



SuperStor Solar Supplement

Installation

Start-Up

Maintenance

Parts

Warranty

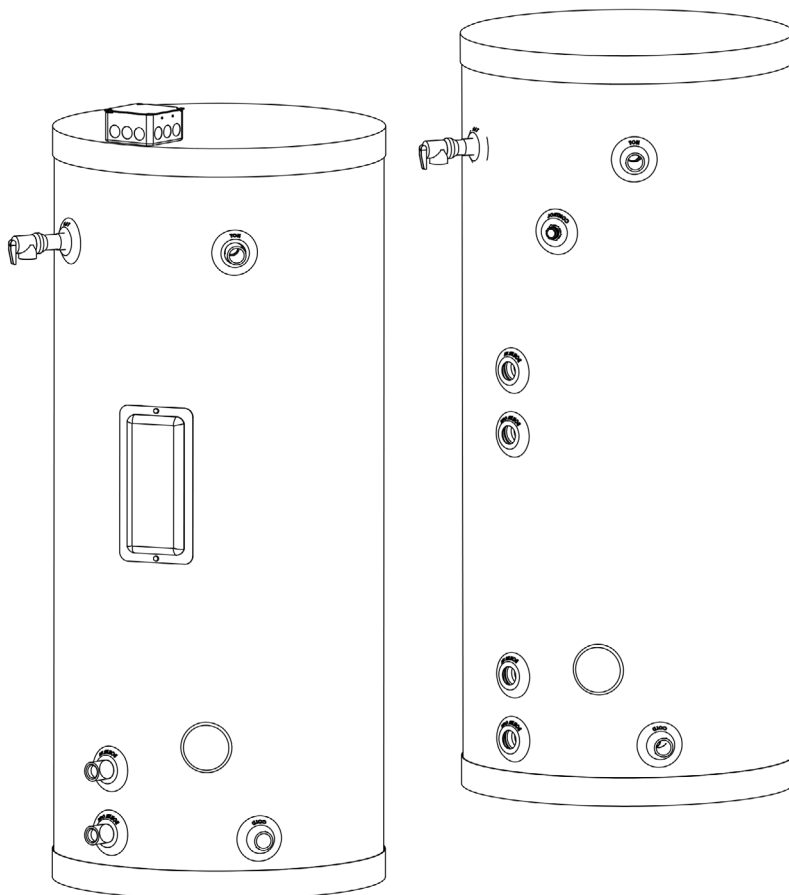
*For Residential and
Commercial Use*

SB Series and SE Series Models*

*SB Denotes Back-Up Heat Exchanger

SE Denotes Back-Up Electric Element

A Suffix of "DW" Denotes Double Walled Heat
Exchanger Models



The solar energy system described in 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.

WARNING

This manual must only be used by a qualified installer / service technician. Read all instructions in this manual before installing. Perform steps in the given order. Failure to do so could result in substantial property damage, severe personal injury, or death.

NOTICE

HTP reserves the right to make product changes or updates without notice and will not be held liable for typographical errors in literature.

The surfaces of these products contacted by potable (consumable) water contain less than 0.25% lead by weight as required by the Safe Drinking Water Act, Section 1417.

NOTE TO CONSUMER: PLEASE KEEP ALL INSTRUCTIONS FOR FUTURE REFERENCE.

SPECIAL ATTENTION BOXES

The following defined terms are used throughout this manual to bring attention to the presence of hazards of various risk levels or to important product information.

DANGER

DANGER indicates an imminently hazardous situation which, if not avoided, will result in serious personal injury or death.

WARNING

WARNING indicates a potentially hazardous situation which, if not avoided, could result in personal injury or death.

CAUTION

CAUTION indicates a potentially hazardous situation which, if not avoided, may result in moderate or minor personal injury.

CAUTION

CAUTION used without the safety alert symbol indicates a potentially hazardous situation which, if not avoided, may result in property damage.

NOTICE

NOTICE is used to address practices not related to personal injury.

Foreword

This manual is intended to be used in conjunction with other literature provided with the Solar Water Heater. This includes all related control information. It is important that this manual, all other documents included with this system, and additional publications, such as *Solar Water Heating System Design and Installation Guidelines, SRCC OG-300*, be reviewed in their entirety before beginning any work.

"The solar energy system described in 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."

The design of this solar system is approved by the Solar Rating and Certification Corporation (SRCC). Any deviation from the approved specified SRCC components may affect your ability to certify this system.

Installation should be made in accordance with the regulations of the Authority Having Jurisdiction, local code authorities, and utility companies which pertain to this type of water heating equipment.

Authority Having Jurisdiction (AHJ) – The Authority Having Jurisdiction may be a federal, state, local government, or individual such as a fire chief, fire marshal, chief of a fire prevention bureau, labor department or health department, building official or electrical inspector, or others having statutory authority. In some circumstances, the property owner of his/her agent assumes the role, and at government installations, the commanding officer or departmental official may be the AHJ.

NOTE: HTP, Inc. reserves the right to modify product technical specifications and components without prior notice.

For Your Records

Write the Product Model and Serial Numbers:

Model # _____

Serial # _____

**These numbers are listed on the product ratings label.
Keep this manual and information for future reference.**

For the Installer

WARNING

For your safety, please read through this manual carefully before installation to minimize the risk of fire, property damage, personal injury, or death. Ensure the solar hot water system is properly installed in accordance with this manual before use.

INSTALLATION OR SERVICE OF THIS SOLAR SYSTEM IS REQUIRED TO BE PERFORMED BY LICENSED PROFESSIONALS WHERE SOLAR, PLUMBING, AND ELECTRICAL WORK IS REQUIRED.

The installer should be guided by the instructions furnished with the tank, as well as local codes and utility company requirements. Preference should be given to codes and requirements where they differ from the furnished instructions. Always use the latest edition of codes.

Additional publications which should guide the installer include:

Local, state, provincial, and national codes, laws, regulations, and ordinances.

Solar Water Heating System Design and Installation Guidelines, SRCC OG-300, available from Solar Rating & Certification Corporation, 400 High Point Drive, Suite 400, Cocoa, FL 32926-6630, www.solar-rating.org.

The latest version of the *National Electrical Code, NFPA No. 70*.

In Canada refer to *Canadian Electrical Code C 22.1*, from Canadian Standards Association, 5060 Spectrum Way, Suite 100, Mississauga, Ontario, Canada L4W 5N6.

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- Valves between your backup water system and the solar system
- NOTE:** Failure to follow the procedures and instructions in this manual WILL VOID the warranty.

Part 1 - General Safety Information

WARNING

Installer - Read all instructions in this manual before installing. Perform steps in the given order.

User - This manual is for use only by a qualified heating installer / service technician. Have this solar water heating system serviced / inspected annually by a qualified service technician.

Failure to adhere to these guidelines can result in substantial property damage, severe personal injury, or death.

NOTE: Obey all local codes. Obtain all applicable permits before installing the solar system.

NOTE: Install all solar system components and piping in such a manner that does not reduce the performance of any fire rated assembly.

DO NOT USE THIS WATER HEATER IF ANY PART HAS BEEN SUBMERGED IN WATER. Immediately call a qualified service technician. The water heater **MUST BE** replaced if it has been submerged. Attempting to operate a water heater that has been submerged could create numerous harmful conditions, such as a potential gas leakage causing a fire and/or explosion, or the release of mold, bacteria, or other harmful particulates into the air. Operating a previously submerged water heater could result in property damage, severe personal injury, or death.

NOTE: Water heater damage due to flood or submersion is considered an Act of God, and IS NOT covered under product warranty.

NOTE: If the solar water heating system is exposed to the following, do not operate. Immediately call a qualified service technician.

1. Fire
2. Damage
3. Submersion in Water

Failure to adhere to these guidelines can result in substantial property damage, severe personal injury, or death.

Only use this solar hot water system as intended and described in this installation manual. Any use other than described will void warranty and may lead to fire, property damage, personal injury, or death.

CAUTION

High heat sources (sources generating heat 100°F / 37°C or greater, such as stove pipes, space heaters, etc.) may damage plastic components of the water heater as well as plastic vent pipe materials. Such damages ARE NOT covered by warranty. It is recommended to keep a minimum clearance of 8" from high heat sources. Observe heat source manufacturer instructions, as well as local, state, provincial, and national codes, laws, regulations and ordinances when installing this water heater and related components near high heat sources.

Improper installation or use may result in property damage. Such damages ARE NOT covered by warranty.

NOTICE

UNCRATING THE WATER HEATER - Any claims for damage or shortage in shipment must be filed immediately against the transportation company by the consignee.

Introduction

Your water heater has an internal heat exchanger for use with solar collectors. When there is not sufficient solar energy, the water heater utilizes a backup system to provide hot water. In SB Series models, an extra heat exchanger is provided to connect to a boiler. In SE Series models, the water heater has an electric heating element. (Refer to Applications in this manual for piping examples of both models.)

