SunEarth Inc.

CopperHeart

SRCC OG-300 Certified Solar Water Heating System

Installation, Operation & Maintenance Manual

COPPERHEART INTEGRAL COLLECTOR STORAGE WATER HEATER

INSTALLATION, OPERATION AND MAINTENANCE MANUAL

The CopperHeart 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 CopperHeart 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 must 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.

ICS units may be safely installed in areas within the continental United States that experience mild winter climates. Because of the large volume of water in the unit the CopperHeart does not readily freeze. The unit, however, is susceptible to freeze damage if installed where local temperatures have ever fallen to:

10ºF for 6 consecutive hours, or

20ºF for 18 consecutive hours

When these environmental conditions are met or exceeded the unit must be manually drained in accordance with the instructions in this manual. Failure to do so will void the warranty coverage.

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 system owners responsibility to protect the CopperHeart ICS and piping in accordance with SunEarth's instructions if the air temperature is anticipated to approach the specified freeze tolerance limit.

Note to the contractor: it is an SRCC certification requirement that a conspicuously placed label explaining how the Copperheart is protected from freezing and what actions the homeowner should take shall be attached to the water heater in a plainly visible location. For systems like the Copperheart which rely on manual intervention for freeze protection, this label shall indicate the minimum ambient temperature below which homeowneraction is required. The label must indicate the bypass and draining procedures outlined in sections 6 and 7 of this manual.

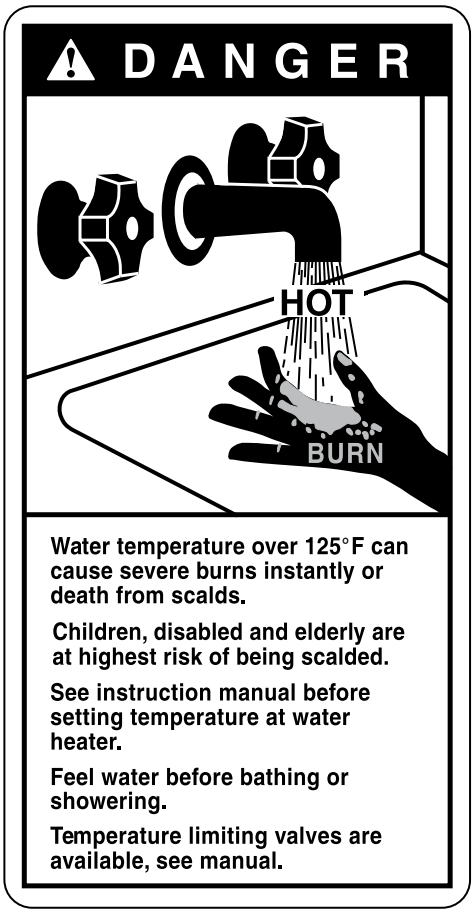
TABLE OF CONTENTS

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**

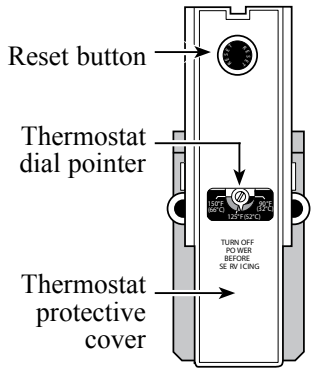
Table courtesy of Shriners Burn Institute

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 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 Imperial and Empire flat plate collectors, CopperHeart ICS units, SunSiphon packaged thermosiphon systems, SunBurst absorber plates, and Solar Strut integrated mounting hardware. We also build specialty collectors for unique architectural and building applications. SunEarth SRCC certified solar water heating systems are sold by leading solar, plumbing and building contractors throughout the United States.

Your CopperHeart ICS system has been designed to meet exacting SRCC certification requirements. The specific components found in your system have been selected by your contractor for their proven reliability, longevity and performance.

1) INTRODUCTION

Solar water heating systems are climate and site specific appliances. Different types of solar systems are installed around the world based upon local and regional weather and water quality conditions. System performance varies as a function of household hot water load, including daily showers and baths, laundry and kitchen uses, local ground water and ambient air temperatures, your 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 in the same neighborhood, will determine how much energy and money your CopperHeart system will save on an annual basis.

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

2) SYSTEM DESCRIPTION AND OPERATIONAL PRINCIPLE

The CopperHeart is an integral collector storage (ICS) system. ICS systems combine the collector and storage tank in a single roof-mounted unit. ICS systems, in general, serve as pre-heaters for conventional electric or gas water heaters. In some parts of the world the CopperHeart may serve as the sole water heater or will be used in conjunction with a tankless wall-mounted gas water heater.

The CopperHeart ICS also is referred to as a "passive" system because it does not require mechanical pumps, thermostats, sensors, wiring or electricity to make hot water. Your CopperHeart ICS will neither freeze nor overheat during prolonged periods of disuse if installed and maintained in accordance with the instructions contained in this manual.

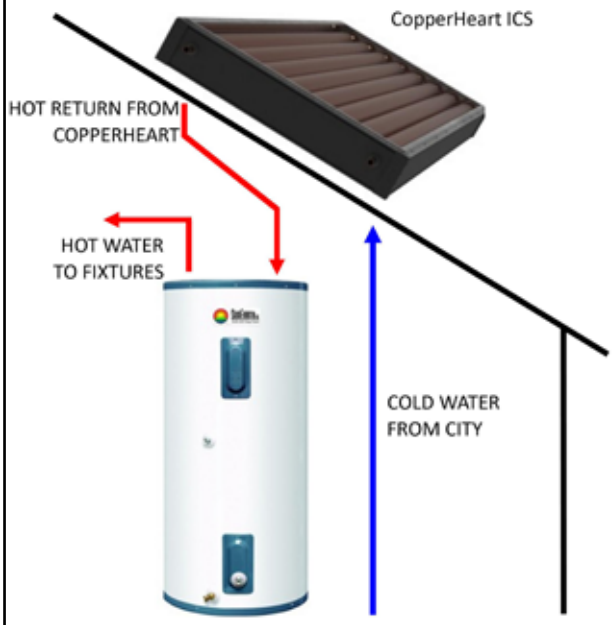


fig.1

fig. 2

The inherent simplicity and durability of the CopperHeart ICS makes it a popular choice for the continental U.S. Sunbelt or markets outside the U.S. where persistent hard freezes do not occur. Although the CopperHeart is protected by its thermal mass down to 10ºF for a six hour period, or 20ºF over an eighteen-hour period, the unit can freeze unless manually drained when these conditions are met or exceeded.

The CopperHeart tank is composed of eight individual 8' x 4" copper cylinders connected in series to form a single storage vessel. The copper cylinders are painted with a moderately selective black paint that absorbs solar irradiance. The thermal energy that falls daily on the painted cylinders quickly and efficiently heats the water within. The all copper tank is therefore also a solar collector. The internal series manifolding ensures that the hottest water in the upper cylinders is drawn first into the conventional electric or gas water heater. Cold water, under city pressure, automatically refills the unit from the bottom when hot water is drawn from the top of the CopperHeart.

The CopperHeart ICS is used in conjunction with a conventional 40 or 50 gallon electric or gas auxiliary water heater. Your CopperHeart ICS system is plumbed with valves to accommodate two separate modes of operation. The system will, (1) serve as a preheater to the electric or gas water heater, or (2) operate as a 100% electric or gas water heater by bypassing the solar system. The system may also be plumbed to allow 100% solar heating by bypassing the auxiliary heater. This third mode of operation is optional.

The placement of the valve handles located above your back-up water heater is extremely important and will determine how your system functions and how much energy you will save. Periodically check your valve handle placement against the settings shown in figures 13a - 14b.

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 stan¬dards governing the installation of solar water heat¬ing systems. The contractor shall adhere to

sound building safety and trade practices. Special consid¬eration must be given to building code requirements for roof loading and the penetration of structural members and fire rated assemblies.

3.3 Shading Considerations:

The CopperHeart must be located in an area of the roof that will not be shaded for the majority of the day all year round. Adjacent build¬ings 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 inspect the condition of the roof and notify the homeowner of any existing roof damage or necessary repairs.

3.5 Structural Considerations:

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

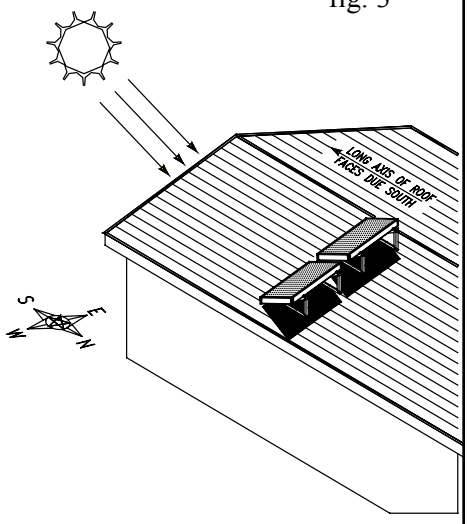
Roof penetrations whether for structural mounts or pipe penetrations must be sealed and leak proofed as per applicable codes and National Roofing Contractors Association practices.

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.

fig. 3



SIDE PITCH MOUNTING

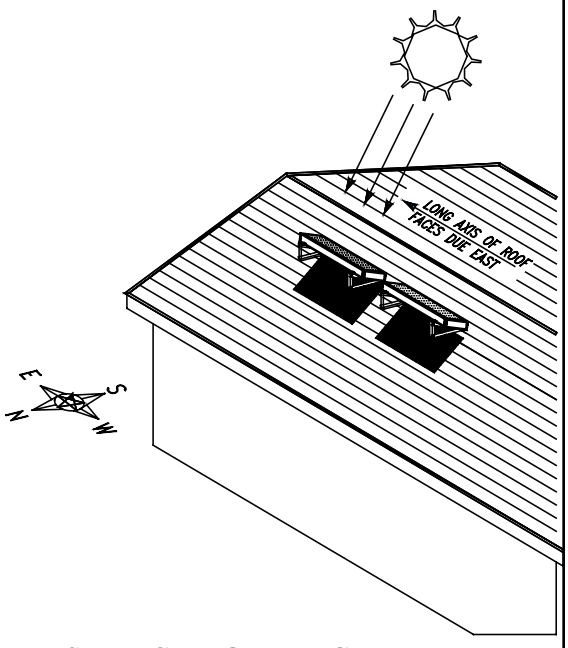
3.8 Building Materials

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.

fig. 4



REVERSE PITCH MOUNTING

3.10 Fluid Identity and Toxicity

The Copperheart system uses only mains water which is directly heated and stored in the Copperheart collector before supplying to the domestic hot water system. Use of any fluids other than water in the Copperheart system is prohibited.

