

# 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:

10°F for 6 consecutive hours, or

20°F 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 owner's 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.

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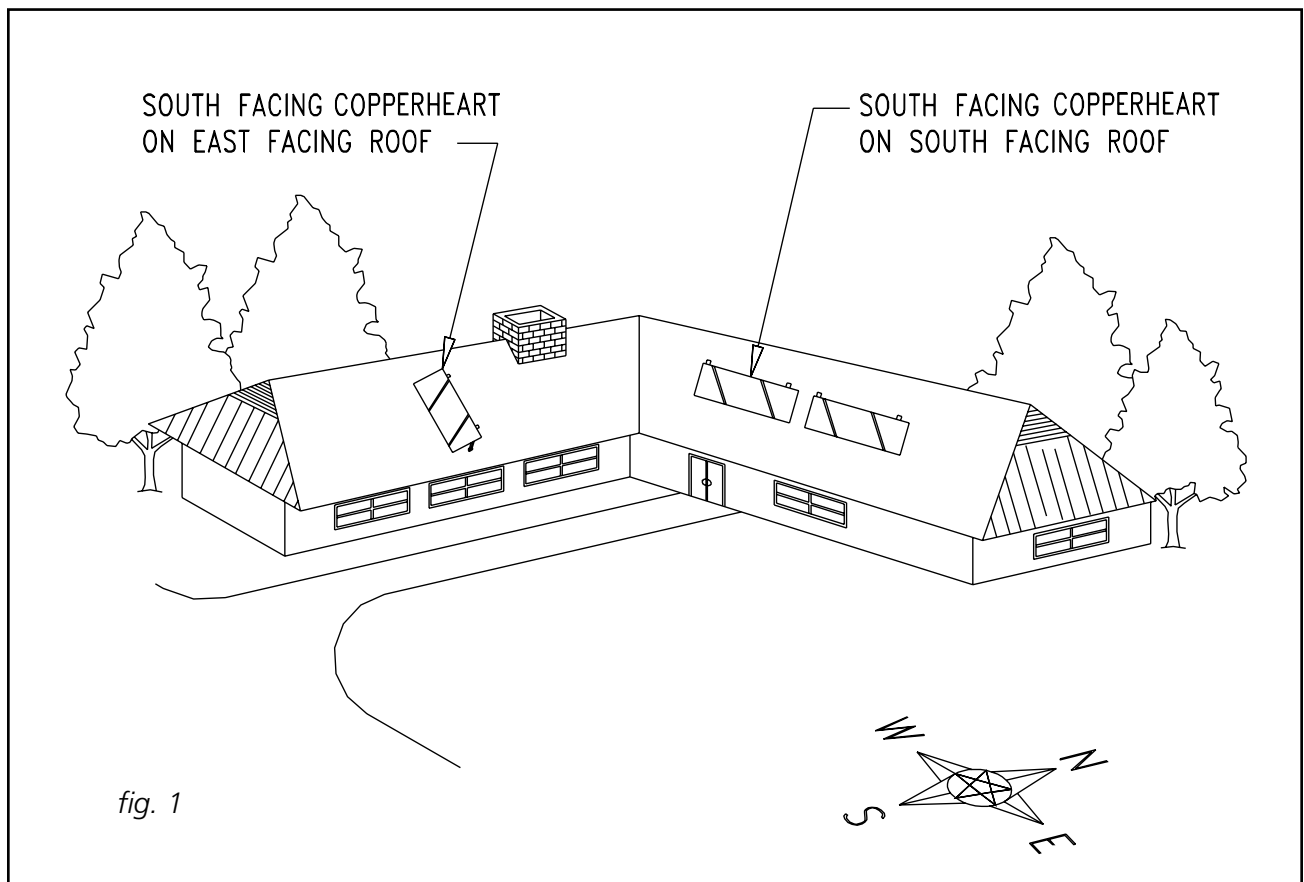
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## PREFACE

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.

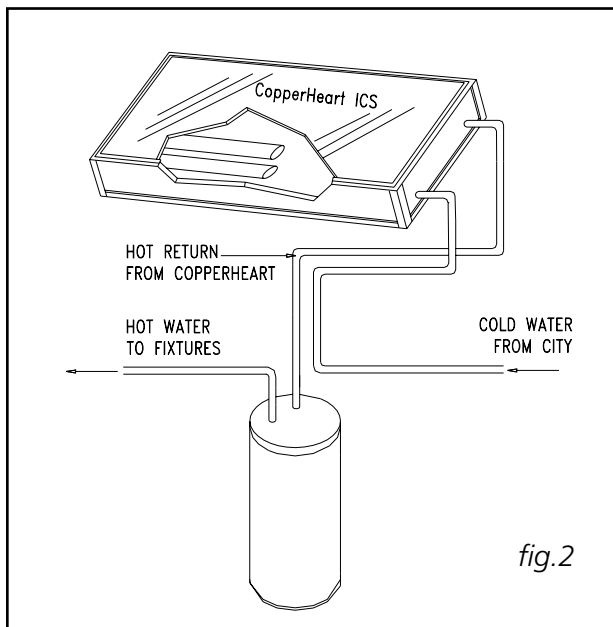


## 1) INTRODUCTION

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 instantaneous 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.

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 10°F for a six hour period, or 20°F 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 paint that is highly absorptive. 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 lower cylinders 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 water heater. Your CopperHeart ICS system is plumbed to accommodate three separate modes of operation. The system will, (1) allow for 100% solar operation, (2) serve as a preheater to the electric or gas water heater, or (3) operate as a 100% electric or gas water heater bypassing the solar system.

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 14, 15 and 16.

## 3) INSTALLATION REQUIREMENTS - GENERAL

- A. The contractor shall obtain all required permits and approvals.
- B. The installation shall conform to all federal, state and local regulations, codes, ordinances and standards governing solar water heating system installations, and the contractor shall

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

- C. The CopperHeart must be located in a structurally sound area of the roof that will be unshaded for the majority of the day all year round. Adjacent buildings and trees should be checked for possible winter shading. An instrument such as the Solar Pathfinder can be used for solar site analysis. (Solar Pathfinder can be reached at 605-528-6473).
- D. Before the installation, the contractor shall inspect the condition of the roof and notify the homeowner of any existing roof damage or necessary repairs.
- E. The homeowner and contractor shall confirm the location of all roof and ground mounted components in advance of the installation.

**4) INSTALLATION REQUIREMENTS - SPECIFIC**

**A. LOCATION, ORIENTATION AND TILT**

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.