Your solar system uses a circulation pump to circulate heat transfer fluid (HTF) throughout a closed loop system. Closed loop propylene glycol systems provide additional freeze protection for the solar components.

This manual intends to familiarize you with the proper installation and maintenance of your solar water heating system. This system must be installed by a licensed solar or plumbing contractor in accordance with SRCC Standard OG-300 and all applicable national, state, and local codes.

NOTE: Solar system performance and efficiency varies with factors such as: household hot water load, ambient air temperature, collector/roof pitch, collector orientation, and seasonal intensity.

Job site conditions will require your installation contractor to supply some or all of the following:

- Plumbing connections
- Piping and insulation

ALL PIPING AND PLUMBING CONNECTIONS SHOULD BE MADE WITH COPPER PIPE ONLY. No less than 3/4" I.D. copper tube of the type meeting local codes must be used for piping. Pipe runs must be solidly attached with proper clamping methods. Soldered connections should be secured with 95/5 lead-free solder. Use only pipe rated for 250°F minimum on both the collector return and supply piping.

A. When Servicing the Solar Water Heating System

To avoid electric shock, disconnect electrical supply before performing maintenance.

To avoid severe burns, allow solar collector and associated equipment to cool before servicing.

B. Local Installation Regulations

Installation of this solar water heating system may be governed by individual local rules and regulations for this type of system, which must be observed. Always use the latest edition of codes. The installation, adjustment, service, and maintenance of the solar water heater must be done by a licensed professional who is qualified and experienced in the installation, service, and maintenance of solar hot water systems.

C. Chemical Vapor Corrosion

Products to Avoid	Areas Likely to Have Contaminants
Spray cans containing fluorocarbons	Dry cleaning / laundry areas and establishments
Permanent wave solutions	Swimming pools
Chlorinated waxes / cleaners	Metal fabrication plants
Chlorine-based swimming pool chemicals	Beauty shops
Calcium chloride used for thawing	Refrigeration repair shops
Sodium chloride used for water softening	Photo processing plants
Refrigerant leaks	Auto body shops
Paint or varnish removers	Plastic manufacturing plants
Hydrochloric or Muriatic acid	Furniture refinishing areas and establishments
Cements and glues	New building construction
Antistatic fabric softeners used in clothes dryers	Remodeling areas
Chlorine-type bleaches, laundry detergents, and cleaning solvents	Garages and workshops
Adhesives used to fasten building products	

Table 1 - Products and Areas Likely to Have Contaminants

NOTE: DAMAGE TO THE WATER HEATER, COLLECTOR, OR RELATED COMPONENTS CAUSED BY EXPOSURE TO CORROSIVE VAPORS IS NOT COVERED BY WARRANTY. (Refer to the limited warranty for complete terms and conditions.)

D. Insulation Blankets

For installation of insulation blankets, refer to *Solar Water Heating System Design and Installation Guidelines, SRCC OG-300*.

E. Water Temperature Adjustment

An ASSE 1017 rated mixing valve to avoid severe burns or death from scalding temperatures IS REQUIRED PER SRCC OG-300.

Approximate Time / Temperature Relationships in Scalds

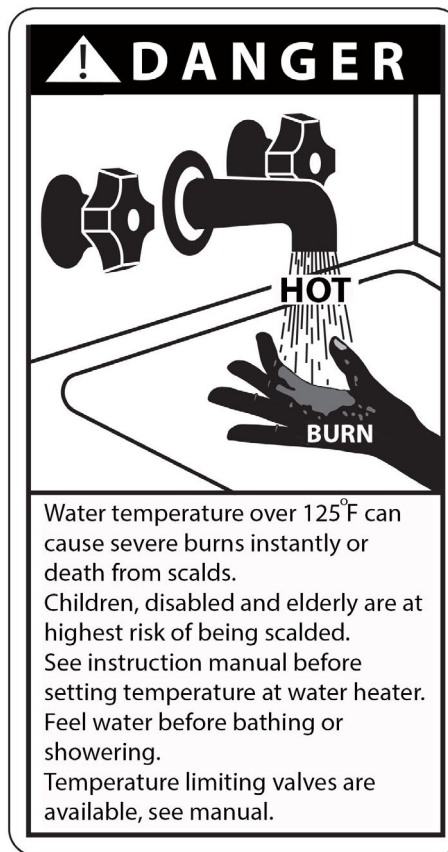
120°F	More than 5 minutes
125°F	1 1/2 to 2 minutes
130°F	About 30 seconds
135°F	About 10 seconds
140°F	Less than 5 seconds
145°F	Less than 3 seconds
150°F	About 1 1/2 seconds
155°F	About 1 second

Table 2 - Approximate Time / Temperature Relationships in Scalds

WARNING

Households with small children, disabled, or elderly persons may require a 120°F or lower temperature setting to prevent severe personal injury or death due to scalding.

In addition, to prevent scalding, the high temperature of the potable water must be limited using an ASSE 1016 tempering valve. This valve is usually located between the hot water storage tank and faucets in bathrooms, kitchens, etc. Tempering valves are mandatory under most codes and usually set to a maximum of 120°F. Tempering valves must be rated for high-temperature solar use.



F. Freeze Protection

NOTE: Consider piping and installation when determining water heater location. Place the water heater in a location not prone to freezing.

CAUTION

Failure of the water heater, solar system, or components due to freeze related damage IS NOT covered by product warranty.

In order to meet health and safety regulations, solar system antifreeze fluid should be food grade polypropylene glycol, FDA rated as “generally recognized as safe” (GRAS). The recommended glycol is DOWFROST or equivalent. Using proper concentrations of glycol, solar systems can be operated at ambient temperatures as low as -60°F. Freeze tolerance limits are based upon an assumed set of environmental conditions. Refer to the specification sheet included with the glycol for recommended concentrations. A glycol / potable water mix must not exceed 50%, unless the manufacture specifies that a different ratio is recommended for use with solar water heaters. Glycol may need to be changed periodically (every 3-5 years) to prevent it from becoming acidic; please refer to the guidelines provided by the glycol manufacturer regarding replacement.

NOTE: The use of glycol not recognized as GRAS is allowed in double wall heat exchanger models ONLY.

Part 2 - Important Information

A. Scope of this Manual

This manual pertains only to the installation and operation of the solar water heater. Details for the installation, operation, and maintenance of the complete solar water heating system, including, but not limited to: the solar collector(s), boiler, pump, system controller, valves, and other plumbing components, should be provided separately by their respective manufacturers.

NOTE: This manual is primarily a reference document for authorized installation individuals, as the solar water heater is not permitted to be installed by non-authorized persons.

B. Local Standards and Authorized Persons

Installation must be completed in accordance with local standards and regulations.

Installation must also be completed by a qualified tradesperson who holds relevant industry licenses or certificates. The term “authorized person(s)” used throughout this document refers to a suitably qualified professional. Unless otherwise specified, no part of the solar water heater may be inspected, repaired, or maintained by anybody other than an authorized person.

C. Terminology

Solar terminology differs from region to region. To avoid confusion, please note the following:

Supply – The plumbing line running from the outlet of the collector to the tank (or heat exchanger).

Return – The plumbing line running from the tank (or heat exchanger) to the inlet of the collector. This line incorporates the circulation pump.

D. System Design

Closed Loop Systems

A closed loop system uses non-potable heat transfer fluid (HTF) and must be pressurized to less than 72.5 psi. Closed loop systems require an expansion tank to accommodate HTF expansion. The system should be designed to minimize stagnation after tank temperature has been met; extensive stagnation may increase pH levels and glycol deterioration.

The expansion tank and plumbing must be properly sized so that the safety pressure relief valve will not activate except in the event of component failure or extreme conditions. The pressure release must be set at no more than 90 psi. (There may be exceptions in engineered designs for tall buildings.)

E. Fluid Quality

Water quality is very important. Water in direct flow through the solar collectors must first meet potable water requirements; any fluid

circulated through the collectors should be non-corrosive to copper. In addition, water quality must meet the following requirements.

Total Dissolved Solids	< 500 ppm
Total Hardness	< 7 grains
Chloride	< 100 ppm
pH Levels	6.5 - 8.5

Table 3 - Water Quality Requirements

In order to meet health and safety regulations, glycol used should be food grade propylene glycol, FDA rated as “generally recognized as safe” (GRAS). If using a glycol / potable water mix, the water must meet the above requirements. The glycol content of the liquid must not exceed 50%, unless the manufacturer specifies that a different ratio is recommended for use with solar water heaters. Glycol should be checked periodically to prevent it from becoming acidic. Please refer to guidelines provided by the glycol manufacturer regarding glycol maintenance.

NOTE: Glycol not recognized as GRAS may only be used in solar water heaters with double wall heat exchangers.

F. Corrosion

Both copper and stainless steel are susceptible to corrosion when, amongst other factors, high concentrations of chlorides are present.

NOTE: Leakage of the solar water heater due to corrosion caused by improper water quality IS NOT covered by product warranty.

G. Freeze Protection

Freeze protection must be implemented in any regions that may experience freezing conditions at any time throughout the year.