4) INSTALLATION REQUIREMENTS - SPECIFIC

4.1 Collector Location & Orientation:

Depending upon the model purchased, single CopperHeart ICS units will weigh between 321 and 597 pounds when filled. DO NOT proceed with the installation unless the roof can safely support the unit. Consult your local building code for structural requirements before beginning the installation.

The thermal performance of the CopperHeart is optimized in the Northern Hemisphere when the unit is mounted facing True South. Actual perfor¬mance, however, suffers very little when the unit is oriented no more than 45º 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 hot¬test summer months.

To ensure proper water drainage from the glazing the unit must maintain a minimum angle from horizontal of at least 10º. Never mount the CopperHeart directly or parallel to a flat roof. Use SunEarth Copperheart tilt mount kits to rack the unit to the proper angle.

The minimum acceptable tilt angle from horizontal is 10°.

4.3 Mounting Procedures, Materials and Methods:

In continental North America it is best to mount the CopperHeart with the long side horizontal on a south facing roof (fig 1). If necessary, the unit may be mounted on an east or west facing roof, with the long axis perpendicular to the ridge and eve, and tilted toward the south. In this case the CopperHeart inlet and outlet fittings must face toward the eve to allow for drainage, DO NOT plumb the unit with the

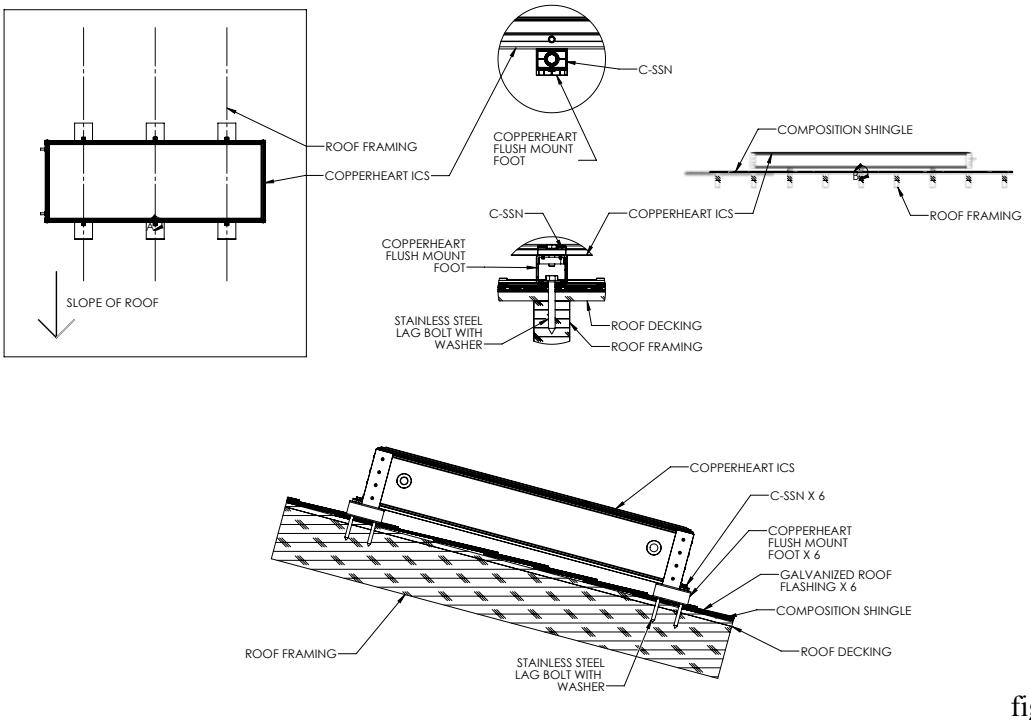


fig. 5

COMPOSITION SHINGLE MOUNTING

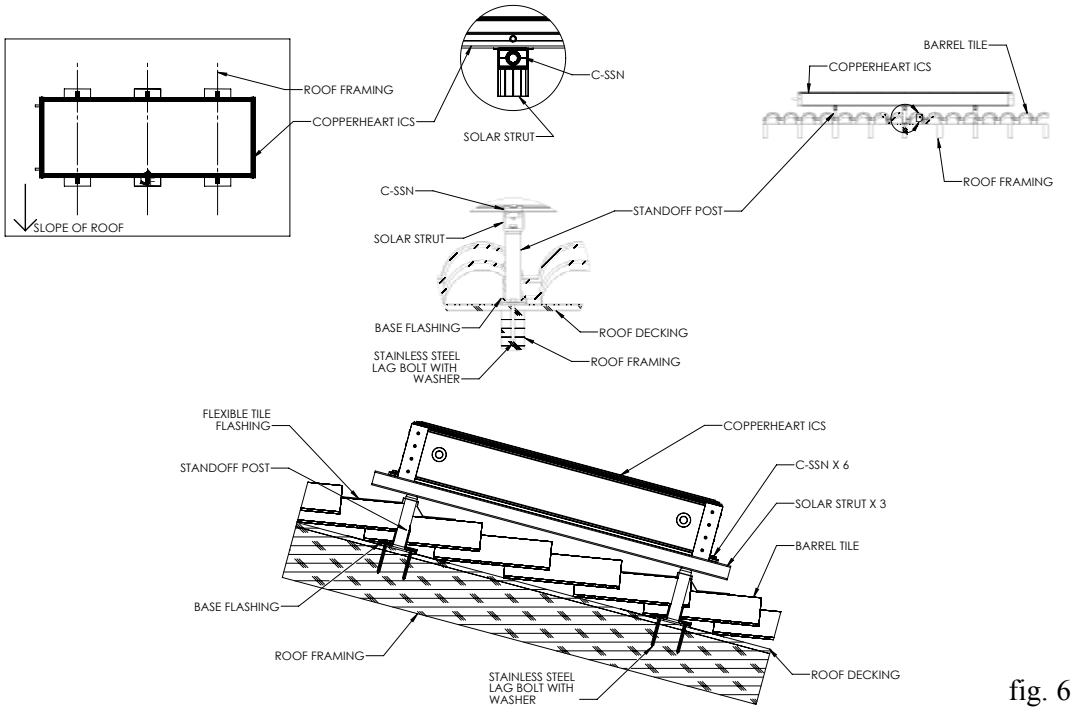


fig. 6

TILE ROOF MOUNTING

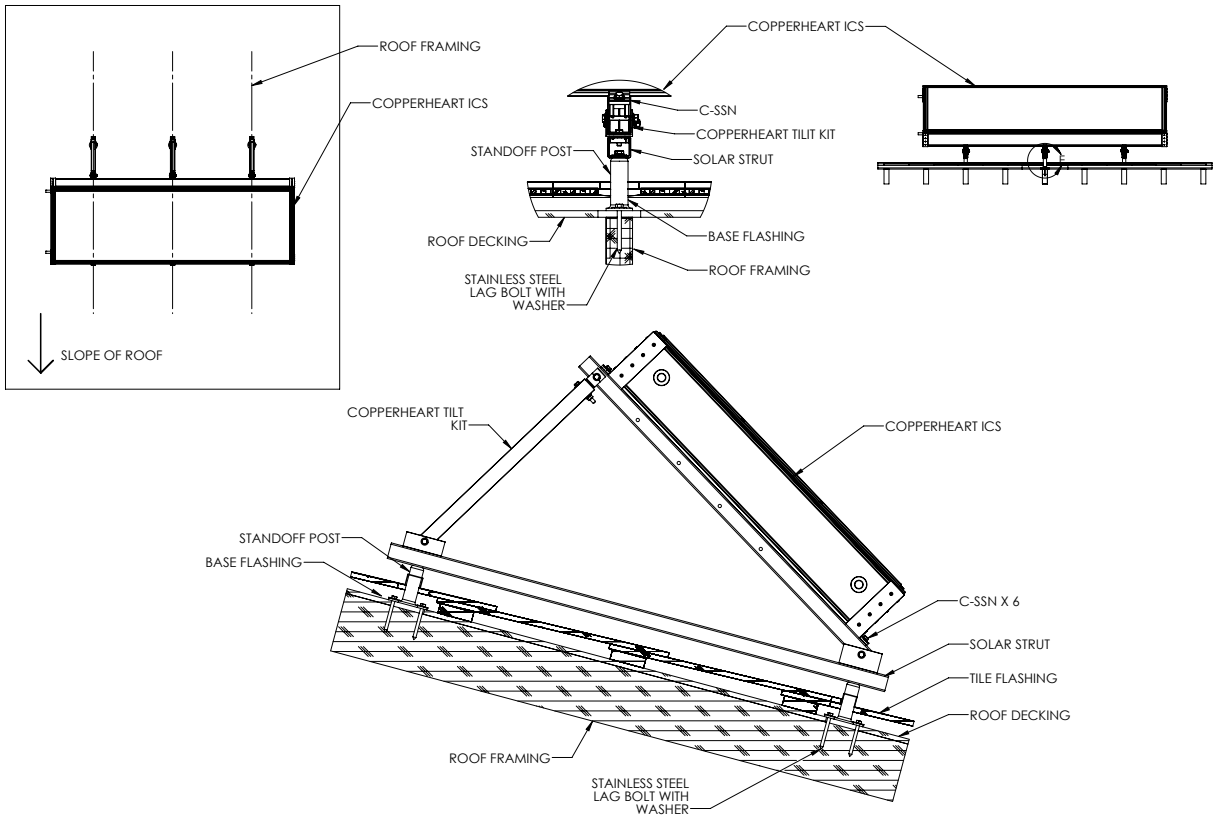


fig. 7

TILT MOUNT

CopperHeart inlet and outlet fittings facing the ridge of the roof. In two unit installations on east or west facing roofs, the CopperHearts must be mounted in a staggered, or "sawtooth", configura¬tion (See figure 3.)