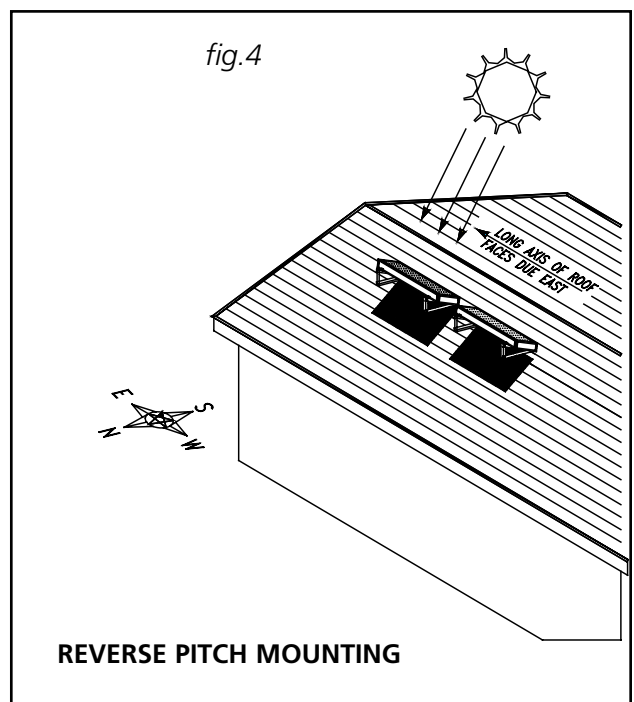
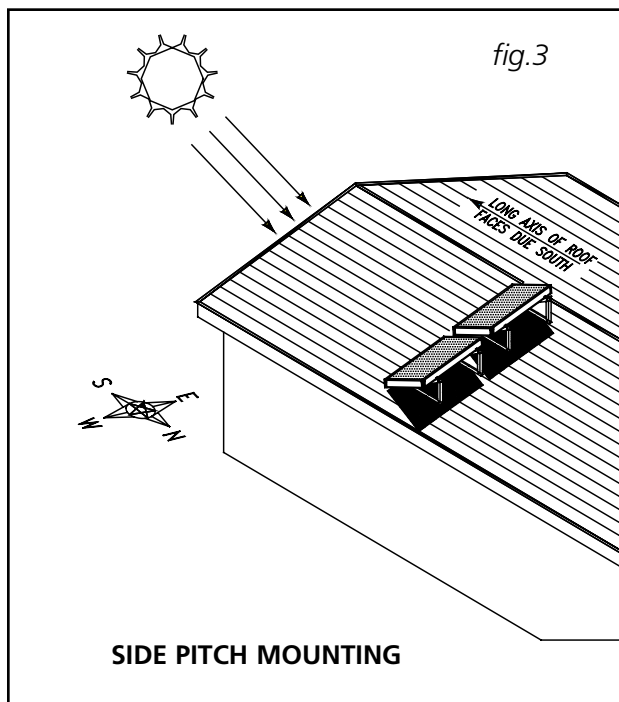
The thermal performance of the CopperHeart is optimized in the Northern Hemisphere when the unit is mounted facing True South. Actual performance, however, suffers very little when the unit is oriented no more than 45° East or West of True South. The unit should be unshaded for the middle six hours of each day throughout the year.

The slope of your roof will have an impact on thermal performance. We recommend that you tilt the unit to achieve an angle for horizontal that is equal to your latitude plus an additional 10 degrees (See Table 1). This tilt angle favors the lower winter sun when system performance may suffer and minimizes overheating during the hot summer months.

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

**B. COPPERHEART ROOF MOUNTING PROCEDURES, MATERIALS AND METHODS**

In continental North America it is best to mount the CopperHeart horizontally 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 eave, and tilted toward the south. The collector inlet and outlet fittings **must** face down the roof slope toward the eave when the CopperHeart is mounted in this orientation to allow for drainage. In two unit installations on east or west facing roofs, the CopperHearts must be mounted in a staggered, or "sawtooth", configuration (See figure 3). For flat roof installations the unit must maintain a minimum angle from horizontal of 10° to ensure proper drainage of the glazing.

The CopperHeart ICS must be mounted in accordance with the materials and methods detailed in figures 5 – 11. Use SunEarth's 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 mounting hardware with anodized aluminum mounting clips and a stainless steel nut, bolt, lock washer and flat washer. When the unit is flush mounted (figure 5), CopperHeart models CP-30 and CP-40 should be anchored to the roof by no less than six support footings, three on each side of the unit.

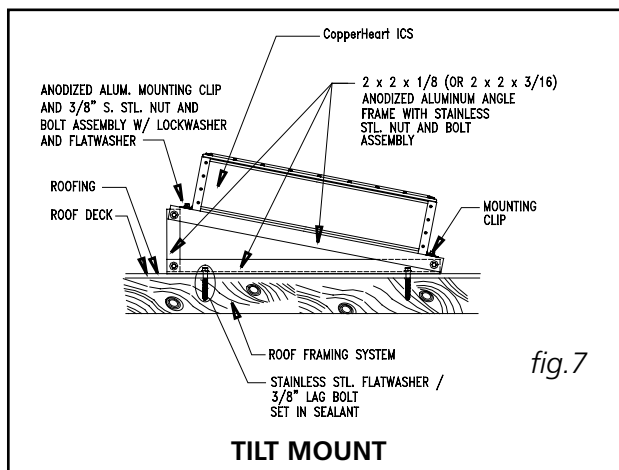
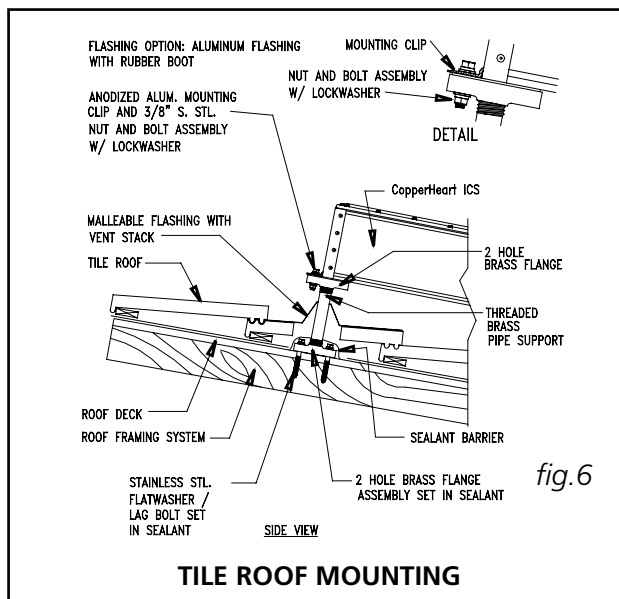
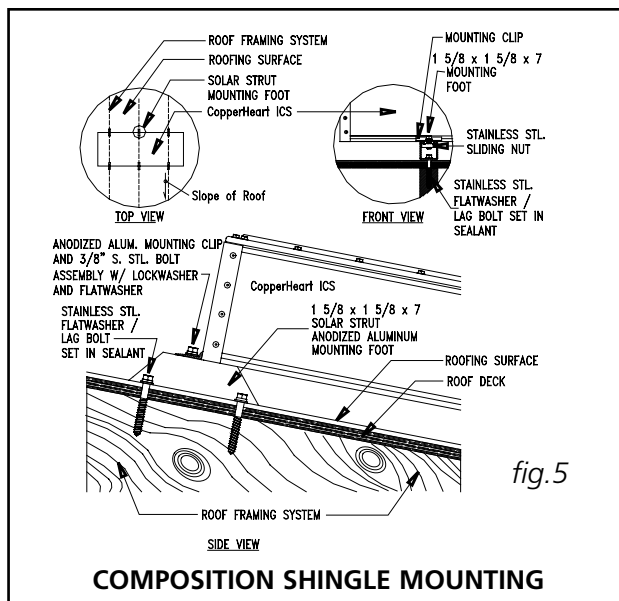
Follow these general principles when mounting the CopperHeart:

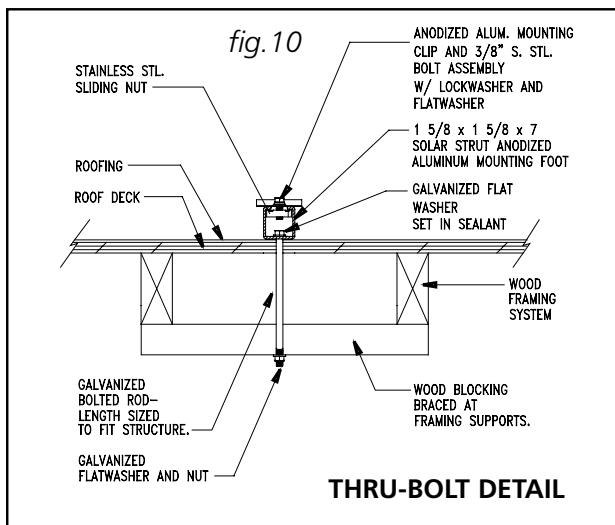
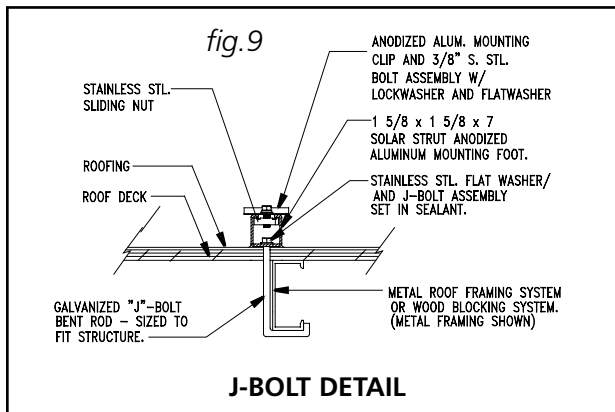
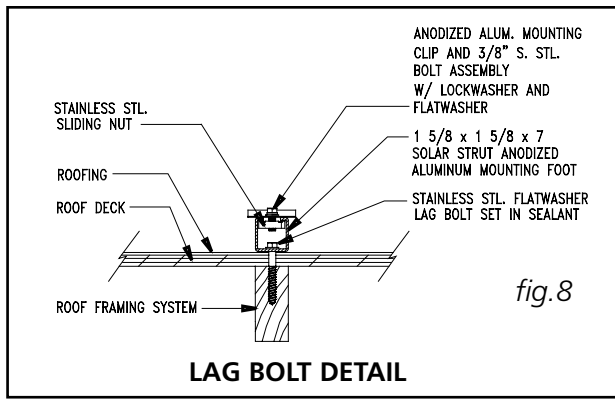
B.1 The roof must be rated to safely support the weight of the unit when filled with water.

B.2 The CopperHeart should be mounted as close to the storage tank as practical in order to minimize heat loss in the piping runs.

B.3 SunEarth recommends that the CopperHeart be raised from the roof surface at least 1½" to allow for rainwater and debris to pass under the unit and for proper ventilation of the roofing material.

B.4 If a low profile "roof integrated" look is preferred 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 waterproof 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.

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

B.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 solar collector are properly flashed and sealed in accordance with standard roofing practices. Tremco "POLYroof" is the recommended elastomer for sealing roof penetrations. Henry Co. 204, 208 or 209 roof mastic or Dow Corning Glazing Sealant also are approved sealants.

B.7 If the CopperHeart is mounted on a flat roof or the ground, a CopperHeart Tilt Mount Kit is required (figures 7 and 11). Optimal system performance is achieved by establishing a rack angle from horizontal equal to latitude plus ten degrees. The leg length required to achieve the appropriate angle is:

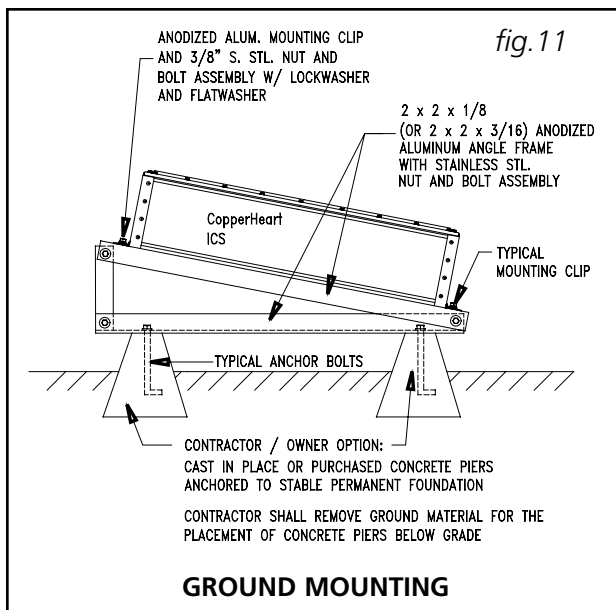
If Your Latitude Is	Your Tilt Mount Kit Leg Length Should Be
10°	14"
15°	18"
20°	21"
25°	24"
30°	26"
35°	29"

B.8 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.