“Freeze tolerance limits are based upon an assumed set of environmental conditions. Extended periods of cold weather, including ambient air temperatures below the specified limit, may cause freezing in exposed parts of the system. It is the owner’s responsibility to keep the system’s freeze protection levels maintained in accordance with the supplier’s instructions if the air temperature is expected to approach the specified freeze tolerance limit.”

Closed loop systems: In areas with temperatures not falling below 23°F, a differential solar controller with freeze protection may be used (e.g. requiring pump to circulate if the manifold temperature approaches freezing).

Closed loop systems: In areas with temperatures falling below 23°F, a propylene glycol / potable water mix should be used to provide freeze protection. Please refer to glycol manufacturer’s specifications about the temperature ranges the liquid can withstand. Only food grade propylene glycol, FDA rated as GRAS, should be used. The use of glycol not recognized as GRAS is allowed in double wall heat exchanger models ONLY.

NOTE: HTP DOES NOT WARRANT THE SOLAR WATER HEATER AGAINST FREEZE-RELATED DAMAGE.

Part 3 - General Solar Information

A. System Description

By using the sun’s energy to heat water, solar hot water heating systems help reduce the nation’s dependence on polluting fossil fuels. This reliable, efficient solar water heater meets the certification requirements of SRCC OG-300.

Basic components of the solar water heating system include: the solar collector(s), a solar water heater, a circulator pump, a differential solar control, and an expansion tank. The types of solar systems in which the solar water heater can be installed include:

Pressurized Closed Loop Systems – These systems use a glycol / potable water mix as HTF, which protects the system from freezing. These systems operate at high pressures.

In systems using a glycol / potable water mix, freeze protection fluid must be nontoxic propylene glycol, FDA rated as GRAS. To protect the heat exchanger and other system components, regular scheduled maintenance must be established to monitor and maintain proper HTF pH levels.

CAUTION

Do not introduce HTF into any fittings on the heater except those clearly marked for that purpose.

The system components should carry temperature and pressure ratings equivalent to the design of the solar collector. To ensure system is appropriate for the installation climate, the solar collector ratings should be verified against the collector manufacturer specifications. Collector and storage tank temperatures can be read from the system controllers. Typical tank operating temperatures range from 40-80°F on the cold supply line to the 175°F tank high limit. The collector temperature sensor should be 5-20°F higher than the tank sensor during normal charging operation. During idle period, when there is no sun, the collector sensor will read the ambient temperature; in full sun, the sensor will read as high as 250°F. Temperatures vary depending on installation climate.

Using proper concentrations of glycol, solar systems can be operated at ambient temperatures as low as -60°F. Freeze tolerance limits are based upon an assumed set of environmental conditions. Refer to the manufacturer's specification sheet for recommended concentrations.

Depending on the controller model, the differential controller uses 10k ohm thermistors or 1k ohm RTDs to monitor the temperature difference between the collector and the solar water heater. The controller turns on when the collector is 12-20°F above tank temperature and turns off when the differential drops to 4°F.

B. System Design

System design should be completed prior to installation. Solar collectors need to be installed correctly to ensure high efficiency and, most importantly, safe and reliable operation. Please seek professional advice for the design and installation of your solar heating system.

NOTE: Only authorized licensed contractors are permitted to install the solar collector.

C. Solar Collector Installation

NOTE: These solar collector instructions are general in nature. Reference the solar collector manufacturer's instructions for more specific and detailed installation information.

The solar collector installation contractor shall obtain all required permits and approvals when installing the solar system. The installation shall conform to all federal, state and local regulations governing solar water heating system installations. The contractor shall adhere to sound building safety and trade practices. Special consideration must be given to building code requirements for the penetration of structural members and fire rated assemblies.

WARNING

All persons working on roofs should have completed a fall safety course and must be properly outfitted with appropriate safety equipment. Failure to follow this information could result in property damage, severe personal injury, or death.

Before installation, the contractor shall inspect the condition of the roof and notify the homeowner of any existing roof damage or necessary repairs. The most important structural consideration is to securely anchor the solar collector and solar strut mounting hardware to the structural members of the roof with stainless steel hanger or lag bolts. Consult with the collector manufacturer installation manual for proper guidelines in your application.

WARNING

Solar collectors should be covered at all times until installation is complete. Failure to follow this information could result in severe personal injury or death.

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. The recommended elastomer for sealing roof penetrations is Tremco "POLYroof".

D. Collector Angle, Plane, and Direction

1. Collector Direction

The collector should face the equator. In the northern hemisphere, this is due south, and in the southern hemisphere, due north. Facing the collector in the correct direction and angle is important to ensure optimal heat output. A deviation of up to 15° from due south is acceptable, and will have minimal effect on heat output.

2. Collector Angle (Tilt)

It is common for collectors to be installed at an angle that corresponds to the installation latitude. While adhering to this guideline, an angle of latitude +/- 10° is acceptable, and will not greatly reduce solar output. The solar collector should be installed at an angle between 20 – 80° to ensure optimal operation.

For year-round domestic hot water, the collector should be tilted to an angle of equal to the latitude of the installation site. Add 15° to the latitude to optimize for winter performance (space heating). Subtract 15° from the latitude to optimize for summer performance (indirect pool heating).

Given the formula above, a solar collector installed at 30°N latitude should face due south at an angle of 45° for wintertime advantage, and 15° for summertime heating.

Preventing Overheating

To reduce summer heat output, angle the collector for optimal winter absorption. This is achieved by installing the collector at an angle of around 15° above the latitude angle (e.g. 45° at 30°N latitude). This angle corresponds closely to the angle of the sun in the sky during the winter months, thus maximizing winter output. Conversely, during the summer when the sun is high in the sky, the relative collector surface area exposed to sunlight is reduced, cutting overall heat production considerably (by about 15%). This option is ideal for installations where solar thermal is being used for space heating.

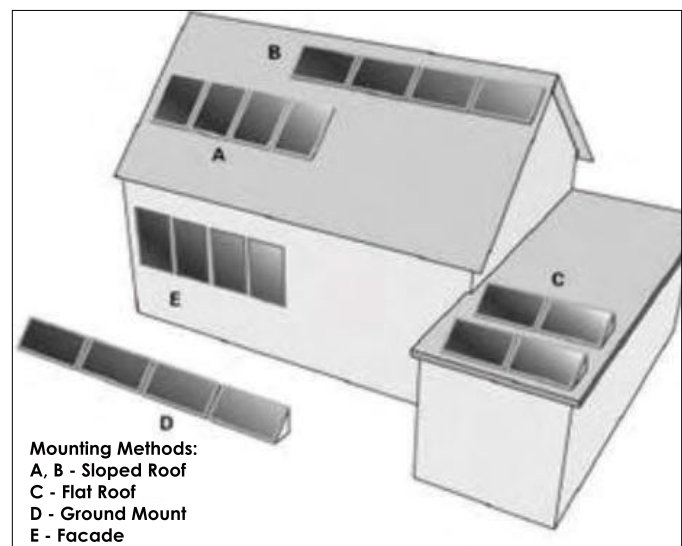


Figure 1 - Suggested Solar Collector Mounting Designs

3. Collector Plane (Horizontal or Vertical)

The collector could be installed vertically, but may be installed at an angle, such as sideways on a pitched roof. It is not recommended to install a drain back system in the horizontal or landscape style. In vertical installations, collectors may be installed level, or with 1/4" pitch towards the supply port to facilitate the drain back process.

E. Collector Piping

CAUTION

Never use dielectric unions or galvanized steel fittings in the collector loop. Doing so will lead to corrosion, property damage, and possible early water heater failure. Such damage IS NOT covered by warranty. Use only copper and brass fittings.

Collector piping requires the use of copper and brass fittings in the collector loop. To avoid leaks and fluid loss, copper and brass ground joint unions should be used to join the collectors. Use only lead-free solder. Engelhard Silvacore 100 or equivalent is the required soldering material. Use of 50/50 lead solder is expressly prohibited. Use of galvanized steel, CPVC, PVC or any other nonrated plastic pipe is prohibited.

Penetrations through walls or other surfaces shall not allow intrusion by insects and/or other vermin. Ensure that all structural penetrations are properly sealed with an elastomer, such as Tremco "POLYroof".

Piping in new solar installations may have dirt, grease, solder flux, or other impurities that will affect the quality of HTF over time. Thorough cleaning is required before charging new solar installations with glycol.

Ensure that there are no dips or low points in solar piping that could trap fluid and possibly rupture in freezing conditions. Copper plumbers tape or tube strap is the required strapping material. The pipe insulation may not be compressed or crimped by the strapping material.

The installation of all piping may not reduce the performance or rating of structural members or fire rated assemblies and must adhere to all applicable local codes and ordinances.

F. Collector Loop Pipe Insulation

The collector loop supply and return lines must be well insulated with high quality, flexible, closed cell insulation to minimize heat loss. Wall thickness of pipe insulation should not be less than 3/4". 1" wall thickness is required in all areas prone to annual hard freeze conditions. When it comes to pipe insulation the rule is simple: thicker is better. The specified insulation material is HT/Armaflex or equivalent.