Once the optimum tilt and orientation has been decided, select the appropriate mounting hardware for the installation. Mounting hardware must be capable of maintaining the tilt and orientation (azimuth) of the Copperheart. The CopperHeart ICS must be mounted in accor¬dance with the materials and methods detailed in figures 5 to 11. Use SunEarth's collector mounting clips and integrated Solar Strut anodized aluminum mounting hardware for mounting the unit.

Secure the Solar Strut mounting hardware directly to the rafters or support cross bracing. Attach the CopperHeart to the Solar Strut with SunEarth's anodized aluminum mounting clips and stainless steel strut nut, bolt, lock washer and flat washer. When the unit is mounted on a sloped roof (figure 5, 6 & 7), CopperHeart model CP-40 should be anchored to the roof by no less than six support footings, three on each side of the unit.

Follow these general principles when mounting the CopperHeart:

4.3.1 The roof must be rated to safely support the weight of the unit when filled with water.

4.3.2 The CopperHeart should be mounted as close to the auxiliary water heater as practical in order to minimize heat loss in the piping runs.

4.3.3 SunEarth recommends that the CopperHeart be raised from the roof surface at least 1-1/2" to allow for rainwater and debris to pass under the unit and for proper ventilation of the roofing material.

4.3.4 If a low profile "roof integrated" look is pre¬ferred for tile roofs, an aluminum flashing pan must be placed under the CopperHeart and directly over the roof decking and felt. Roofing felt is not a water-proof membrane and the CopperHeart should not be laid flush on the felt or plywood roof decking. DO NOT curb mount and flash the CopperHeart in the manner of a skylight. Curb mounting will not allow for water proofing directly under the CopperHeart.

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

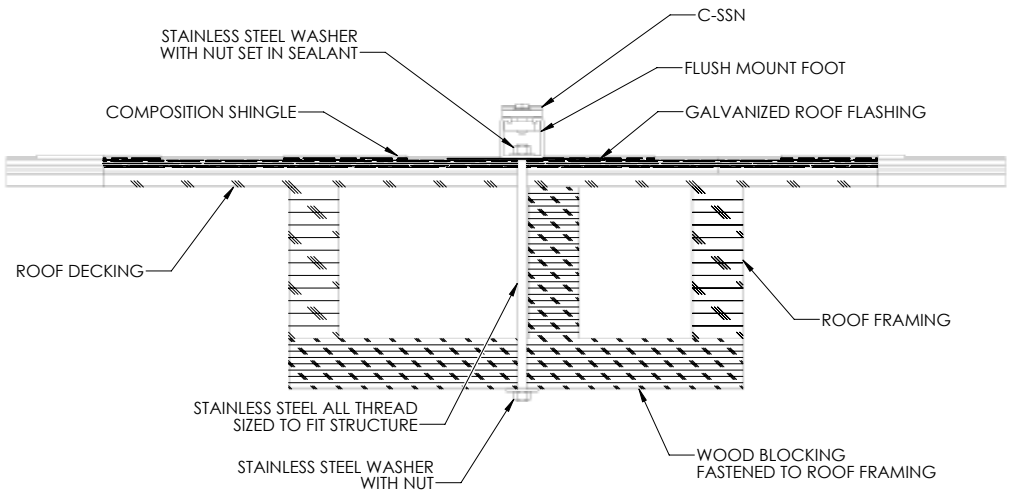


fig. 8

THRU-BOLT DETAIL

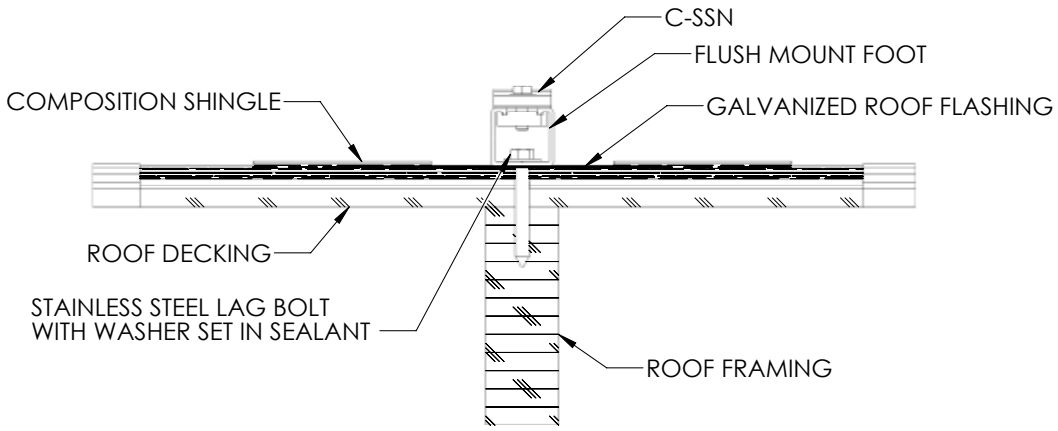


fig. 9

LAG BOLT DETAIL

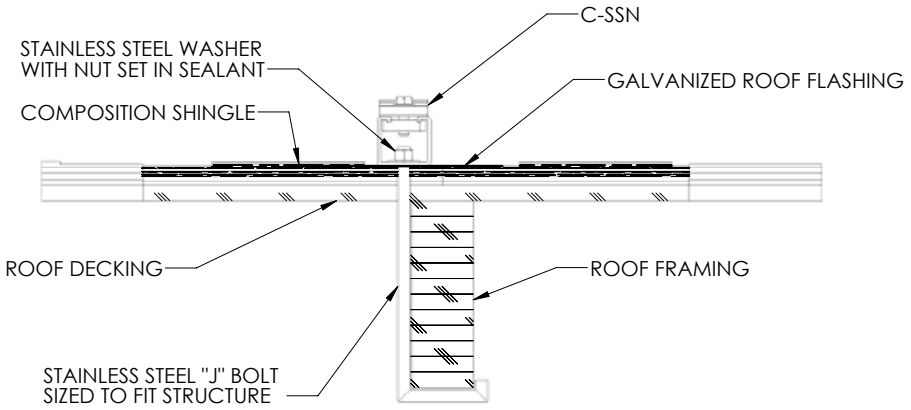


fig.10

J-BOLT DETAIL

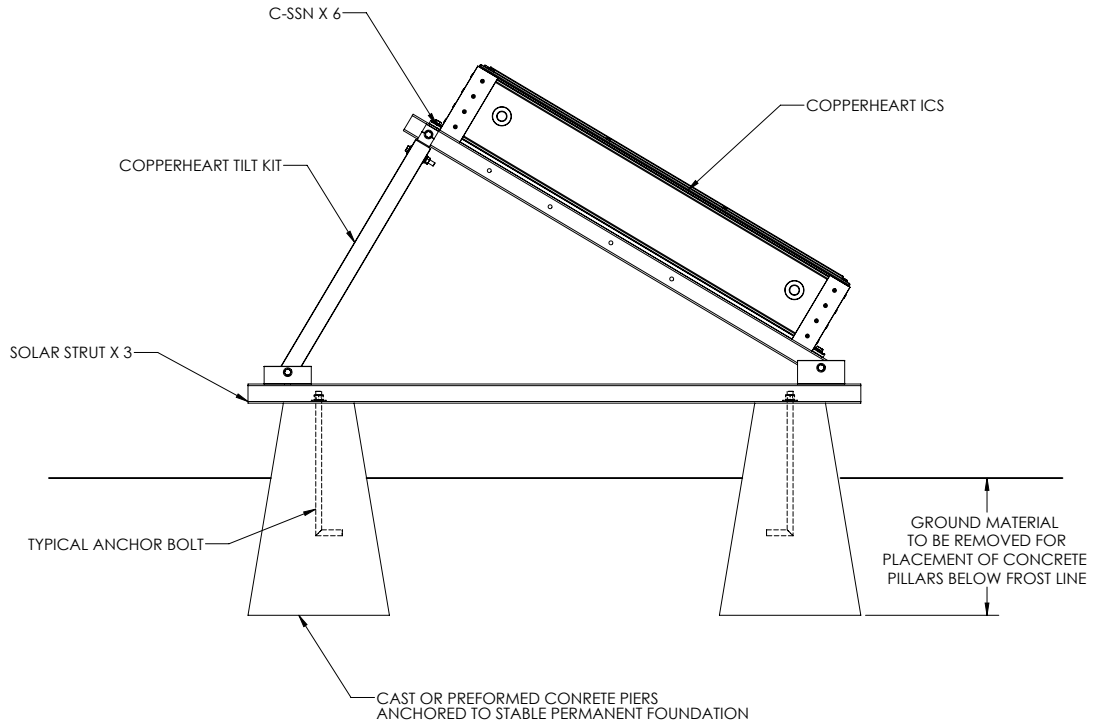


fig. 11

GROUND MOUNTING

recommended. In climates subject to severe winters or high humidity use of galvanized fasteners is prohibited.

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

4.3.7 If the CopperHeart is mounted on a flat roof or the ground, a SunEarth CopperHeart Landscape Rack should be used to tilt the unit to the desired angle. The Copperheart Landscape Rack should also be used when the required tilt angle is greater than the roof slope (figure 7). Optimal system performance is achieved by establishing a tilt angle from horizontal equal to latitude plus ten degrees.

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

4.3.9 If the CopperHeart is ground mounted the unit must have a stable, permanent foundation. This may be either a concrete slab or four standard con¬crete piers embedded in the ground. All bolts and fasteners should be either cast in place or anchored and then epoxyed into the slab or pier. All exposed bolt threads used to secure the CopperHeart rack should be thoroughly coated with silicone oil to prevent corrosion.

If the CopperHeart is mounted below the conven¬tional water heater in the home, the collector loop piping must slope to allow for complete drainage. There should be a boiler drain at the system low point, and another boiler drain or vacuum breaker near the system high point to allow for draining the system.