### C. GROUND MOUNTING

The CopperHeart can be ground mounted. The unit must have a stable, permanent foundation. This may be either a concrete slab or four standard concrete 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 mounting rack must be thoroughly coated with silicone oil to prevent corrosion.

If the CopperHeart is mounted below the con-



ventional water heater in the home, the solar loop piping must slope to allow for complete drainage. A boiler drain must be installed on the inlet fitting to the unit and a vacuum breaker or boiler drain must be installed on the outlet fitting.

Buried copper tubing must be insulated in accordance with the instructions in section 4F below. 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 and butt joints with Rubatex Contact Adhesive or equal. For optimum performance, the insulated lines should be encased in a conduit to protect the material from problems associated with groundwater or frost.

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.

#### D. SYSTEM PLUMBING

The CopperHeart ICS should be plumbed with all copper and brass fittings and valves. Use of galvanized fittings is prohibited. Solar loop piping shall be a minimum 3/4" Type-M copper tubing. 3/4" Type-L continuous soft copper tubing is recommended for all attic pipe runs. No tubing connections or solder joints should be made in the attic. Use only lead free solder (Englehard Silvabrite 100 is recommended). DO NOT use CPVC, PVC or any type of plastic piping in the

solar loop. The CopperHeart can produce temperatures that will melt plastic piping.

All roof and attic piping must be installed to slope 1/4" per foot of pipe run to ensure that the pipes will drain during winter shutdown conditions. A combination vacuum breaker and air vent must be installed in a plumb and vertical orientation at the highest point in the system (Watts No. FV-4M1 or equal) to facilitate draining.

Figure 12 details the plumbing connection between the CopperHeart and the conventional electric or gas water heater. SunEarth requires a 3-way plumbing configuration that allows for 100% solar operation bypassing the water heater, solar pre-heating or 100% conventional electric resistance or gas water heating bypassing the CopperHeart. Depending upon the weather conditions all three settings may be used during any given year.

In plumbing the conventional water heater use only copper and brass fittings, nipples and unions. Galvanized fittings and di-electric unions may not be used. All connections should be hard copper. Water heater flex hose connectors use gaskets that become brittle and compressed over time and may cause leaks.

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 (figure 12, valve 7). A high quality 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 (figure 12, component 10). The specified mixing valve shall be the Heatguard model HGBASE or equal and shall have an operating range between 95°F and 140°F. Set the mixing valve to operate at 120°F.

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 expect from November through March. On sunny days system temperatures may range between 110°F to 180°F depending upon the season and hot water demand. The mixing valve described above blends the hot and cold water supplies to deliver hot water to your fixtures at a safe, controlled temperature.