Whenever possible, slide the insulation material over the pipe without cutting or taping. All butt joints must be sealed with contact adhesive. HT/Armaflex should be sealed with Armaflex HT 625 adhesive. Use of rigid polyethylene pipe insulation is prohibited. Temperatures generated by your collector in the summer months or under stagnation conditions can melt this type of material.

Any above ground exterior pipe insulation is subject to UV degradation and must be wrapped with PVC pipe wrap or painted with two coats of high quality water-based acrylic resin coating as supplied by the insulation manufacturer. Foil tape should not be used as it will fail. The required coating material is Armaflex WB Finish or equivalent. Prior to applying finish, wipe insulation clean with denatured alcohol. Paint insulation with two coats of finish. Do not tint the finish.

G. Collector Sensor Placement

The collector sensor must be located on the hot water return line as close to the collector as possible. Some collectors have insertion wells to measure temperatures more accurately at the manifold.

Sensors are typically accurate to +/- 1/2 °F if properly installed and

weatherized. To maximize sensor accuracy, attach the flanged portion of the sensor to the collector header pipe with a stainless steel hose clamp. Wire nuts used to connect the sensor and low voltage wiring shall be all plastic, sealed with silicone and thoroughly wrapped in electrician's tape.

The low voltage wiring used to connect the sensors to the controller should be a minimum 18 AWG. The wiring should be bare or tinned copper, two conductor, PVC insulated, with a PVC UV rated gray jacket suitable for exterior use. Use Eastman Wire & Cable no. 5704, Beldon Wire and Cable no. 8461 or equivalent.

The sensor must be placed on the solar collector hot out line as close to the collector header as possible, or inserted into a sensor well near the hot out line. Place the sensor wire over the rubber pipe insulation, under the insulation tape or PVC pipe wrap. Thoroughly wrap and weatherize the insulation with electrician's tape or insulation tape as provided by the manufacturer.

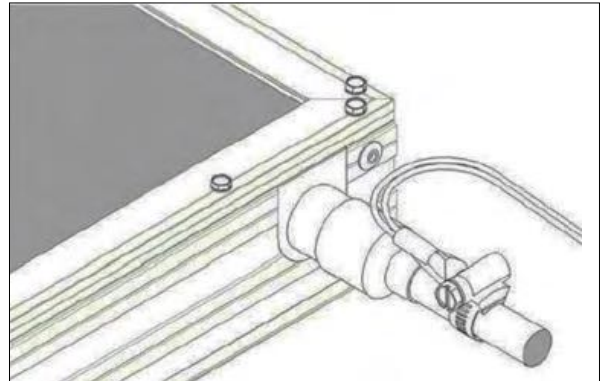


Figure 2 - Sensor Cable Detail

H. Avoid Shade

Collectors should be located so that shading does not occur between 9 AM and 3 PM local time. Partial shading due to small objects such as antennas and flues is not of great concern.

I. Location

To avoid long pipe runs, the collector should be positioned as close as possible to the storage tank. Storage tank location should therefore be considered part of the location requirements of the solar collector. The storage tank should be located as close as possible to the most frequent draw off points in the building.

J. Lightning Protection

To avoid lightning related damage or electrical safety issues, it is advisable to earth/ground the frame and copper circulation loop of the collector.

K. Galvanic Reaction

WARNING

Zinc galvanized components should NOT be installed in direct contact with stainless steel or aluminum, as galvanic reaction between metals can cause premature oxidation of the zinc coating, as well as the steel and aluminum underneath. This reaction could lead to structural failure, property damage, severe personal injury, or death.

Avoid using galvanized steel bolts. Use stainless steel components instead. If galvanized components ARE used, avoid direct contact between two metals by using rubber/plastic separators.

If roof surface is galvanized steel, refer to manufacturer's corrugated roof installation guidelines.

L. Wind Stress

When installing the solar collector(s), please consider the issue of wind resistance and the resultant stress on attachment points. Adhere to relevant building codes/regulations regarding installation of such

objects.

It is the responsibility of the installation contractor to ensure that the frame mounting is of suitable strength. Where applicable, inspection by building department officer or equivalent should be completed to ensure the installation is in accordance with relevant regulations.

M. Snow Load

In areas prone to heavy snowfall, the solar collector(s) should ideally be installed at an angle of 50° or greater to help promote snow sliding off the collectors. In addition, it is advisable to raise the lower collector frame off the roof surface 6 – 8 inches or higher. Doing this places the collector above moderate snowfall accumulation and allows drifting snow to more easily slide out from under the collector, which helps ensure that snow does not cover the collector array.

Please refer to local regulations regarding snow loading precautions.

N. Hail Resistance

Solar collectors are surprisingly strong and able to handle significant impact stresses once installed. Testing and impact stress modeling proves that when installed at an angle of 40° or greater, collectors are able to withstand impact from hail larger than 1" in diameter. The ability of collectors to withstand hail impact is greatly influenced by the angle of impact, so installing the collectors at low angles does reduce their impact resistance.

O. Storage Tanks

It is recommended that the lever on the pressure and temperature relief valves (PTRV) on main pressure hot water storage tanks be operated once every 6 months to ensure reliable operation. It is important to raise and lower the lever gently, and be careful as the water released will be HOT. Failure to operate the PTRV on a regular basis could lead to failure of the component and the possibility of the storage tank exploding.

It is recommended, and may also be a local regulation, that, in order to expel water safely, the PTRV have a copper pipe connected and run to an appropriate drainage location. The PTRV and drain outlet pipe must not be sealed or blocked.

NOTE: If the water heater is left in an operating condition and not used for two weeks or more, a quantity of highly flammable hydrogen may accumulate in the top of the water cylinder.

WARNING

To dissipate hydrogen safely, it is recommended that a hot water tap be turned on for several minutes at a sink, basin, or bath, but not a dishwasher, clothes washer, or other electrical or heat producing appliance. During this process, there must be no smoking, open flame, or electrical appliance operating nearby. Hydrogen discharged through the tap will sound like air escaping. Failure to dissipate hydrogen properly could result in explosion and fire, serious property damage, severe personal injury, or death.

P. Thermal Expansion (Closed Loop Systems)

As water is heated, it expands. This is known as thermal expansion. Thermal expansion can cause premature component failure. Such failures ARE NOT covered under product warranty.

An expansion tank, properly sized for your solar system, should be installed to control thermal expansion. Refer to expansion tank manufacturer's specifications for proper sizing guidelines.

Part 4 - Installation

A. Checklist

Location

- Sufficient room to service water heater, piping, and related controls
- Provisions made to protect area from water damage
- Centrally located to fixtures
- Protected from freezing temperatures
- Area free of flammable and/or corrosive vapors

Potable Water Supply

- All related piping free from leaks
- Thermal expansion tank installed
- Water heater and fixtures have been properly purged of air
- ASSE 1017 rated thermostatic mixing valve IS REQUIRED PER SRCC OG-300
- Have water supply tested and ensure it meets the requirements outlined in this manual

Relief Valve

- Temperature and Pressure relief valve properly installed and discharge line runs to open drain
- Discharge line not exposed to freezing temperatures
- Discharge line constructed of copper

Wiring; SE models

- Power supply voltage agrees with the water heater rating plate
- Branch circuit wire fusing or circuit breaker properly sized
- Electrical connections tight and unit properly grounded

Wiring; SB models

- Water heater control is secure and in control well
- Boiler backup control is wired to the boiler control or relay center

Solar Heat Exchanger to Solar Panel; SE and SB models

- Anti-freeze is added and rated as nontoxic with copy of MSDS sheet for homeowner
- Solar heat exchanger completely purged of air
- Expansion tank and temperature and pressure gauge operating properly
- Solar control shows circulators operating properly on the solar panels

Boiler Heat Exchanger; SB models only

- Boiler heat exchanger completely purged of air
- Expansion tank and temperature and pressure gauge operating properly
- Boiler control shows circulators operating properly on the solar panels

Anti-Freeze Fluid

- Solar water heaters with single wall heat exchangers: Make sure freeze protection fluids are certified non-toxic, FDA rated GRAS
- The use of glycol not recognized as GRAS is allowed in double wall heat exchanger models ONLY.
- Glycol percentage must be calculated per local area freeze level
- Provide glycol MSDS sheet to end user

NOTE: Make sure you have all necessary tools, materials and accessories before beginning work on the solar system.

CAUTION

COLD WEATHER HANDLING - If the water heater has been stored in a very cold location (BELOW 0°F) before installation, handle with care. Failure to do so could result in damage to the water heater.

B. Tools and Materials

The following is a minimum list of basic required tools. Other plumbing components will be field supplied according to installation needs.