DO NOT GROUND MOUNT THE COPPERHEART IF THE BURIED PIPING TO THE UNIT CANNOT BE COMPLETELY DRAINED AND PROTECTED WHEN THE SYSTEM'S FREEZE TOLERANCE LIMIT IS MET OR EXCEEDED.

4.4 System Plumbing

The Copperheart system 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 Copperheart can produce temperatures that will melt plastic piping.

All vertical piping between the storage tank and the collector shall be supported at each story or at maximum intervals of ten feet (10') with hangar supports, standoffs or tube strap. Horizontal roof runs shall be secured and supported providing at least 1-1/2 inches clearance from roof. Standard best piping practices shall be followed as described in the Uniform Plumbing Code, International Plumbing Code or other recognized code or standard.

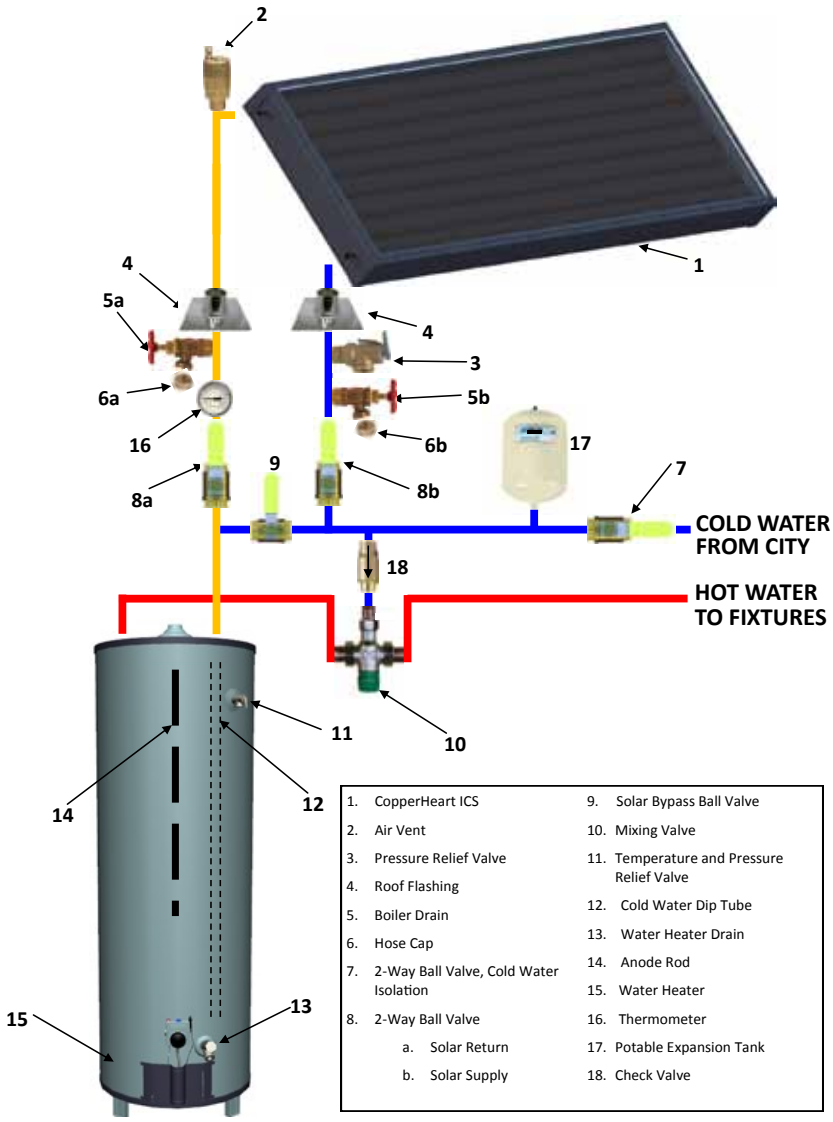
The installation of all horizontal and vertical piping shall not reduce the performance or rating of any structural member or fire rated assembly. Adhere to all applicable local codes and ordinances.

Continuous soft copper tubing or flexible stainless steel hose is recommended for all attic pipe runs to avoid making tubing connections or solder joints in the attic space.

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.

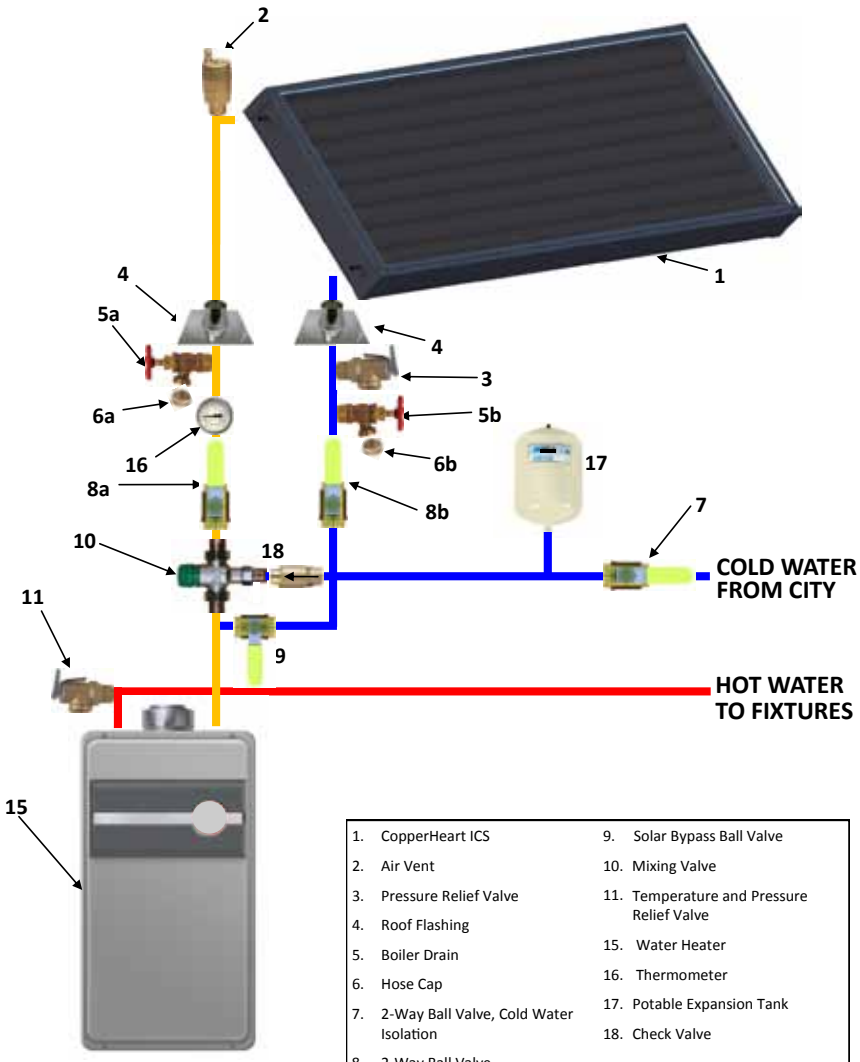
A vacuum breaker or combination air vent and vacuum breaker must be installed in a plumb and vertical orientation near the highest point in the system to facilitate draining and protect the collector from conditions where it may experience negative pressure.

A potable water expansion tank may need to be included in the system if not already present in the



1. CopperHeart ICS
2. Air Vent
3. Pressure Relief Valve
4. Roof Flashing
5. Boiler Drain
6. Hose Cap
7. 2-Way Ball Valve, Cold Water Isolation
8. 2-Way Ball Valve
   a. Solar Return
   b. Solar Supply
9. Solar Bypass Ball Valve
10. Mixing Valve
11. Temperature and Pressure Relief Valve
12. Cold Water Dip Tube
13. Water Heater Drain
14. Anode Rod
15. Water Heater
16. Thermometer
17. Potable Expansion Tank
18. Check Valve

fig. 12a



1. CopperHeart ICS
2. Air Vent
3. Pressure Relief Valve
4. Roof Flashing
5. Boiler Drain
6. Hose Cap
7. 2-Way Ball Valve, Cold Water Isolation
8. 2-Way Ball Valve
   a. Solar Return
   b. Solar Supply
9. Solar Bypass Ball Valve
10. Mixing Valve
11. Temperature and Pressure Relief Valve
15. Water Heater
16. Thermometer
17. Potable Expansion Tank
18. Check Valve

fig. 12b

hot water piping. This expansion tank is particularly important in residences that have backflow preventers or non-return valves that will not allow reverse flow of water back into the mains.

For seasonal systems in locations experiencing hard winter freezes all roof and attic piping should be installed to slope 1/4" per foot of pipe run to ensure that the pipes will drain during winter shutdown conditions.

Figures 12a & 12b detail the plumbing connection between the CopperHeart and the auxiliary heater. Figure 12a is used for conventional gas or electric tank type water heaters and Figure 12b for tankless gas auxiliary heaters. SunEarth requires two modes of operation that allow for solar pre-heating through the Copperheart or bypassing the Copperheart to provide 100% conventional electric resistance or gas water heating. Figures 12a & 12b show three standard ball valves in the bypass assembly (figures 12a & 12b, valves 8a, 8b & 9). Other acceptable options for the bypass assembly include using two 3-way valves (figure 13a & 13b, valves 8a & 8b) or one four port valve (figure 14a & 14b, valve 8). In each case the valve arrangement must provide the user with the required two modes of operation: solar pre-heat and 100% gas or electric heat.

Tank plumbing must allow for the isolation of the water heater from the city cold water supply line by means of an isolating ball valve (figures 12a & 12b, valve 7).

