2.30	1996001J	TE48C-80-2
1.90	1996001K	TE40C-120-2
2.60	1996001N	TE64P-120-2
2.80	1996001O	TE64C-120-2
3.90	1996001Q	TE80C-120-2
6.40	1993001S	TE80C-120-1
1.90	2000003D	TE40P-80-2-PV
2.20	2000004A	TE40C-80-PV
3.60	2000004N	TE80P-120-PV
4.30	2000004O	TE80C-120-PV
The installed system is marked above.		

Appendix G

Solar Rating & Certification Corporation™
The Industry Standard Since 1980.

OG-300 Certification Page Artwork

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The solar system installer is to indicate (circle, check, etc.) the system that was actually installed.

	This product certified by: Solar Rating & Certification Corporation™ www.Solar-Rating.org	SunEarth, Inc. 8425 Almeria Avenue Fontana, CA 92335 USA
Solar Energy Factor (SEF_D)	SRCC Cert. No.	System Model:
1.90	1993001A	TE32P-80-1
2.40	1993001D	TE40C-80-1
4.70	1993001H	TE64C-80-1
2.60	1993001K	TE48P-80-1
2.80	1993001L	TE48C-80-1
2.20	1993001C	TE40P-80-1
1.90	1993001B	TE32C-80-1
3.90	1993001G	TE64P-80-1
2.10	1993001M	TE40C-120-1
3.20	1993001P	TE64P-120-1
3.60	1993001Q	TE64C-120-1
The installed system is marked above.		

Appendix H

Service & Warranty Information

Contractor/Installer Information

Name: _____

Company:_____

Address: _____

Phone: _____

Email:_____

System Info

Model NO. _____

Date Puchased:_____

Date Installed: _____

Product Serial: _____

For Service and Repair Contact: _____

Comments: _____

_____

_____

8425 Almeria Avenue • Fontana, CA 92335

Phone: (909) 434-3100 • Fax: (909) 434-3101

email: sales@sunearthinc.com • www.sunearthinc.com

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