Electric Drill	Drill Index (w/ 1/2" and 3/4" Wood Bits)	Torch and Striker
Putty Knife	Hack Saw	High Temperature Joint Compound
Tubing Cutter	Tin Snips	Solder Flux
Tape Measure	Emory Paper	24" Level
Extension Cord	Slip Joint Pliers	Needle Nose Pliers
Silicon Caulk and Roof Tar	Pipe Wrenches, 10" and 14"	Angle Iron
Open End Wrenches 9/16 & 7/16	Screw Driver 6" Flat Blade	Screw Driver 6" Phillips
Wire Stripper or Knife	Wire Cutters	Black Latex Outdoor Paint
Adjustable Wrenches 8" & 10"	Aluminum Flashing Sheet	Flashlight
Extension Cord	Wire Nuts or Connectors	Threaded Rod, Nuts, and Washers
Miscellaneous Copper Pipe and Fittings (3/4")	1" x 3/4" Copper Sweat Couplings	1" Copper Sweat Caps
Minimum 3/4" ID Type M Copper Tubing	Stainless Screw Clamps	Thermal Adhesive
7/8" x 3/4" and 1 1/8" x 3/4" Pipe Insulation		

Table 4 - Basic Required Tools

C. Locating the Solar Water Heater

This water heater is certified for indoor use only. **DO NOT INSTALL OUTDOORS.** Outdoor installations ARE NOT covered by warranty.

To minimize expense, choose a location for the water heater as centralized to the domestic piping system and near the solar collectors as possible. Also, locate the water heater and domestic water piping where it will not be exposed to freezing temperatures. All piping should be insulated to protect against freezing and minimize heat loss. Additionally, place the water heater so that the drain, controls, and inlets/outlets are easily accessible.

NOTE: If you do not provide the minimum clearances shown in Figure 3, it might not be possible to service the water heater without removing it from the space.

NOTE: A combustible door or removable panel is acceptable front clearance.

The solar water heater should also be installed in a place where T&P discharge or a leak will not result in damage to the surrounding area. Install a 2" high drain pan with a minimum of 3/4" drain line to prevent water damage if leakage should occur. See Figure 3.

WARNING

Filled hot water storage tanks are very heavy, and should be located in areas that can structurally support such weight. Failure to properly locate water storage tanks could result in property damage, personal injury, or death.

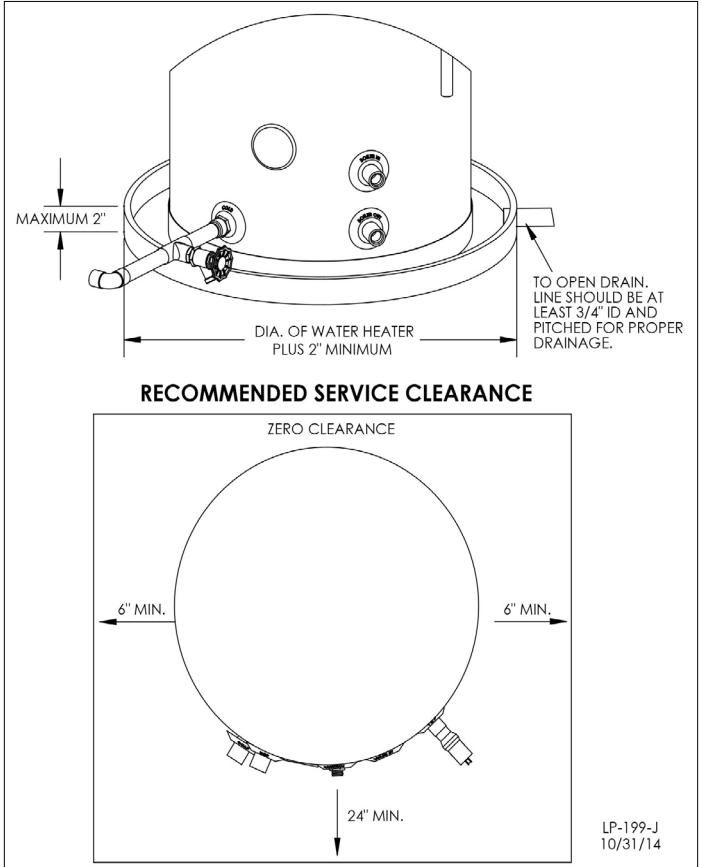


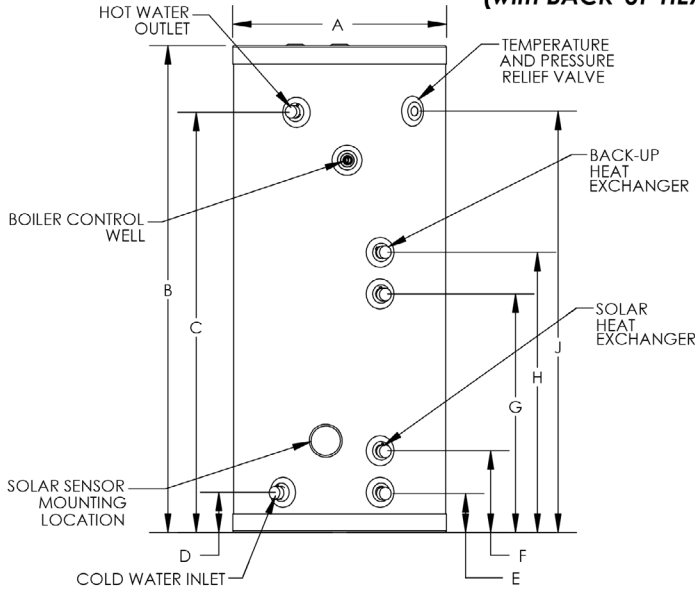
Figure 3 - Recommended Service Clearances

WARNING

This water heater must be installed upright in the vertical position as described in this manual. **DO NOT** attempt to install this water heater in any other orientation. Doing so will result in improper water heater operation and property damage, and could result in serious personal injury or death.

D. Specifications and Dimensions

**SUPERSTOR SB SERIES SOLAR WATER HEATER
(with BACK-UP HEAT EXCHANGER)**



MODEL #	GAL.	DIMENSIONS								
		A	B	C	D	E	F	G	H	J
SSU-60SB	60	23"	52"	46"	5"	5"	9-1/4"	26-1/2"	31"	46"
*SSU-80SB	80	23"	72"	64-1/2"	5"	4-1/2"	9-1/4"	36-1/2"	41-1/2"	64-1/2"
*SSU-119SB	119	27"	74"	66-1/2"	7-1/2"	7"	11-1/4"	38-1/2"	43-1/2"	66-1/2"

MODEL #	GAL.	HEAT EXCHANGER OUTLET SIZE	INLET/OUTLET SIZE	DRY WEIGHT	WET WEIGHT	SHIPPING WEIGHT (lbs)
SSU-60SB	60	1" NPT	1" NPT	100	492	120
*SSU-80SB	80	1" NPT	1" NPT	131	656	151
*SSU-119SB	119	1" NPT	1" NPT	210	1722	220

* DW SOLAR COIL MODELS SPECIAL ORDER, CONSULT FACTORY

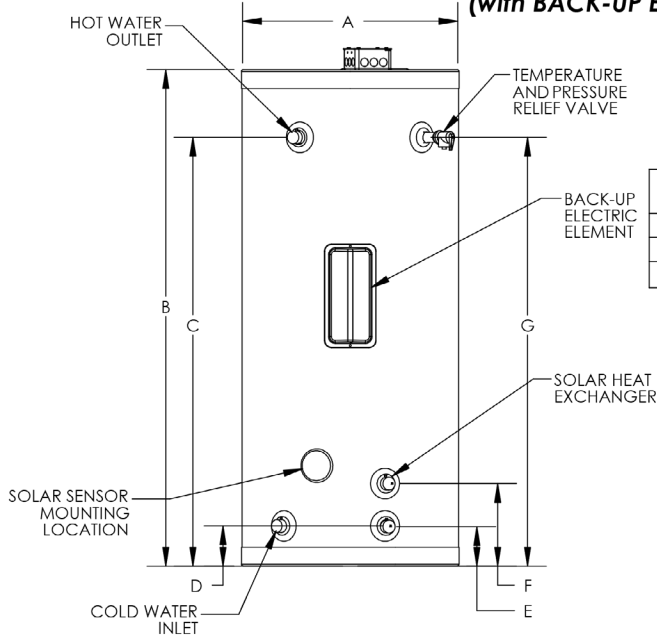
MODEL	HX VOLUME GALLONS		HEATED WATER VOLUME OF BACK UP	MAX. OPERATING PRESSURE OF COIL	RECOVERY OF BACK UP IN MINUTES		BOILER OUTPUT FOR TEST RECOVERIES	FIRST DRAW *	
	SOLAR	BOILER			65° RISE	90° RISE		65° RISE	90° RISE
SSU-60SB	1 GAL	1 GAL	35 GAL	150 PSI	11 MIN	16 MIN	104,000 BTU/HR	40 GAL	28 GAL
SSU-80SB	1 GAL	1 GAL	49 GAL	150 PSI	14 MIN	19 MIN	114,000 BTU/HR	60 GAL	40 GAL
SSU-119SB	1 GAL	1 GAL	64 GAL	150 PSI	22 MIN	31 MIN	121,000 BTU/HR	90 GAL	60 GAL

* AMOUNT OF WATER DRAWN OUT OF STORAGE TANK WITHOUT ANY ENERGY INPUT

All tank dimensions are approximate.