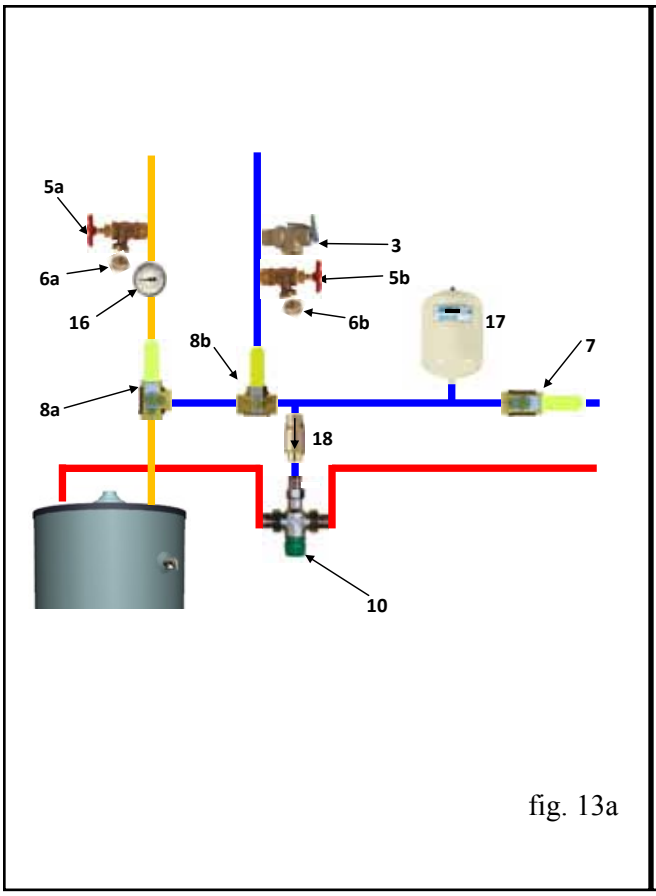


fig. 13a

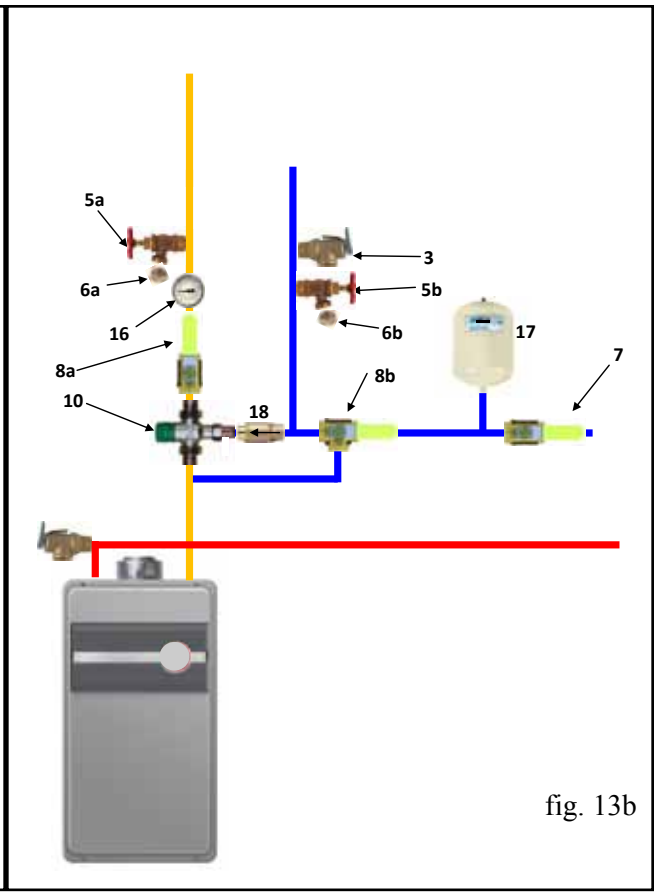


fig. 13b

A thermostatic mixing valve is a required component on all OG-300 certified systems and should be plumbed in line with brass union connections for ease of future repair or replacement (Figures 12a & 12b, component 10). The mixing valve is normally set to supply hot water at 120ºF.

On sunny days system temperatures may range between 110ºF to 180ºF depending upon the season and hot water demand. The mixing valve described above blends the hot and cold water supplies to deliver hot water to the auxiliary heater at a safe, con¬trolled temperature.

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

4.5 Pipe Insulation:

⚠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 hot water piping to and from the Copperheart, plus any interconnecting hot water piping must be well insulated with a high quality flexible closed cell insulation to minimize heat loss and provide protection against freezing. In addition, the final 5 feet of metallic cold water supply pipe leading to the system, or the length of piping which is accessible if less than 5 feet, must also be insulated. The insulation shall have a maximum operating temperature of 220ºF or higher and a minimum thermal resistance of R-2.6 ºF.ft².hr/Btu.

To the extent possible, slide the insulation material over the pipe without cutting or taping. All butt joints should 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.

Copper plumbers tape or tube strap is required to

support the piping. The pipe insulation should not be compressed or crimped by the pipe hangars or strapping material.

Any above ground exterior pipe insulation shall be protected from UV degradation and moisture damage. Insulation 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. Inspect the insulation for cracks and signs of shrinkage every three to five years. Repaint and repair as necessary.

Buried copper tubing must be insulated in accordance with the recommendations above. All insulated lines must be buried above the water table and use a clean fill such as a sand layer of 3" to 5" to protect the insulation before backfilling. All buried material must be properly sealed at all the seams. For optimum performance, the insulated lines should be encased in a conduit to protect the material from problems associated with groundwater or frost.

4.6 Plumbing Two CopperHearts:

When two CopperHearts are plumbed together in a single system they should be plumbed in parallel in accordance with figures 15 and 16. Couplings rather than unions should be used to join the collectors to avoid leaks and fluid loss.

4.7 Auxiliary Water Heater:

In plumbing the system make sure that all the components are accessible and easy to reach. Provide for clear access to the water heater, mixing valve and other key components. If a component may require future service or maintenance make the connections with brass unions or other approved connections. Use only brass nipples and unions and copper and brass fittings. The use of galvanized fittings or nipples, CPVC, PVC or other plastic pipe is prohibited. Di-electric nipples may be required by some Authorities Having Jurisdiction (AHJ). 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. Conventional

fig. 14

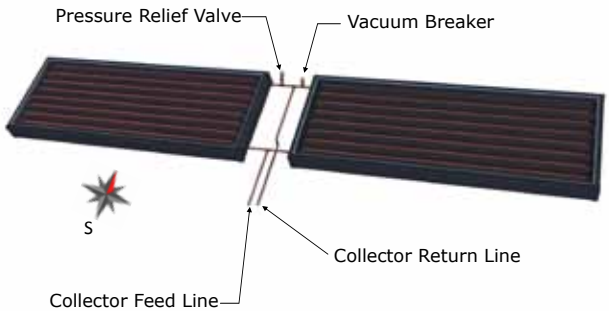


fig. 15

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 auxiliary water heater should not sit directly on the concrete slab or floor. The heater should be placed on a well-insulated pad with a minimum insulation value of R-10.

5) SYSTEM COMPONENTS

The Copperheart ICS system components are listed below. Please refer to figures 12 & 12a for the component number and locataion.

1. The CopperHeart ICS unit. Integrated solar collector and storage tank.

2. Vacuum Breaker. Allows water to drain from the CopperHeart whenever negative pressure conditions are experienced, also assists with system drainage necessary during winter conditions or routine maintenance.

3. Pressure Relief Valve. Protects the CopperHeart from system pressure in excess of the pressure relief setting. Typical pressure relief valves have a setting between75 psi and 150 psi. The pressure relief valve setting must be lower than the maximum design pressure of all the components in the collector loop.

4. Roof Jacks or Flashings. Seals the roof penetrations for the solar loop piping.

5a. Boiler Drain. Valve used in conjunction with

5b. to fill and drain the Copperheart.

5b. Boiler Drain. Valve used in conjunction with 5a. to fill and drain the Copperheart.

6a. Hose Cap. Threaded safety cap for capping 5a. to prevent unintentional use or scalding.

6b. Hose Cap. Threaded safety cap for capping 5b to prevent unintentional use or scalding.

7. Ball Valve. This valve is normally open to allow incoming mains water to the system. When closed this valve isolates the system from the cold water supply.

8a. Ball Valve. This valve is normally open to return heated water from the Copperheart. When closed in conjunction with 8b. the Copperheart ICS is isolated from the rest of the system.

8b. Ball Valve. This valve is normally open to supply cold water to the Copperheart. When closed in conjunction with 8a. the Copperheart ICS is isolated from the rest of the system.

9. Ball Valve. This valve is normally closed when Copperheart ICS is heating. When opened in conjunction with closing 8a. and 8b. the Copperheart is bypassed allowing mains water directly into the auxiliary heater.

10. Thermostatic Mixing Valve. This valve delivers hot water to your fixture at a safe, controlled temperature by blending the hot water in your storage tank with incoming city cold water.

11. Temperature and Pressure Relief Valve. This emergency valve will open to protect the water heater at temperatures in excess of 212ºF or under pressures exceeding the pressure setting of the valve.

12. Cold Water Dip Tube. Delivers mains cold water directly to the bottom of the water heater. The dip tube prevents the dilution of hot water in the upper portion of the water heater with the incoming cold water.

13. Water Heater Drain. Allows for draining the auxiliary water heater.

14. Anode Rod. Installed in all steel glass-lined water heaters to prevent internal tank corrosion and premature failure.

15. Auxilliary Gas or Electric Water Heater.

6) SYSTEM START UP PROCEDURES

Once the CopperHeart is mounted and plumbed in accordance with the drawings and specifications outlined in this manual, commission the system as follows:

6.1 Fill the conventional water heater.

6.1.1 Set the ball valves (valves 8a, 8b and 9) above the water heater to the solar bypass position as shown in figure 17. Valves 8a and 8b are closed and valve 9 is open.

6.1.2 Open the cold water supply ball valve (valve 7) and fill the conventional water heater. Make sure the tank is completely filled by opening and running a hot water fixture until the water runs free of

bubbles from the fixture.

⚠WARNING: IF YOU HAVE AN ELECTRIC AUXILIARY WATER HEATER DO NOT TURN ON THE ELECTRICITY TO THE HEATER UNTIL THE TANK IS COMPLETELY FILLED. IT ONLY TAKES EIGHT (8) SECONDS TO DESTROY THE HEATING ELEMENTS IN AN ELECTRIC WATER HEATER IF THEY ARE NOT COMPLETELY SUBMERGED WHEN THE TANK IS FIRST ENERGIZED. BE CAREFUL.