SunEarth, Inc.  
 CopperHeart Model Numbers  
 CP-20, CP-30, and CP-40

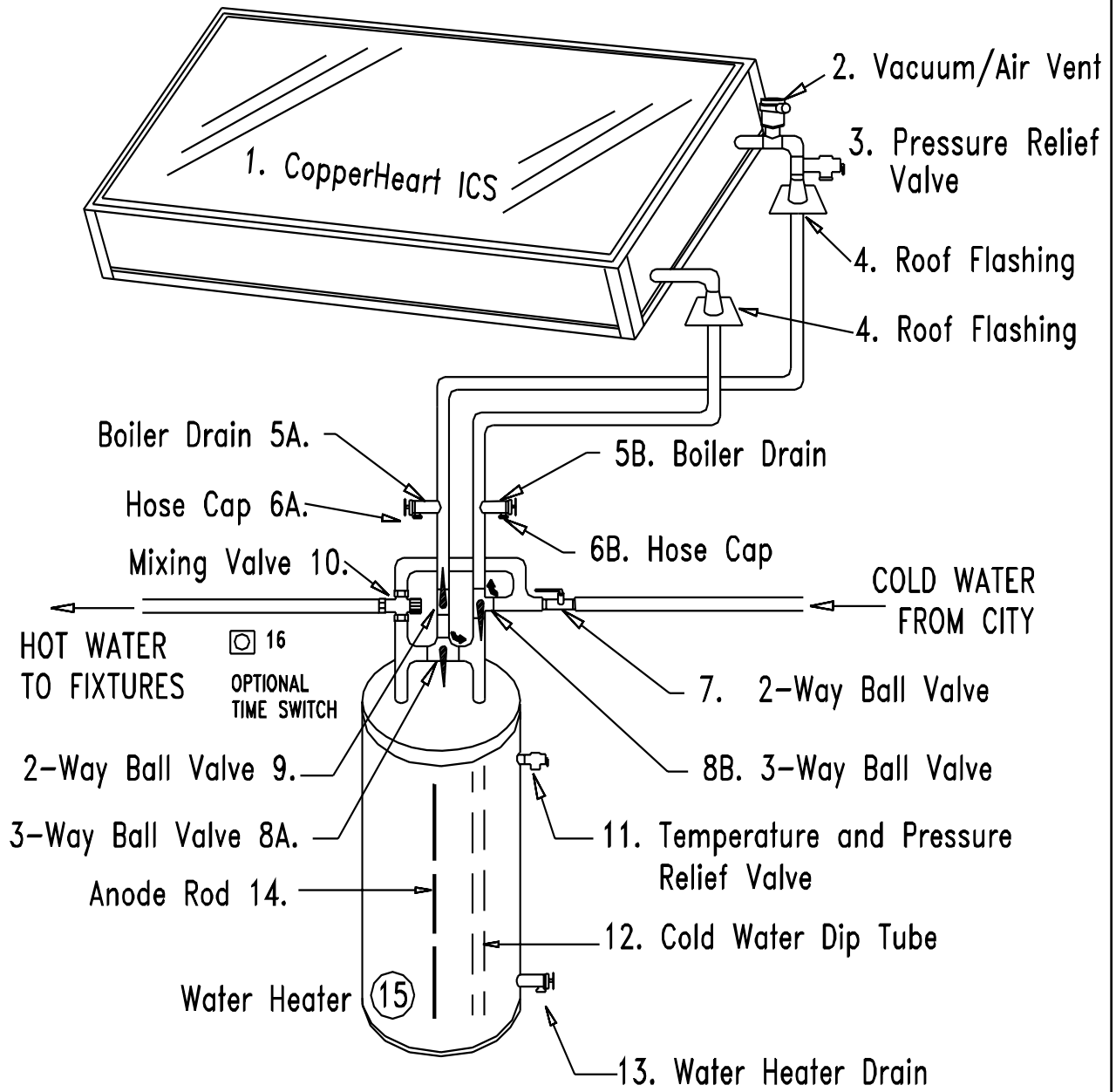


fig.12

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

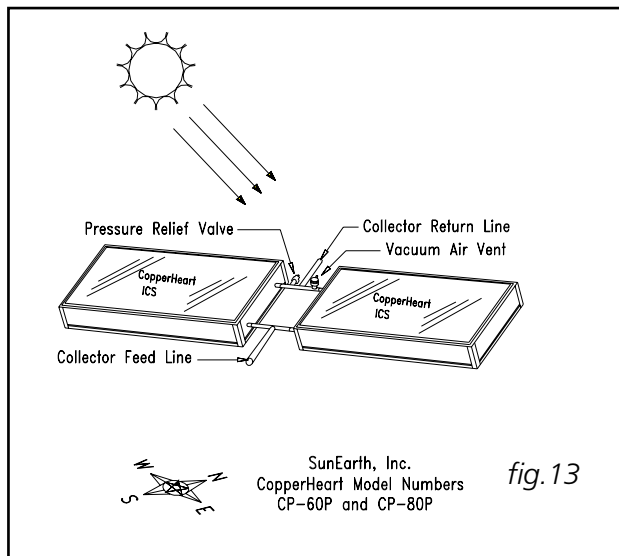
All vertical copper piping from the conventional water heater to the CopperHeart ICS unit shall be supported at each story at maximum intervals of ten feet (10'). Copper plumbers tape or tube strap is required to secure the piping. Piping insulation covering the copper tubing may not be crimped or compressed by the strapping material.

#### E. PLUMBING TWO COPPERHEARTS

When two CopperHearts are plumbed together in a single system they must be plumbed in parallel in accordance with figures 13 and 13A. In either single or double unit installations mounted on east or west facing roofs and tilted toward south, the CopperHeart inlet and outlet fittings must face toward the eave to allow for drainage. **DO NOT** plumb the unit with the CopperHeart inlet and outlet fittings facing the ridge of the roof.

#### F. INSULATION PROCEDURES

Proper insulation of the copper tubing to and from the roof prevents heat loss and provides freeze protection. The 3/4" feed and return lines must be covered with pipe insulation of a minimum 3/4" wall thickness (specified as 7/8" X 3/4" flexible elastomeric thermal insulation,

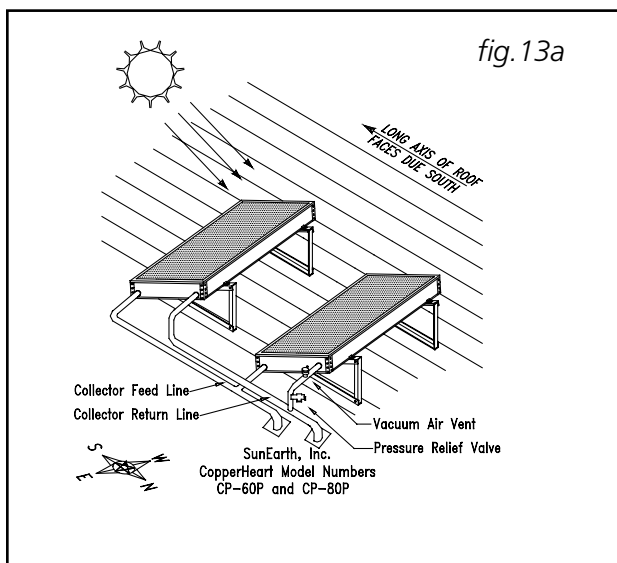


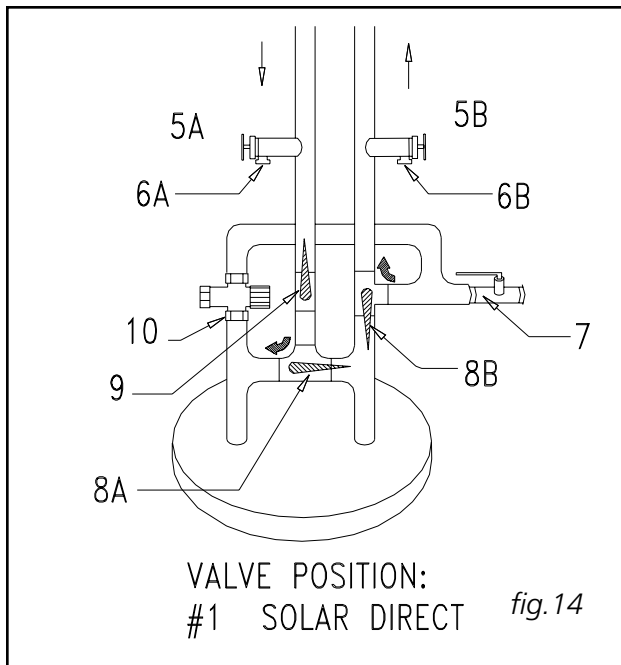
Rubatex "Insultube" or equal). A 1" wall thickness is highly recommended.

All exposed pipe insulation must be coated with two coats of an acrylic water based paint such as Rubatex Protective Coating or equal. The paint protects the insulation from UV degradation, including cracking and shrinkage, and also provides moisture vapor protection. Inspect the insulation for cracks and signs of shrinkage every three to five years. Repaint and repair as necessary.

The 3/4" cold water supply line to the conventional water heater must be insulated with a minimum 1/2" thick elastomeric thermal insulation (specified as 7/8" X 1/2" Rubatex "Insultube" or equal) to a minimum distance of five feet (5') back from the storage tank, or to the wall if closer than 5'. The overall performance of the water heating system is enhanced if the hot water supply lines to all the fixtures are well insulated. The insulation wall thickness may vary between 1/2" to 3/4" depending upon the local climate. The thicker the insulation wall the better the heat retention in the piping. If the CopperHeart is installed in new construction, all exposed hot water service piping in the home should be well insulated.