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**SUPERSTOR SE SERIES SOLAR WATER HEATER
(with BACK-UP ELECTRIC ELEMENT)**



MODEL #	GAL.	DIMENSIONS						
		A	B	C	D	E	F	G
SSU-60SE	60	23"	52"	46"	5"	5"	9-1/4"	46"
*SSU-80SE	80	23"	72"	64-1/2"	5"	4-1/2"	9-1/4"	64-1/2"
*SSU-119SE	119	27"	74"	66-1/2"	7-1/2"	7"	11-1/4"	66-1/2"

MODEL #	GAL.	HEAT EXCHANGER OUTLET SIZE	INLET/OUTLET SIZE	DRY WEIGHT	WET WEIGHT	SHIPPING WEIGHT (lbs)
SSU-60SE	60	1" NPT	1" NPT	90	492	115
*SSU-80SE	80	1" NPT	1" NPT	121	656	146
*SSU-119SE	119	1" NPT	1" NPT	200	1722	215

* DW SOLAR COIL MODELS SPECIAL ORDER, CONSULT FACTORY

MODEL	SOLAR HX VOLUME GALLONS	WATER VOLUME OF BACK UP	MAX. OPERATING PRESSURE OF COIL	RECOVERY OF BACK UP IN MINUTES		FIRST DRAW*	
				65° RISE	90° RISE	65° RISE	90° RISE
SSU-60SE	1 GAL	35 GAL	150 PSI	74 MIN	102 MIN	40 GAL	28 GAL
SSU-80SE	1 GAL	49 GAL	150 PSI	104 MIN	143 MIN	60 GAL	40 GAL
SSU-119SE	1 GAL	64 GAL	150 PSI	135 MIN	187 MIN	90 GAL	60 GAL

* AMOUNT OF WATER DRAWN OUT OF STORAGE TANK WITHOUT ANY ENERGY INPUT

All tank dimensions are approximate.

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Figure 4 - SSU SB and SE Series Water Heater Dimensions and Specifications

Part 5 - Piping

The design and installation of the solar water heating system should be done by qualified individuals. It is important that good design and installation practices be followed to assure that your system will operate properly. Failure to follow installation guidelines for your solar water heating system could cause component failure and possible safety issues.

A. Potable Water Piping

CAUTION
It is very important that you do the potable piping before you pipe into your solar system. Failure to do so may damage your water heater.
Do not introduce HTF into any fittings on the heater except those clearly marked for that purpose.

It is mandatory that all plumbing be done in accordance with local and state codes or warranty will be void. It is also necessary to use both thread tape and pipe dope on all mechanical connections. The potable water piping is located on the side of your solar water heater and marked Hot and Cold. It is recommended that unions or flexible copper connectors be used so heater can be easily serviced. Install a shut-off valve on the cold feed near the solar water heater to isolate the tank for future service.

Provide clear access to the water heater, pump, expansion tank, mixing valve, time clock and other key components. The components on the potable side of the system may require future service or maintenance, so it is recommended that the connections be made with brass unions. You must use copper and brass fittings in plumbing the solar storage tank and expansion tank. The use of galvanized fittings, nipples, dielectric unions, CPVC, PVC, or other plastic pipe is prohibited.

Hard copper connections to the city cold water supply line and 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, a drip or leak may cause serious damage to the tank's electrical components, or, in extreme cases, cause the tank to leak from the outside in.

B. Water Chemistry Requirements

CAUTION
Chemical imbalance of the water supply may affect efficiency and cause severe damage to the appliance and associated equipment. Water quality must be professionally analyzed to determine whether it is necessary to treat the water. Various solutions are available to adjust water quality. Adverse water quality will affect the reliability of the system. In addition, operating temperatures above 135°F will accelerate the build-up of lime scale and possibly shorten appliance service life. Failure of an appliance due to lime scale build-up, low pH, or other chemical imbalance IS NOT covered by the warranty.

The water must be potable, free of corrosive chemicals, sand, dirt, and other contaminates. It is up to the installer to ensure the water does not contain corrosive chemicals or elements that can damage the heat exchanger. Potable water is defined as drinkable water supplied from utility or well water in compliance with EPA secondary maximum contaminant levels (40 CFR Part 143.3). If the water contains contaminants higher than outlined by the EPA, water treatment is recommended and additional, more frequent maintenance may be required.

If you suspect that your water is contaminated in any way, discontinue use of the appliance and contact an authorized

technician or licensed professional.

- **Water pH between 6.5 and 8.5**
 - pH levels below 6.5 can cause an increase in the rate of corrosion. pH of 8.5 or higher can potentially cause lime scale build-up
 - Maintain water pH between 6.5 and 8.5. Check with litmus paper or have it chemically analyzed by a local water treatment company.
 - If the pH is not between 6.5 and 8.5, consult a local water treatment company for solutions.
- **Hardness less than 12 grains (200 mg/L) (Residential Use - water temperatures below 140°F)**
- **Hardness less than 7 grains (120 mg/L) (Commercial Use - water temperatures of 140°F and greater)**
 - Hardness levels above the required amounts can lead to lime scale build-up throughout the system. Water below 5 grains/gallon (85 mg/L) may be over softened.
 - Consult local water treatment companies for unusually hard water areas (above the required amounts) or for other treatment solutions if water is being over softened (below 5 grains/gallon [85 mg/L]).
- **Chloride concentration less than 100 ppm (mg/L)**
 - Do not fill appliance or operate with water containing chlorides in excess of 100 ppm (mg/L).
 - Using chlorinated fresh water should be acceptable as levels are typically less than 5 ppm (mg/L).
 - Do not connect the appliance to directly heat swimming pool or spa water.
- **Total Dissolved Solids (TDS) less than 500 ppm (mg/L)**
 - Total dissolved solids are minerals, salts, metals, and charged particles that are dissolved in water.
 - The greater the amounts of TDS present, the higher the corrosion potential due to increased conductivity in the water.
 - If using softened water to fill the appliance, it is still possible to have high TDS. This water can be corrosive. Consult local water treatment companies for other treatment solutions to reduce this affect.

***NOTE:**To promote appliance service life, it is strongly recommended to follow the maintenance procedures in this manual.

C. Solar Heat Exchanger Piping

Set up the primary balance of the system components following the piping detail in Figure 5.

Run ½" type M or larger copper pipes, or flex line sets, to and from the collector following the direction of supports, penetrations, and other relative items.

Only copper, cast iron, or brass are to be allowed in the collector piping loop due to transient operating temperatures that may reach as high as 300°F. PEX, PVC, CPVC, and other polymers are expressly prohibited in the piping network of closed loop systems.

When making a connection to the heat exchanger, use Teflon Tape and joint compound to prevent leaks. The connections to the heat exchanger are 1" NPT. Do not apply heat directly to the heat exchanger thread connection when sweating fittings.

Line pressure and temperature gauge shall be installed in the collector supply and return lines to allow for a simple diagnostic check of proper system operation. On a sunny day, the hot water return line should be approximately 5 – 12°F warmer than the water in the collector supply line. Compare the temperature readings in the two line thermometers. The ¾" cold water supply line to the storage tank must be insulated with a minimum 7/8" x ½" pipe insulation to a minimum distance of 5' behind the storage tank, or to the wall if closer than 5'.