6.1.3 The final electrical or gas connection to the conventional water heater must be made by a properly licensed contractor.

6.1.4 Close the cold water supply valve (valve 7).

6.2 Fill the ICS Unit.

6.2.1 Remove the brass hose cap (component 6a) from the boiler drain (component 5a) on the Copperheart return line and attach a hose to the boiler drain 5a. Place the hose in either a service basin or outside the home. As the CopperHeart fills with water any air trapped in the system will be purged through this valve.

6.2.2 Close the bypass ball valve (valve 9) and open the Copperheart supply and return valves (valves 8a & 8b).

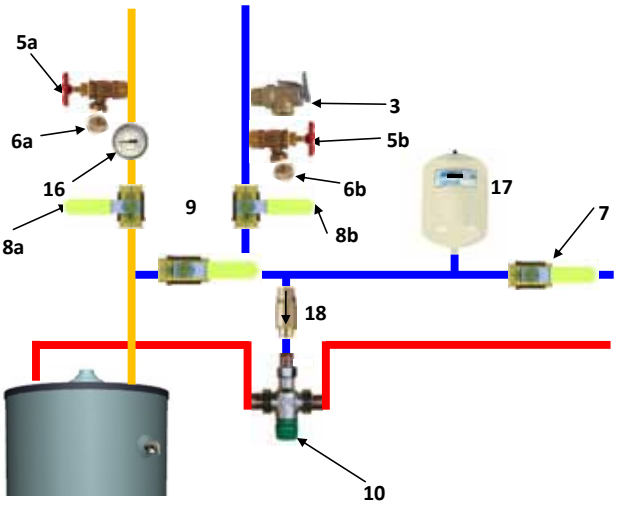


fig. 16

Solar By Pass Mode

6.2.3 Open the cold water supply ball valve (valve 7).

6.2.4 Fill the CopperHeart. Allow water to flow out through the hose and flush the system for several minutes to eliminate trapped air in the system.

6.2.5 Close the boiler drain (5a) and remove the hose. Place the brass hose cap on the boiler drain (component 6a).

6.2.6 Inspect the system plumbing for any leaks.

6.2.7 Open a hot water fixture in the home and run the water until the water runs clear and any trapped air has been eliminated.

6.2.8 The thermostat on the electric or gas water heater should be set no higher than 120 degrees. Use the "low" or "warm" setting if the thermostat is not calibrated in degrees.

7) MODES OF SYSTEM OPERATION

The normal system mode of operation is as a solar pre-heat to an auxiliary water heater (solar pre-heat mode). The system can also be set to bypass the solar and operate utilizing 100% auxiliary heater (solar bypass mode). It may be necessary to use the solar bypass mode when performing maintenance on the Copperheart or supply and return piping. In locations experiencing freezing conditions during the winter it may also be necessary to operate in solar bypass mode during the winter months.

Changing between the modes of operation is achieved by setting the positions of the valves that make up the bypass valve assembly: valves 8a, 8b, & 9 in Figures 12a & 12b; valves 8a & 8b in Figures 13a & 13b; or valve 8 in Figures 14a & 14b. For systems using a bypass assembly consisting of three ball valves; figures 18a, 18b, 19a & 19b illustrate the correct valve positions for solar pre-heat and solar bypass modes. For systems using a bypass assembly consisting two three-way valves; figures 20a, 20b, 21a & 21b illustrate the correct valve positions for solar pre-heat and solar bypass modes. For systems using a bypass assembly consisting of a single four port valves; figures 22a, 22b, 23a & 23b illustrate the correct valve positions for solar pre-heat and solar bypass modes.

8) SYSTEM SHUTDOWN PROCEDURES

The CopperHeart ICS and the solar loop feed and return line piping must be drained during mainte-

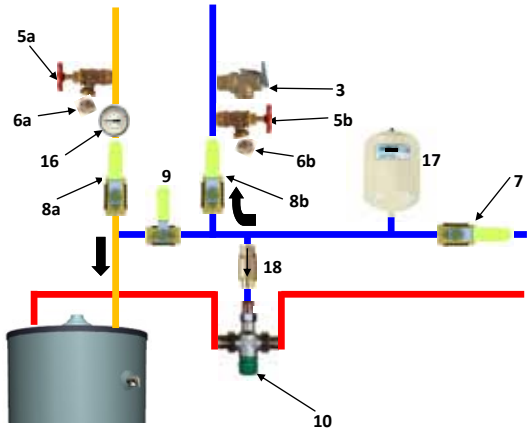


fig. 17a

Solar Pre-Heat Mode

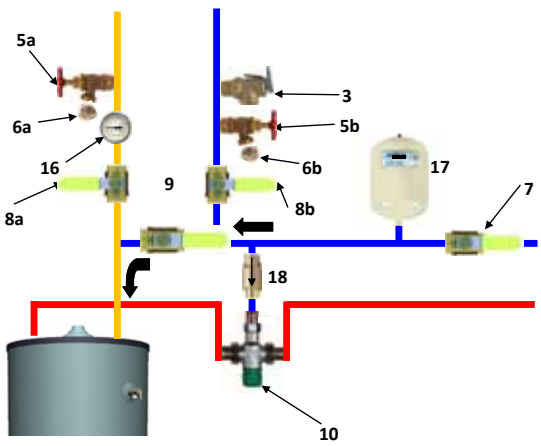


fig. 17b

Solar By Pass Mode

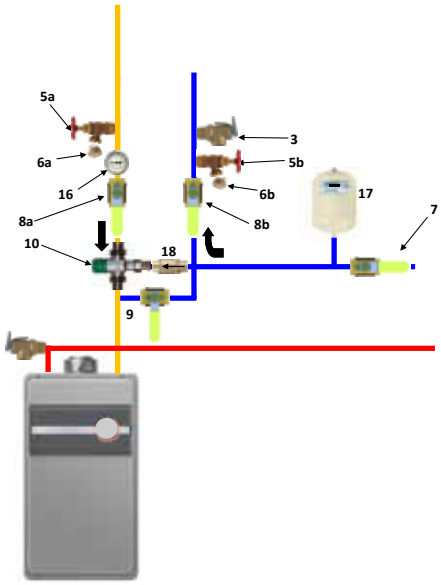


fig. 18a

Solar Pre-Heat-Mode

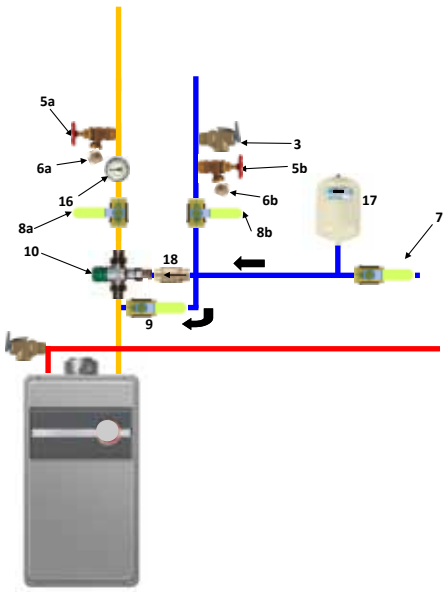


fig. 18b

Solar By Pass Mode

nance or during cold weather conditions that meet or exceed the CopperHeart's freeze tolerance limit. During winter vacations the CopperHeart must be drained if freezing conditions are anticipated. The system should be shut down by following the procedures below:

Drain the unit as follows:

8.1 Set the valves in the bypass assembly to solar bypass mode by turning the valves to the position shown in figures 18b, 19b, 20b, 21b, or 22b.

8.2 Remove the protective brass hose cap (components 6a and 6b) on the boiler drains. Attach garden hoses to both boiler drains (components 5a and 5b). Terminate the hoses in either a service basin or an appropriate spot outside the home.

8.3 Open both boiler drains and allow the unit to drain. **BE CAREFUL**. The water may be extremely hot. When the unit and piping are drained, close both boiler drains and replace the protective brass hose caps.

When refilling the unit follow the appropriate steps outlined in Section 6) System Start-Up Procedures above.