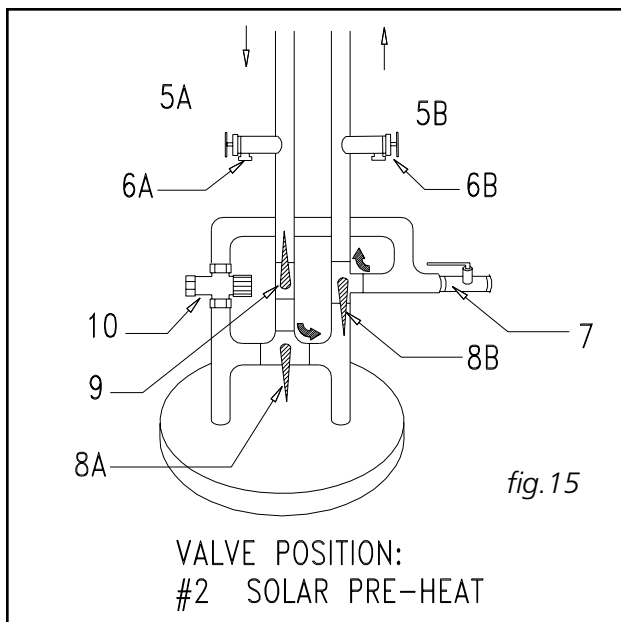
The outside and top of the conventional electric or gas heater also must be insulated with a water heater insulation jacket. The combined R-Value, or insulation value, of the water heater and insulation jacket should be no less than R-17. A foil-faced bubble-pack insulation material as manufactured by Reflectix, or equal, is recommended.





An air gap between the tank jacket and the insulation material should be created. First apply three strips of the material around the complete tank circumference near the top, middle and bottom of the heater. Then attach the insulation blanket to the strips.

Thoroughly insulate the top of the water heater. Fit the insulation snugly around the brass nipples or unions and temperature and pressure relief valve on the top of the water heater. If you have an electric water heater, cut two windows in the insulation around the access plates covering the upper and lower thermostats and heating



elements. Insulate the area over the access plates, but make sure that these areas always remain accessible for service or repair as necessary.

If the CopperHeart is installed in a new home, SunEarth specifies that the conventional water heater have a minimum insulation value of R-20. The total insulation value of the water heater and the insulation jacket shall be no less than R-25.

The conventional 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. A 2" polystyrene insulation pad such as manufactured by Frost King is recommended.

## 5) 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:

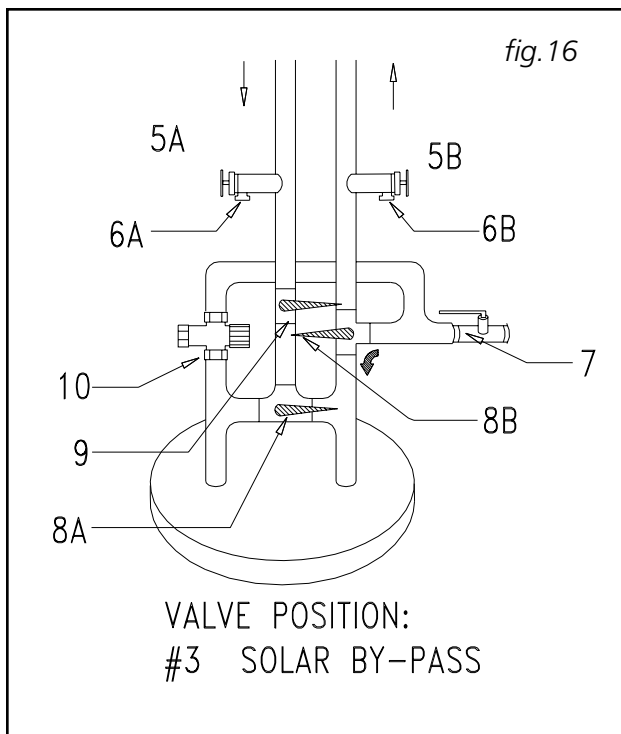
A. Fill the conventional water heater.

A.1. Set the ball valves (figure 16, valves 8A, 8B and 9) above the water heater to the solar bypass position. All three valve handles should be in the horizontal position as shown in figure 16.

A.2 Open the cold water supply ball valve (figure 16, valve 7) and fill the conventional water heater. When the heater is completely filled close the cold water supply ball valve (figure 16, valve 7). **If you have an electric water heater DO NOT turn on the electricity to the heater until the tank is completely filled.**

Make sure the tank is completely filled by opening and running a hot water fixture in the home, or by opening the pressure and temperature relief valve if located on the top of the water heater (Note: on some water heaters the temperature and pressure relief valve is located on the side of the tank near the top). It only takes 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.

A.3 The final electrical or gas connection to the conventional water heater must be made by a properly licensed contractor.



B. Fill the ICS Unit.

B.1 Remove the brass hose cap (figure 15, component 6A) from the boiler drain (figure 15, valve 5A) on the solar loop return line and attach a hose to the boiler drain. 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.

B.2 Close the 2-way ball valve (figure 15, valve 9) above the heater by turning the valve handle to the horizontal position.

B.3 Set the 3 way ball valves (figure 15, valves 8A and 8B) to the solar preheat position by turning them to the indicated vertical position.

B.4 Open the cold water supply ball valve (figure 15, valve 7).

B.5 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.

B.6 Close the boiler drain (figure 15, valve 5A) and remove the hose. Place the brass hose cap on the boiler drain (figure 15, component 6A).

B.7 Inspect the system plumbing for any leaks.

B.8 Open the ball valve on the solar loop return

line (figure 15, valve 9) by turning the valve handle to the vertical position. Valves 8A, 8B and 9 now should have each valve handle in the vertical position exactly as shown in figure 15.

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

B.9 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.

B.10 Place the valves to either **Valve Position #1** (as shown in figure 14) for 100% solar operation or **Valve Position #2** (as shown in figure 15) for solar-preheating.

**6) COLD WEATHER AND VACATION SHUT-DOWN PROCEDURES: DRAINING THE COPPERHEART**

The CopperHeart ICS and the solar loop feed and return line piping must be drained during cold weather conditions that met or exceed the CopperHeart's freeze tolerance limit. During winter vacations the CopperHeart must be drained if freezing conditions are anticipated.

Drain the unit as follows:

A. Set the ball valves above the water heater to bypass the CopperHeart ICS (figure 16).

B. Remove the protective brass hose cap (figure 16, components 6A and 6B) on the boiler drains. Attach garden hoses to both boiler drains (figure 16, valves 5A and 5B). Terminate the hoses in either a service basin or an appropriate spot outside the home.

C. Open both boiler drains and drain the unit. **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 Five (System Start-Up) above.

**NOTE TO THE CONTRACTOR:** IT IS AN SRCC CERTIFICATION REQUIREMENT THAT A CONSPICUOUSLY PLACED LABEL EXPLAINING HOW THE COPPERHEART IS PROTECTED FROM FREEZ-

ING 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.