D. Potable Water Piping Application

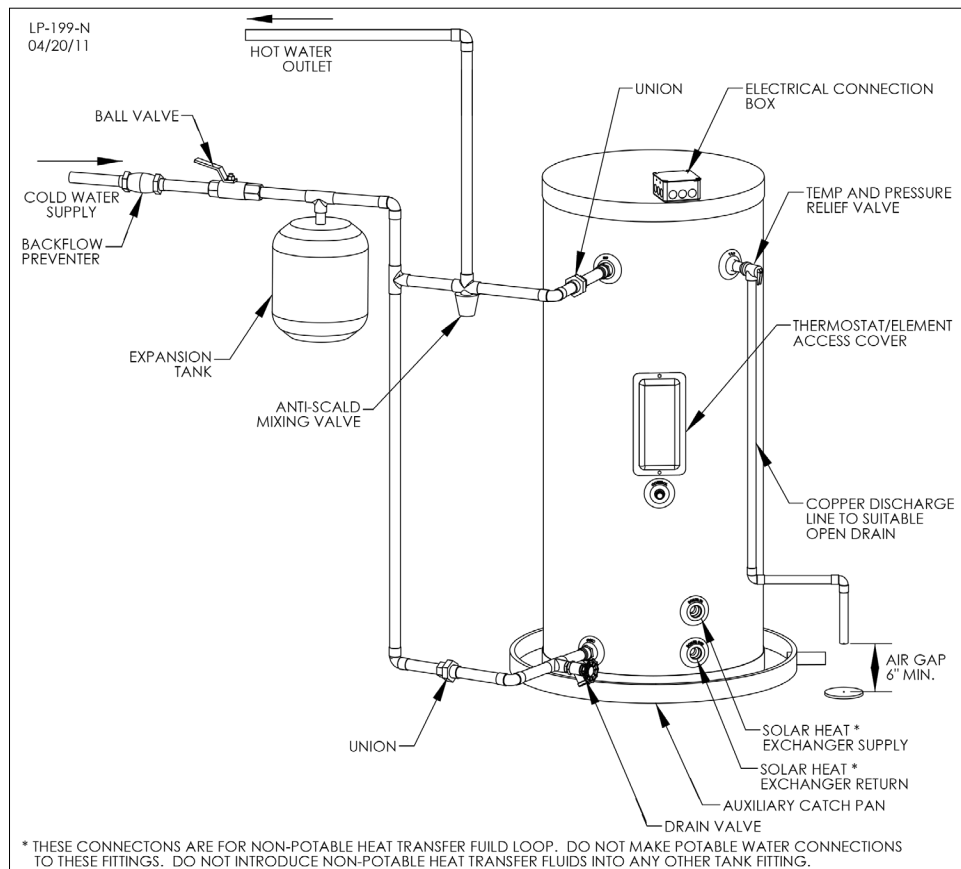


Figure 5 - Potable Water Piping Application. Meant to demonstrate piping concept only. Installer is responsible for all equipment and detailing per local codes.

E. Tank Sensor Placement

Make sure the sensor is secured on the stud located in the lower section of the water heater. Secure the sensor by packing Armaflex insulation behind it. This will also help the sensor react to temperature change.

Non-toxic freeze protection fluid must be used to protect the system from freezing. Use a mixture appropriate for your climate. Do not use a higher glycol to water concentration than necessary, as this will adversely impact heat transfer efficiency. See the **DowFrost Data Sheet** in the back of this manual for recommended concentrations. A copy of the MSDS sheet must be left with the end user of the solar system. See **"EMERGENCY OVERVIEW"** as part of the DowFrost Data Sheet in the back of this manual.

The collector loop must be charged with HTF. The use of regular tap water as a mixing agent is prohibited. Use potable water as a mixing agent **ONLY**. Regular scheduled maintenance must be established to monitor and maintain the proper pH level of HTF in the system to protect the heat exchanger and other components in the system.

F. Necessary Components for Water Heater Installation

Listed below are components needed for installation of the solar water heater.

Solar Collector

Absorbs and transfers the sun's energy into the solar heat exchanger located on the bottom of the solar water heater.

Solar Air Release Vent*

This air vent allows air contained in the solar system to release. The air vent valve must be designed to work in high temperatures (as high as 350°F) with a glycol medium. (This is typical of solar systems.)

*Remove and cap the solar air release vent after commissioning the system.

Solar Collector Sensor

This sensor is wired to the solar controller and automatically turns on the circulator pump when the differential set point is reached between the solar water heater and collector.

Tank and Heat Exchanger Temperature and Pressure Gauge

The temperature and pressure gauge on the solar piping will show the user the actual temperature and pressure supplied and returned to the solar collector.

Check Valve

Helps minimize convective heat loss at night when the system is not operating. If a check valve is not installed, most of the heater energy stored during the day would be transferred into the panel and lost.

Collector Isolation Valve (Valve #6)

Valve #6 and 11 (for solar collector isolation) isolates the collector loop from the solar water heater.

Pressure Relief Valve (for Solar System)

Releases pressure in the solar loop when it exceeds 150psi. Contact your installation contractor immediately if this valve opens and releases fluids.

System Fill Valve (Valve #8)

Fills the system with HTF. Also eliminates air from the system.

Expansion Tank

Precharged with air to allow for the expansion and contraction of HTF.

Drain Valve (Valve #10)

Used to charge the collector loop with glycol, purge air from the loop and drain the solar water heater heat exchanger of fluid.

Collector Isolation Valve (for system fill) (Valve #11)

Used to direct the flow of HTF and to pressurize and eliminate air from the solar system.

Ball Valve (for circulator) Valve #12

Used to isolate the circulator pump for service. Close both ball valves to isolate pump.

Circulator (#13)

Circulates the HTF from the solar collector into the solar heat exchanger.

Drain Valve (Tank) (Valve #14)

Flushes sediment which may accumulate on the bottom of the solar water heater and also provides a means of draining the tank.

Tank Sensor

Is wired to the solar controller to measure the temperature on the bottom of the solar water heater in conjunction with the solar collector sensor. Turns the circulating pump on and off at the solar control preset temperature differentials.

Solar Controller

The solar controller turns the circulator on or off depending on heat gained from solar operation. The controller also limits overheating in the solar water heater. Some controllers have various options. The controller should always be set in the "auto" position so that it operates the array automatically when there is solar energy to be collected.

Solar Heat Exchanger

The solar heat exchanger has an integral finned tube designed to transfer heated energy rapidly from the solar collector into potable water. The heat exchanger is constructed in 90/10 copper nickel for superior corrosion resistance and long-term reliability.

Hot Water Outlet

Each solar water heater has a hot water dip tube outlet which draws water from the top of the heater. This helps to keep heat trapped inside the highly insulated storage tank.

Solar Tank Temperature and Pressure Relief Valve

The relief valve must comply with standards for relief valves (ANSI Z21.22) by a nationally recognized lab that maintains periodic inspections of production listed equipment. No valve of any type should be installed between the relief valve and tank. Local codes govern installation of relief valves.

The relief valve outlet must be piped to a suitable open drain so that the discharge water cannot contact live electric parts to eliminate potential damage. Piping used should be approved for hot water distribution. The discharge line must be no smaller than the outlet of the relief valve and must pitch downward to allow complete drainage. The end of the discharge piping should not be threaded or concealed and must be protected from freezing. No valve of any type, restriction or reducer coupling should be installed in the discharge line.

Mixing Valve (Rated ASSE 1017) REQUIRED PER SRCC OG-300

Automatically blends hot and cold water feed lines to control discharge to an acceptable and safe temperature. This also increases the amount of hot water drawn from the solar water heater by not allowing incoming cold water to fully temper the hot water stored inside the tank. To help prevent injury due to scalding, it is recommended that the mixing valve be set at 120°F.

Back-up Electric Element with Thermostat (SE Models)

The back-up electric element will only activate when the desired minimum set point temperature set on the back-up thermostat cannot be satisfied by the solar gain achieved from the solar collector.

Boiler Back-up Heat Exchanger (SB Models)

The back-up boiler will only activate when the desired minimum set point temperature set on the back-up thermostat cannot be satisfied by the solar input from the solar collector.

Boiler Back-up Aquastat

The boiler back-up aquastat will activate the boiler to circulate the hot water generated from the boiler into the heat exchanger located on the top section of SB models. Once the system has reached the desired set point, the controller will shut off the boiler. This back-up portion will only activate if the solar gain from the collector cannot keep the tank at the minimum desired temperature setting.

Ball Valve (for cold water shut-off) (Valve #24)

The cold water shut off valve should be used in the event of an emergency shutdown.

CAUTION

Never use dielectric unions or galvanized steel fittings on any domestic water connections or auxiliary connections. ONLY use copper or brass fittings. Teflon thread sealant must be used on all connections.