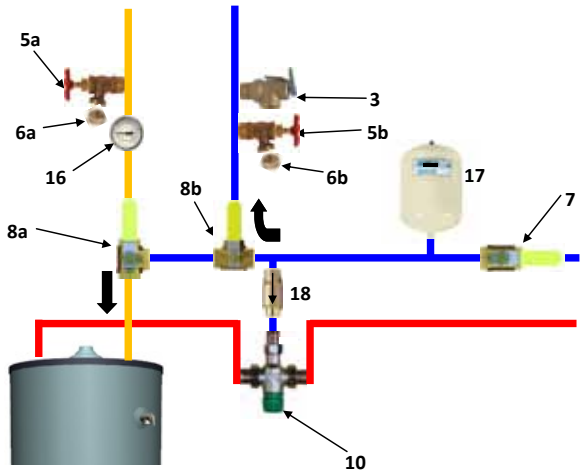


fig. 19a

Solar Pre-Heat-Mode

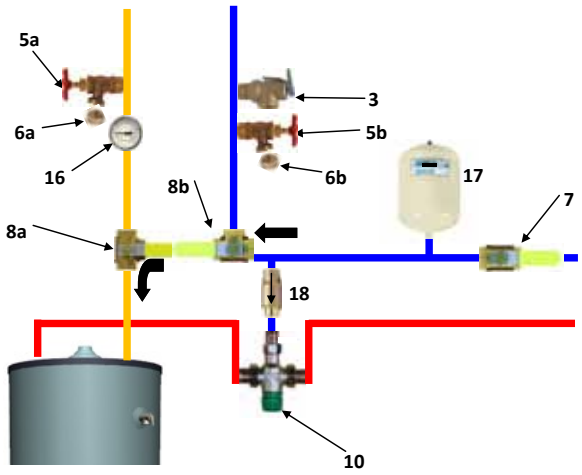


fig. 19b

Solar By Pass Mode

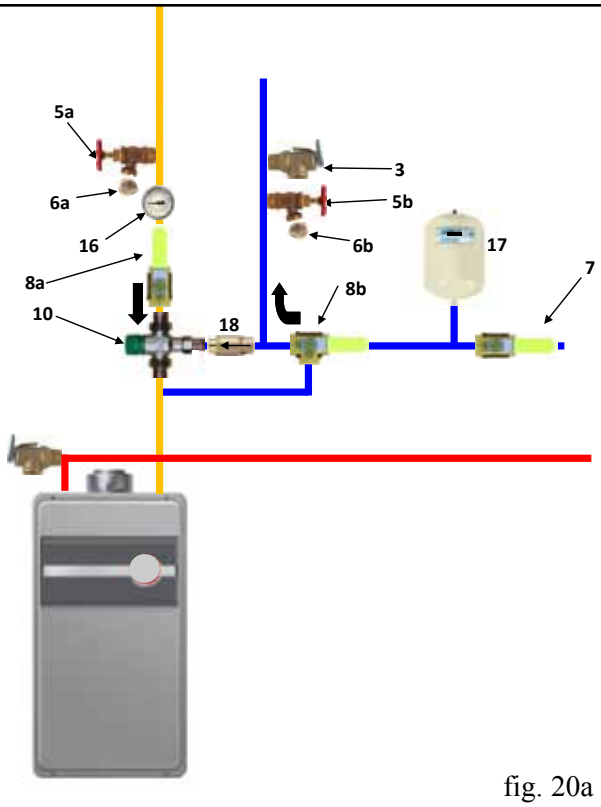


fig. 20a

Solar Pre-Heat-Mode

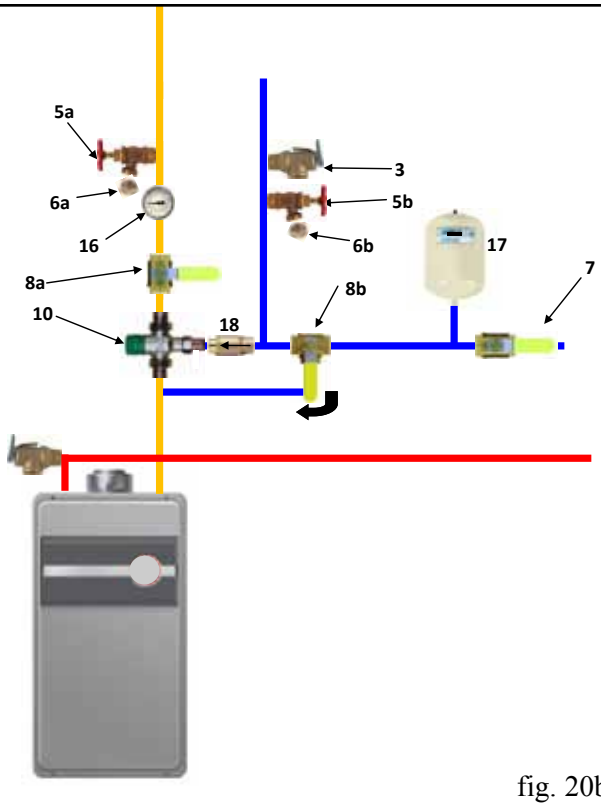


fig. 20b

Solar By Pass Mode

⚠NOTE TO THE CONTRACTOR: IT IS AN SRCC CERTIFICATION REQUIREMENT THAT A CONSPICUOUSLY PLACED LABEL EXPLAINING HOW THE COPPERHEART IS PROTECTED FROM FREEZING AND WHAT ACTIONS THE HOMEOWNER SHOULD TAKE SHALL BE ATTACHED TO THE WATER HEATER IN A PLAINLY VISIBLE LOCATION. FOR SYSTEMS LIKE THE COPPERHEART WHICH RELY ON MANUAL INTERVENTION FOR FREEZE PROTECTION, THIS LABEL SHALL INDICATE THE MINIMUM AMBIENT TEMPERATURE BELOW WHICH HOMEOWNER ACTION IS REQUIRED. THE LABEL MUST INDICATE THE BYPASS AND DRAINING PROCEDURES OUTLINED IN SECTIONS 6 AND 7 OF THIS MANUAL.

9) OVERHEAT PROTECTION

The CopperHeart ICS has a distinct advantage over other types of solar water heating systems relative to stagnation conditions. If hot water is not drawn from the unit for extended periods, the stored heat in the tubes will radiate heat back to the atmosphere during the late night and early morning hours. This process naturally cools the unit and prevents the system from overheating.

10) ROUTINE MAINTENANCE AND TROUBLESHOOTING

10.1 Cleaning the Collector Glass:

If you live in a dusty climate it is beneficial to wash off the dirt that settles on the collector glass once a month. Clean glass allows the collector to maintain a high level of thermal performance. Hose off any caked on dirt or dust and then clean the glass with Windex or a household glass cleaner and a soft cloth.

10.2 Replacing the Anode Rod:

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 (ST1). Typically constructed from magnesium, anode rods are installed in "glass lined" water heaters and storage tanks to inhibit corrosion.

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

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

10.3 Flushing the Storage Tank:

The auxiliary water heater also should be flushed annually to minimize sediment buildup 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. Open the flush valve on the bottom of the storage tank 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

10.4 Maintaining Pipe Insulation:

Check the exterior pipe insulation annually and patch or repair any exposed surfaces or degraded areas. Repair as necessary with manufacturer's recommended jacket or coating or a high quality exterior latex paint.

10.5 Glass Replacement:

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

10.6 Leaks:

If you detect a water leak in the solar loop piping or tank plumbing, contact your installation contractor to service and refill the system.

10.7 Mode of Operation:

Check the system bypass valve assembly at least once a year to make sure the valves are properly positioned.

10.8 Auxiliary Electric Element not Operating:

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. There may be one or two elements and thermostats in the electric auxiliary water heater.

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

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

11) ESTIMATED COMPONENT LIFE

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

The CopperHeart unit has a design life of twenty five to thirty years in most water quality areas. The auxiliary water heater should last between eight and fifteen years. 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. The primary determinants of component longevity are local water quality and the average annual system temperature. Very high finished tank temperatures will adversely impact the life of all conventional glass-lined storage water heaters. Periodic anode rode replacement may significantly extend the life of your conventional water heater.

To obtain warranty service, please contact your installation contractor or SunEarth Inc. for the name of an authorized service agent near you.

12) SYSTEM OPERATING PARAMETERS

12.1 Collector Loop Pressure:

The pressure in the solar collector loop should be close to the local mains pressure. This is normally between 30 PSIG and 80 PSIG.

12.2 Supply Temperature:

The temperatures generated by the CopperHeart ICS unit 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 system temperatures may range between 110ºF to 180ºF depending upon the season and hot water demand. The temperature of the water in the Copperheart, and hence the temperature of the water exiting the Copperheart to the auxiliary heater should be between 45ºF (during a cold winter night) and 180ºF (during a hot summer day).

Appendix A

OG-300 APPROVED PRIMARY COMPONENTS

ICS – Integrated Collector and Storage

Make	Series	Model Numbers
SunEarth	Copperheart	CP-20 CP-40

Collector Mounting Hardware

Make	Series
SunEarth	SolarStrut Copperheart Landscape Rack Copperheart Flush Mount Kit

Install mounting hardware per SunEarth manuals & standard residential drawings.

Thermostatic Mixing Valve

The thermostatic mixing valve shall have a bronze, brass or stainless steel body with a maximum working temperature no less than 200°F and a 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

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

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 75psi and 150psi. The pressure relief valve shall be set below the maximum design pressure of all components in the collector loop.

Check Valve

The check valve shall be spring type 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.

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.

Thermometers

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 mobile phone. The range of measurement shall be not less than 30°F to 200°F with an accuracy of +/- 2%.

Potable Expansion Tank

The expansion tanks shall be rated for potable water. The maximum working temperature shall be no less than 200°F and the maximum working pressure shall be no less than 125 psi. The expansion tank should be sized as per standard expansion tank sizing guidelines . The expansion tank shall be not less than 2 gallons and the acceptance volume shall be not less than 1.0 gallon.

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.

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

COPPERHEART OG-300 SYSTEM LABELS

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

VALVES # 5a AND 5b

VALVES 5a AND 5b ARE NORMALLY CLOSED. WHEN OPEN THEY ARE USED TO CHARGE AND DRAIN THE ICS AND ICS LOOP PIPING.

THE ONLY FLUID USED IN THIS SYSTEM IS MAINS WATER, AWWA CLASS 1. 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.

BE EXTREMELY CARFUL WHEN DRAINING THE SYSTEM. WATER MAY BE DISCHARGED AT A VERY HIGH TEMPERATURE AND/OR PRESSURE.

VALVE # 7

COLD WATER SUPPLY LINE ISOLATION BALL VALVE

THIS VALVE IS NORMALLY OPEN AND ALLOWS POTABLE WATER TO FILL THE COPPERHEART AND THE AUXILLIARY WATER HEATER. WHEN CLOSED, THIS VALVE ISOLATES THE SYSTEM FROM THE PRESSURIZED MAINS WATER SUPPLY LINE.

VALVE # 8a

RETURN FROM ICS ISOLATION BALL VALVE OR THREE WAY VALVE.

THIS VALVE IS OPEN WHEN SOLAR HEATING IS OPERATIONAL. WHEN CLOSED IN CONJUNCTION WITH VALVE # 8b IT WILL ISOLATE THE COPPERHEART ICS UNIT FROM THE REST OF THE SYSTEM.

VALVE # 8b

SUPPLY TO ICS ISOLATION BALL VALVE OR THREE WAY VALVE.

THIS VALVE IS OPEN WHEN SOLAR HEATING IS OPERATIONAL. WHEN CLOSED IN CONJUNCTION WITH VALVE # 8a IT WILL ISOLATE THE COPPERHEART ICS UNIT FROM THE REST OF THE SYSTEM.

VALVE # 8 (OPTIONAL)

FOUR PORT BYPASS VALVE.

THIS VALVE IS CLOSED WHEN SOLAR HEATING IS OPERATIONAL. WHEN OPEN IT ALLOWS COLD WATER TO BYPASS THE ICS UNIT AND FLOW DIRECTLY TO THE AUXILLIARY WATER HEATER.