## 7) BYPASSING THE COPPERHEART

There may be occasion during the winter when it is preferable to bypass the CopperHeart and rely exclusively on back-up utility generated power. Review figure 16 and set the ball valves to the solar bypass position. When the weather improves reset the ball valves to either the **Solar Direct** position (figure 14) or the **Solar Preheat** position (figure 15).

## 8) 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 system overheating.

## 9) ROUTINE MAINTENANCE PROCEDURES

A. Make sure that the CopperHeart glass stays clean. Hose off any caked on dirt or dust and then clean the glass with Windex or a household glass cleaner and a soft cloth.

B. Check the exterior exposed pipe insulation annually. Repaint as necessary to prevent cracking and shrinkage. Repair any exposed areas immediately.

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

D. Check the system ball valve placement at least once a year to make sure the valves are properly positioned.

E. The CopperHeart is capable of generating very high temperatures in some climates for eight to

ten months a year. If the water temperature in your back-up heater is consistently in the range of 140°- 160°F, you may want to change the magnesium anode rod in your back-up water heater every five years. This "sacrificial anode" is installed in the heater to prevent internal corrosion and premature tank failure. Internal corrosion accelerates at higher tank temperatures. By replacing the anode rod every five years the life of the back-up water heater typically can be extended.

## 10) SYSTEM COMPONENTS

When reviewing the primary components in your CopperHeart ICS System, please refer to figure 12.

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

2) Combined Vacuum Breaker and Air Vent. Allows water to drain from the CopperHeart as necessary during winter conditions or routine maintenance.

3) Pressure Relief Valve. Protects the CopperHeart from system pressure in excess of 150 PSI.

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

5A/5B) Boiler Drains. Valves used for filling and draining the CopperHeart.

6A/6B) Hose Caps. Threaded safety caps to prevent unintentional scalding.

7) 2-Way Ball Valve. This on/off ball valve is **normally open** and allows cold water from the city supply line to feed the water heater or CopperHeart.

8A/8B) 3-Way Ball Valves. These two valves allow the system to function in the solar direct, solar pre-heat or solar by-pass operational modes.

9) 2-Way Ball Valve. This valve works in conjunction with valves 8A and 8B to control the operational mode of the system.

10) Thermostatic Mixing Valve. A highly recommended optional system component. 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 212F or under pressures exceeding 150 PSI .

12) Cold Water Dip Tube. Delivers cold water from the city 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 back-up water heater.

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

15) Conventional Electric or Gas Water Heater.

### 11) ESTIMATED COMPONENT LIFE

You can expect a long life from the primary components in your CopperHeart ICS solar water heating system. The CopperHeart unit has a

design life of 25 – 30 years in most water quality areas. The conventional water heater should last between 8 – 15 years. 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 rod replacement may significantly extend the life of your conventional water heater.

### 12) SYSTEM MODEL NUMBERS

<i>Single Unit Systems</i>	<i>Double Unit Systems</i>
CP-20 – 20 Gallons	
CP-30 – 32 Gallons	CP-60P – 64 Gallons
CP-40 – 40 Gallons	CP-80P – 80 Gallons

*The suffix "G" is used to denote a supplemental gas water heater, e.g. CP-20G or CP-60PG*

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



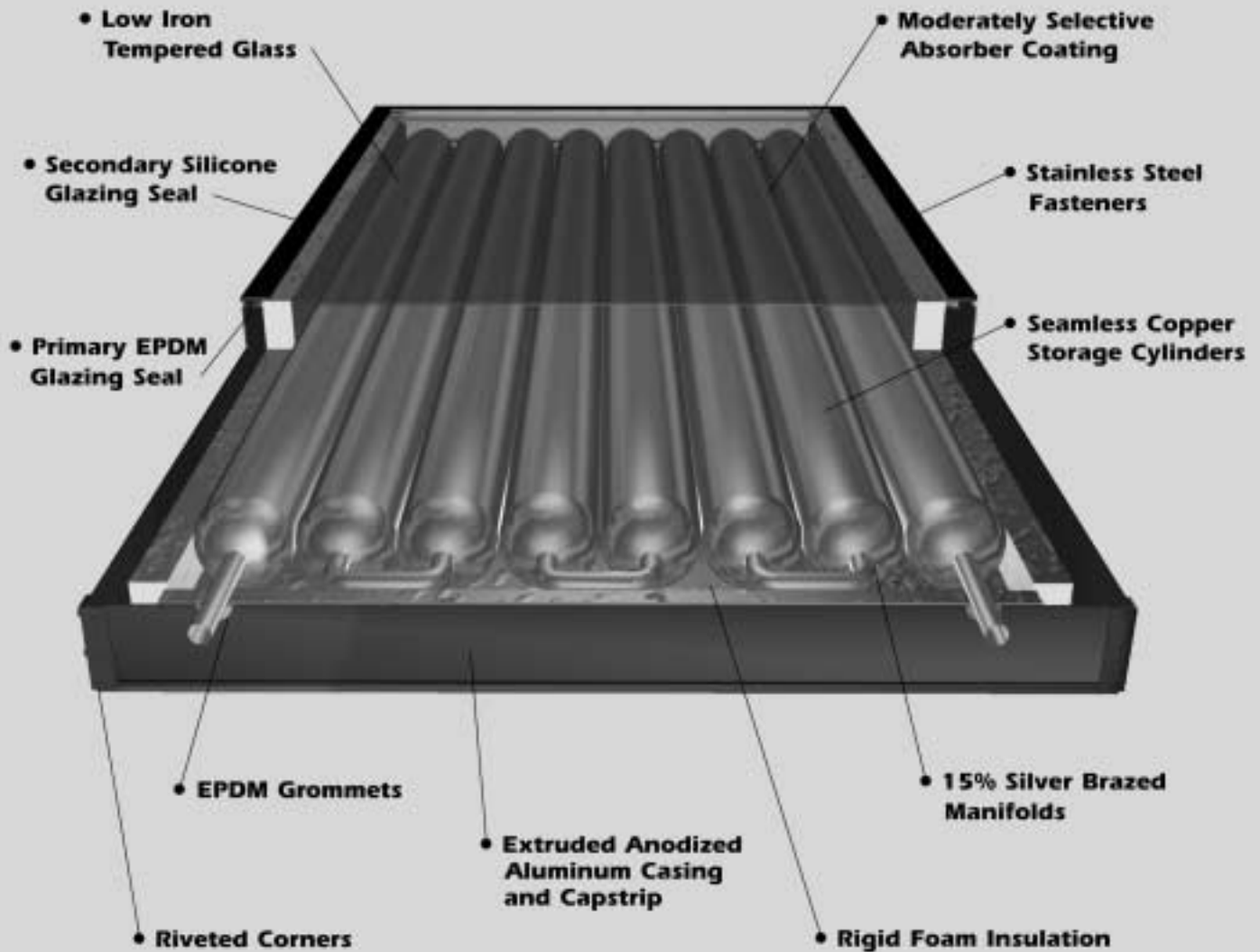
**SUNEARTH INC.**

**SUNEARTH COPPERHEART**

INTEGRAL COLLECTOR STORAGE SYSTEM  
SPECIFICATION SHEET

# **SIMPLE, DURABLE, AND RELIABLE**

## **The CopperHeart Integral Collector Storage System**



PROTECTING OUR ENVIRONMENT—SINCE 1978

### 13) COPPERHEART DIMENSIONS, WEIGHTS AND ENGINEERING 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	20	154	321	36 1/2	50 1/4	6 7/8	13.90	10.90	120	3/4	29
CP-30	32	210	477	36 1/2	78 1/4	6 7/8	21.10	17.40	120	3/4	29
CP-40	40	264	597	36 1/2	98 1/4	6 7/8	24.60	21.91	120	3/4	29

\* For systems where two individual CopperHeart ICS units are required or preferred, the model numbers are CP-40-2 (two CP-20), CP-60P (two CP-30), and CP-80P (two CP-40).

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-200 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 1/2 inches in width, and 6 7/8 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 1/8 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 painted 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 1/8" inch thickness, and have a minimum transmissivity 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 1/2 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 7/8 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 degrees 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.



**SUNEARTH INC.**  
**Quality Solar Energy Products**

**PRODUCT WARRANTY STATEMENT**

**IMPERIAL, EMPIRE, SUNWISE AND SOLARSTAR COLLECTORS  
SUNBURST ABSORBER PLATES AND COPPERHEART ICS**

**TEN YEAR WARRANTY**

Under conditions of normal use and service SunEarth Imperial, Empire, SunWise and SolarStar solar collectors, "SunBurst" absorber plates, and CopperHeart ICS units are warranted to the original or subsequent users for a period of ten (10) years from the date of sale. SunEarth's liability under this warranty 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 station, the Imperial, Empire, SunWise or SolarStar collector, "SunBurst" absorber plate, or CopperHeart ICS unit. 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 delineated in this warranty statement.

**FIELD LABOR**

Field labor to repair or replace any defective Imperial, Empire, SunWise, or SolarStar solar collector, "SunBurst" absorber plate, or CopperHeart ICS unit is reimbursable up to \$100 in year one, \$75 in years two through five, and \$50 in years six through ten.

**FREIGHT AND SHIPPING EXPENSES**

During the first year of warranty coverage SunEarth will pay the shipping costs for the new or repaired Imperial, Empire, SunWise or SolarStar solar collector, "SunBurst" absorber plate, or CopperHeart ICS between SunEarth and the nearest local distributor, dealer, or authorized service center. After the first year freight and packing costs are the responsibility of the owner and are not covered under this warranty.

**THIS WARRANTY WILL NOT APPLY**

This warranty does not apply to conditions resulting from a failed component or part that is not part of the Imperial, Empire, SunWise or SolarStar solar collector, "SunBurst" absorber plate, or CopperHeart ICS unit; to freeze damage; to conditions resulting from misuse, abuse, neglect, accident, or alteration; to minor discoloration of the collector framewall or absorber plate over time; to glass breakage; 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; to propylene glycol pH levels above 10 or below 8; to periods of stagnation

in excess of 90 days; to excessive pressure; to erosion corrosion of the copper tubing resulting from excessive flow rates; to improper plumbing configurations that do not conform to SunEarth's manifolding requirements; to clouding or similar occurrence resulting from the normal intrusion of moisture into the box; to conditions resulting from floods, earthquakes, winds, fire, lightning, or circumstances beyond SunEarth's control; to installation methods that do not conform to relevant national, state or local codes and ordinances, good industry practices or applicable SunEarth manuals, diagrams, technical bulletins or written installation instructions; and to applications other than medium temperature (110 - 160F) domestic water heating. If the Imperial, Empire, SunWise or SolarStar solar collectors, "SunBurst" absorber plate or CopperHeart ICS are purchased outside the continental United States certain conditions of this warranty may not apply. Please contact your local SunEarth distributor.

#### HOW TO MAKE A CLAIM

To obtain service under this warranty, the defective product must be returned to the distributor or dealer of SunEarth products nearest you, an authorized SunEarth service center, or SunEarth directly. Each claim must be accompanied by documentation indicating the homeowner's name, address, phone number, date of installation, date of failure, reason for failure, product model and serial numbers, and the installation contractor's name and phone number. If you have questions regarding this warranty contact your installation contractor or SunEarth at 909-605-5610.

#### LIMITED WARRANTY

EXCEPT AS EXPRESSLY PROVIDED HEREIN, THE IMPERIAL, EMPIRE, SUNWISE OR SOLARSTAR COLLECTOR, "SUNBURST" ABSORBER PLATE, OR COPPERHEART ICS UNIT IS 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. THIS WARRANTY GIVES YOU SPECIFIC LEGAL RIGHTS, AND YOU MAY ALSO HAVE OTHER RIGHTS WHICH VARY FROM STATE TO STATE.

#### LIMITATIONS OF REMEDIES

IN NO EVENT WILL SUNEARTH BE LIABLE TO YOU FOR ANY DAMAGES, INCLUDING ANY LOST PROFITS, LOST SAVINGS OR OTHER INCIDENTAL OR CONSEQUENTIAL DAMAGES, ARISING OUT OF THE USE OR INABILITY TO USE THE IMPERIAL, EMPIRE, SUNWISE OR SOLARSTAR COLLECTOR, "SUNBURST" ABSORBER PLATE, OR COPPERHEART ICS, OR FOR ANY CLAIM BY ANY OTHER 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

THE WARRANTY CONTAINED HEREIN CONSTITUTES THE ENTIRE, COMPLETE, FINAL AND EXCLUSIVE AGREEMENT, AND SUPERSEDES ANY PROPOSAL OR AGREEMENT ORAL OR WRITTEN, AND ANY OTHER COMMUNICATIONS, BETWEEN SUNEARTH AND THE BUYER WITH RESPECT TO THE SUBJECT MATTER HEREOF.



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