WARNING: HOT - DO NOT TOUCH

THIS COMPONENT MAY BE OVER 140^{O}F AND CAN CAUSE BURNS IF TOUCHED. DO NOT TOUCH WITHOUT SUITABLE PROTECTION.

FREEZE LABEL:

THE LARGE THERMAL MASS OF THE COPPERHEART ICS PROVIDES LIMITED FREEZE PROTECTION AT AMBIENT TEMPERATURES DOWN TO 20^{O}F FOR 18 HOURS. FOR COLDER CONDITIONS OR FREEZING CONDITIONS EXCEEDING 18 HOURS THE WATER MUST BE MANUALLY DRAINED FROM THE COPPERHEART UNIT AND EXPOSED PIPING.

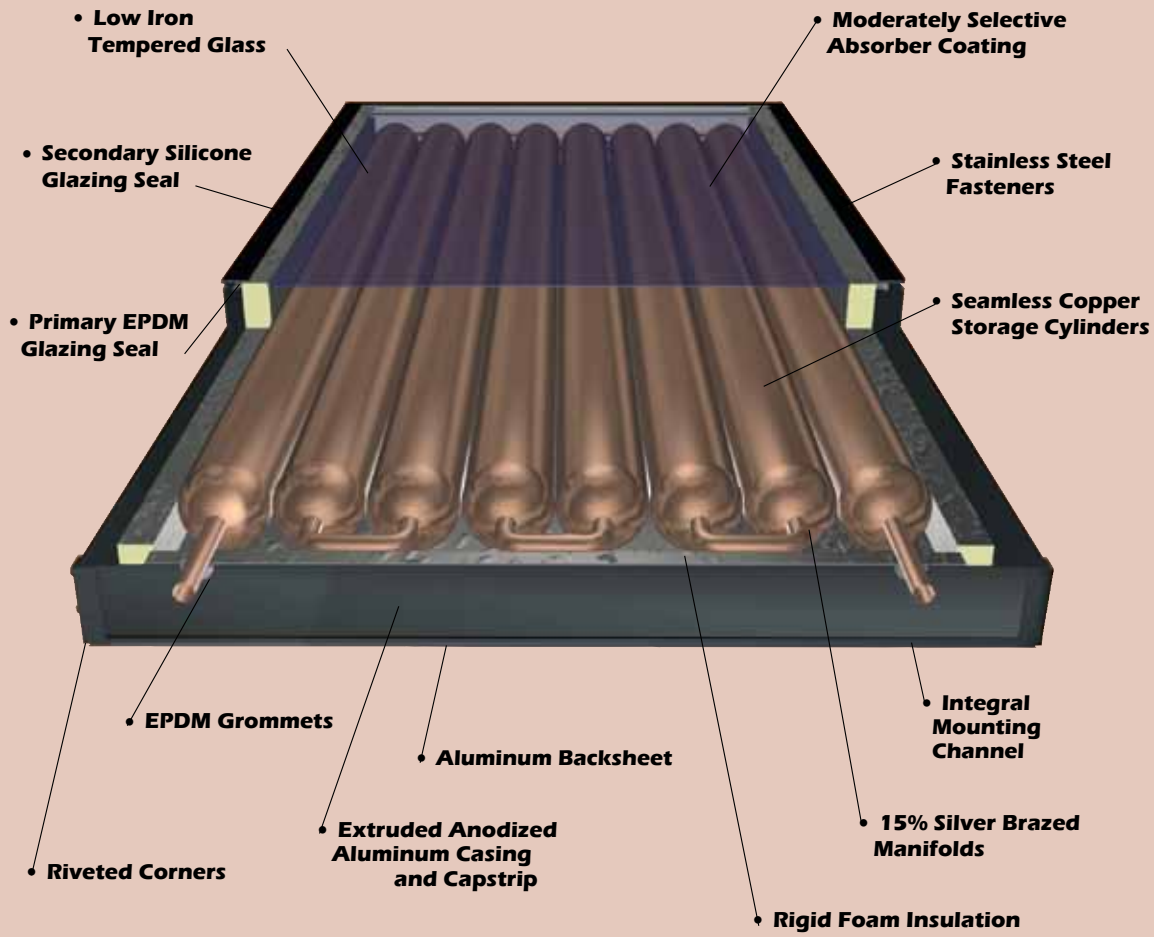
PLEASE CONSULT SECTION 8 OF YOUR INSTALLATION MANUAL FOR INSTRUCTION ON SHUTTING DOWN AND DRAINING THE SYSTEM.

Appendix C

SUNEARTH INC.

THE COPPERHEART SERIES
INTEGRAL COLLECTOR STORAGE SYSTEM
SPECIFICATION SHEET

SIMPLE, DURABLE, AND RELIABLE
The CopperHeart Integral Collector Storage System



PROTECTING OUR ENVIRONMENT—SINCE 1978

SUNEARTH INC. COPPERHEART ICS SPECIFICATIONS

SunEarth Model No.	Fluid Capacity U.S. Gallons	Dry Weight, Lbs.	Wet Weight, Lbs.	Width Inches	Length Inches	Depth Inches	Gross Area Sq Ft	Net Aperture Sq Ft	Rated Internal Working Pressure @ 200F in PSIG	Inlet and Outlet Piping, Inches	Inlet to Outlet Center to Center, Inches
CP-20	19	143	301	36.2	50.2	6.8	12.6	10.6	120	3/4	28.9
CP-40	40	281	615	36.2	98.2	6.8	24.7	21.5	120	3/4	28.9

COLLECTOR THERMAL PERFORMANCE RATINGS (IP Units)

CP-20	Thousands of Btu Per Panel Per Day		
Climate ->	High Radiation	Medium Radiation	Low Radiation
Category ($T_i - T_a$)	(2000 Btu/ft^2.day)	(1500 Btu/ft^2.day)	(1000 Btu/ft^2.day)
A (-9°F)	17.1	13.3	9.6
B (9°F)	12.6	8.9	5.1
C (36°F)	5.8	2.0	0.0

CP-40	Thousands of Btu Per Panel Per Day		
Climate ->	High Radiation	Medium Radiation	Low Radiation
Category ($T_i - T_a$)	(2000 Btu/ft^2.day)	(1500 Btu/ft^2.day)	(1000 Btu/ft^2.day)
A (-9°F)	33.4	25.9	18.4
B (9°F)	25.9	18.4	10.9
C (36°F)	15.0	7.5	0.0

A-Pool Heating (Warm Climate) B-Pool Heating C-Water Heating (Warm Climate).
Collector ratings are derived from the Solar Rating & Certification Corporation (SRCC) in accordance with SRCC OG-100 certification.
Testing was performed as prescribed in FSEC Standard 105-10 and SRCC TM-1.

ENGINEERING SPECIFICATIONS

The solar water heating system shall be of the integral collector storage (ICS) type, and shall require no pumps, controls, or parasitic energy consumption for its normal operation. The ICS unit shall be the SunEarth CopperHeart ICS model number _____. The CopperHeart ICS unit shall be tested in conformance with SRCC Standard OG-100 by an independent testing laboratory, certified by the SRCC under system standard OG-300, and also by the Florida Solar Energy Center (FSEC).

GENERAL
The dimensions of the CopperHeart ICS model number _____shall be_____inches in length, 36.2 inches in width, and 6.85 inches total depth to the top of the glazing capstrip, and be rated at a nominal capacity of _____U.S. gallons. The casing shall be an anodized aluminum extrusion (alloy 6063 T5), a minimum .125 inch in thickness, with an architectural dark bronze finish. Sheet metal fasteners shall be stainless steel (18-8 #10 X 1/2). The framewall shall be secured by four exterior anodized aluminum corner brackets attached with 8 each AD54BS aluminum rivets per corner. The casing backsheet shall be textured aluminum of not less than .014 inches in thickness.

GLAZING
The glazing shall be one sheet of low iron tempered glass of not less than .125 inch thickness, and have a minimum transmittance of 91%. The glazing shall be thermally isolated from the casing by a continuous EPDM gasket. There shall be a secondary silicone seal between the glass and the aluminum capstrip to minimize the intrusion of moisture into the casing.

INSULATION
The backing insulation shall be a foil-faced polyisocyanurate foam sheathing board with a minimum thickness of 1.5 inches, and shall be siliconed in place to the aluminum backsheet. Aged thermal resistance R-value of the backing and side-wall insulation shall be not less than R-12 at 75° F mean temperature. The ends of the ICS shall be insulated with 1 inch polyisocyanurate foam sheathing board with an aged thermal resistance R-Value of no less than 7.2.

ABSORBER/STORAGE CYLINDERS
The CopperHeart ICS shall combine the collector and storage tank as one unit. The all copper storage cylinders shall be seamless drawn 4.125 inch O.D. copper tubing with a minimum wall thickness of .058 inches, and have machine spun ends to accept 0.75 inch O.D. Type L copper internal manifolds. Eight storage cylinders shall be manifolded in series to form a storage vessel. The rated internal working pressure shall be 120 PSIG at 200° F.
All internal manifold braze joints shall be joined utilizing a copper phosphorous brazing alloy with no less than 15% silver content and conforming to the American Welding Society's BCuP-5 classification. EPDM grommets shall isolate the manifolds from the aluminum casing.

ABSORBER COATING
The absorber coating shall be a moderately selective paint with a minimum absorptivity of 94 percent and a maximum emissivity of 56 percent.

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

MANUFACTURED BY:

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

AVAILABLE FROM:

CH 02/13

RECYCLED PAPER—SOY BASED INK

Appendix D

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

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 E

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

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 (SEFD)	SRCC Cert. No.	Model No.
0.9	30003829	CP-20-TLG
1	30003828	CP-40-TLG
0.8	30003827	CP-80PG
0.7	30003826	CP-20G
0.8	30003825	CP-40G
1.4	30003824	CP-80P
1.1	30003823	CP-20
1.2	30003822	CP-40
The installed system is marked above		

Appendix F

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: _____

_____

_____

Revised 4-16-2016

8425 Almeria Avenue • Fontana, CA 92335
Phone: (909) 434-3100 • Fax: (909) 434-3101
email: sales@sunearthinc.com • www.sunearthinc.com