G. Applications

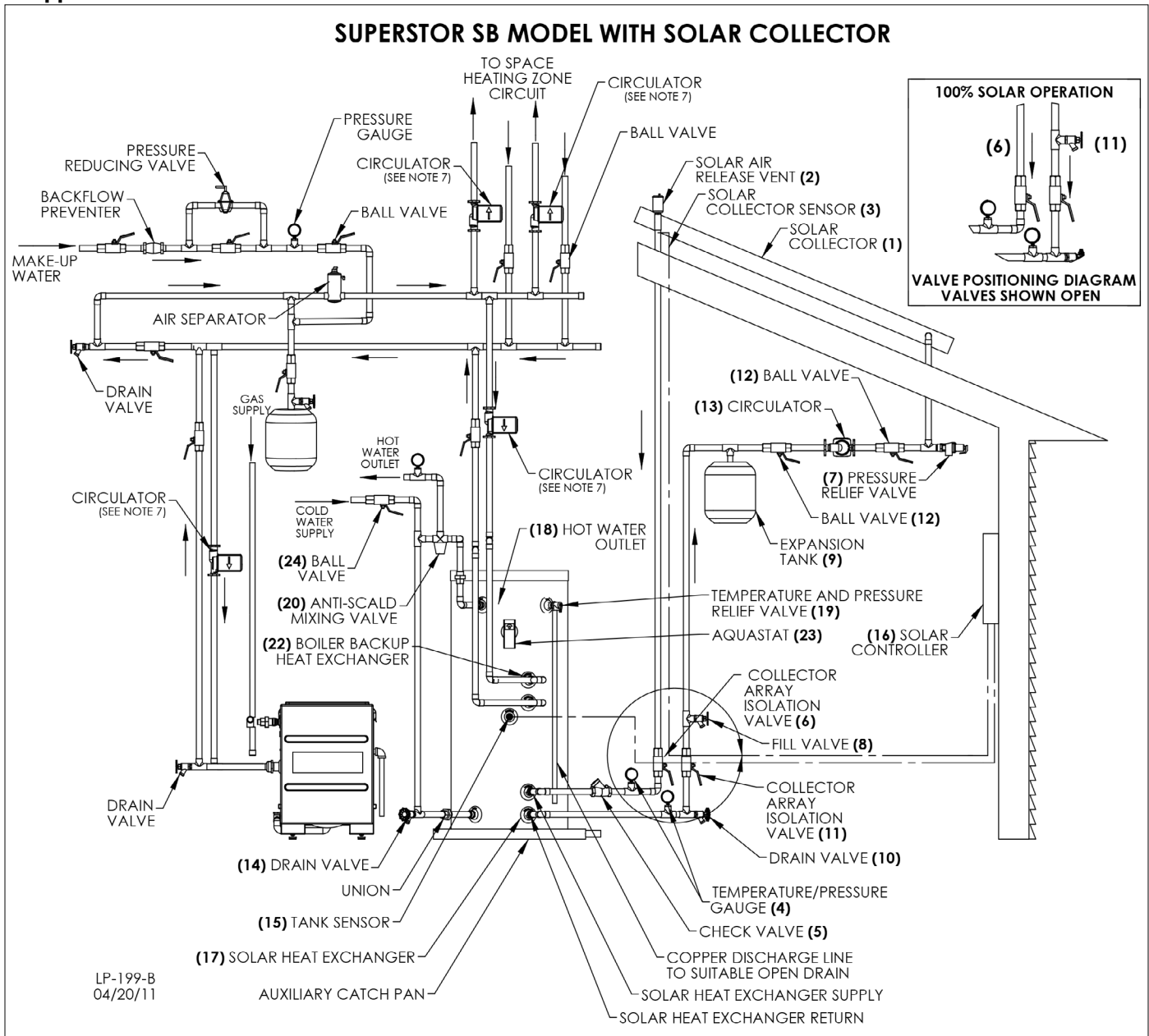


Figure 6 - Solar Water Heater with Boiler Back-Up

FIGURE NOTES:

1. This drawing is meant to show system piping concept only. The installer is responsible for all equipment and detailing by local codes.
2. Antifreeze, non-potable HTF shall be used for the solar heat exchanger circuit only. Never introduce antifreeze solution to any connection other than the solar loop.
3. If there is a check valve on the cold water feed line, a thermal expansion tank suitable for potable water must be sized and installed within this piping system between the check valve and cold water inlet of the solar water heater.
4. An ASSE 1017 mixing valve is required per SRCC OG-300.
5. A minimum of 12 diameters of straight pipe must be installed upstream of all circulators.
6. Make sure tank is fully purged of air before power is turned on to the backup heat source.
7. Circulators shown in the above hydronic piping should have an integral flow check or alternately use a stock pump with an external spring type check valve. **(Due to extreme temperatures, circulators with integral flow checks are not to be used in solar systems. If circulator comes equipped with an integral flow check, remove it.)**

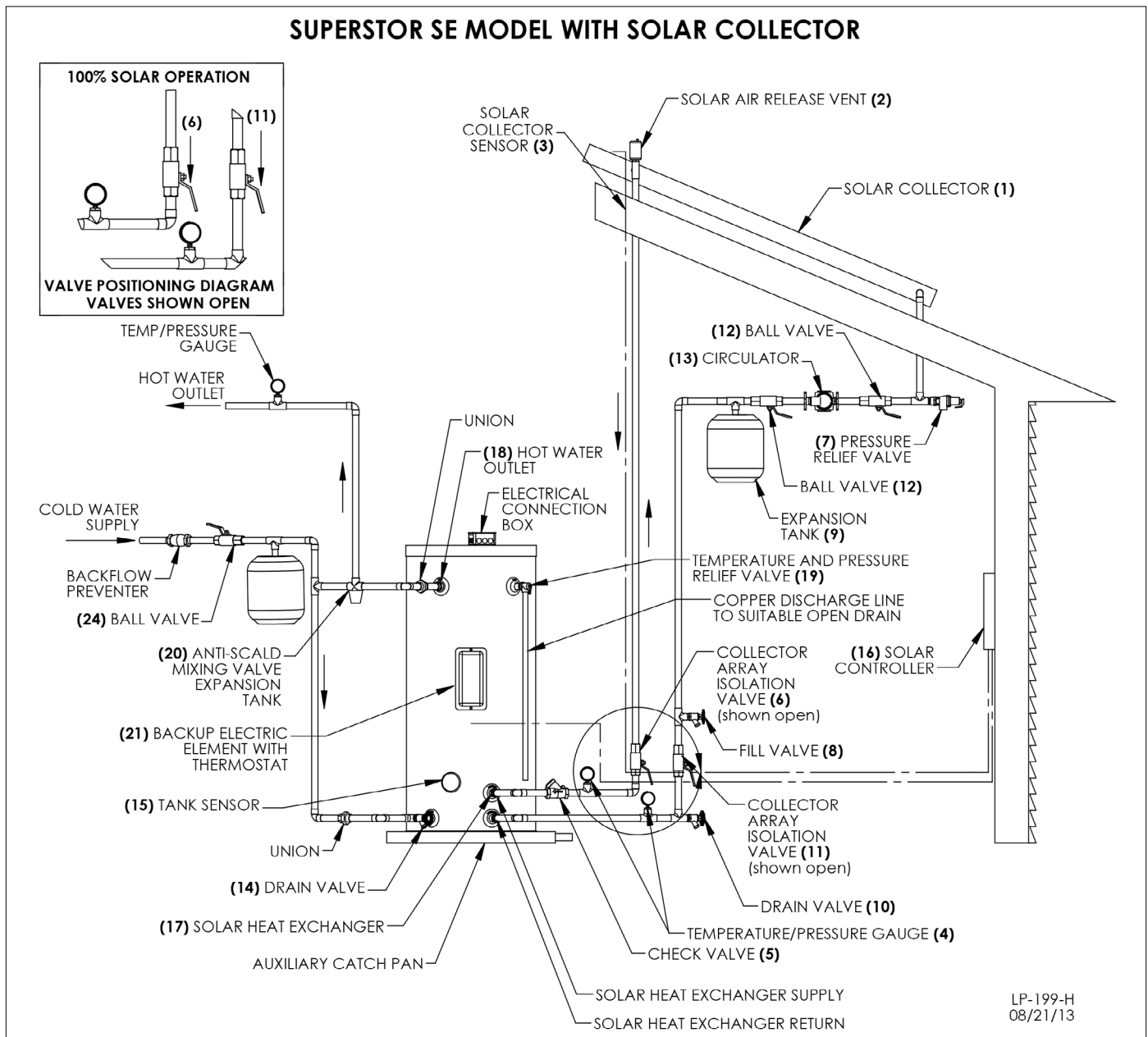


Figure 7 - Solar Water Heater with Electric Back-Up

FIGURE NOTES:

1. This drawing is meant to show system piping concept only. The installer is responsible for all equipment and detailing by local codes.
2. Antifreeze, non-potable HTF shall be used for the solar heat exchanger circuit only. Never introduce antifreeze solution to any connection other than the solar loop.
3. If there is a check valve on the cold water feed line, a thermal expansion tank suitable for potable water must be sized and installed within this piping system between the check valve and cold water inlet of the solar water heater.
4. An ASSE 1017 mixing valve is required per SRCC OG-300.
5. A minimum of 12 diameters of straight pipe must be installed upstream of all circulators.
6. Make sure tank is fully purged of air before power is turned on to the backup heat source.
7. Circulators shown in the above hydronic piping should have an integral flow check or alternately use a stock pump with an external spring type check valve. **(Due to extreme temperatures, circulators with integral flow checks are not to be used in solar systems. If circulator comes equipped with an integral flow check, remove it.)**

H. Boiler Heat Exchanger Connection (SB Models Only)

The boiler heat exchanger connections are located in the front of the solar water heater. Use a 1" minimum pipe size when connecting zone valves or circulators.

The inlet of the circulator must be connected to the hot outlet side of the boiler. Be sure the direction of the arrow on the circulator is facing toward the flow direction from the boiler to the boiler inlet of the water heater. On the water heater, the boiler return must be connected to the return side of the boiler. The return from the heating loop should have a flow check or swing check valve installed before the return pipe from the boiler heat exchanger.

I. Boiler Tank Control (SB Models Only)

Insert the boiler tank control into the control well provided in the front of the water heater. Wire the boiler tank control to the boiler control or relay center. Additional equipment may be needed in order to wire the control to the existing system. Controls also have the ability to monitor and display solar collector temperature and upper and lower tank temperature. See Figure 8 for installation detail.

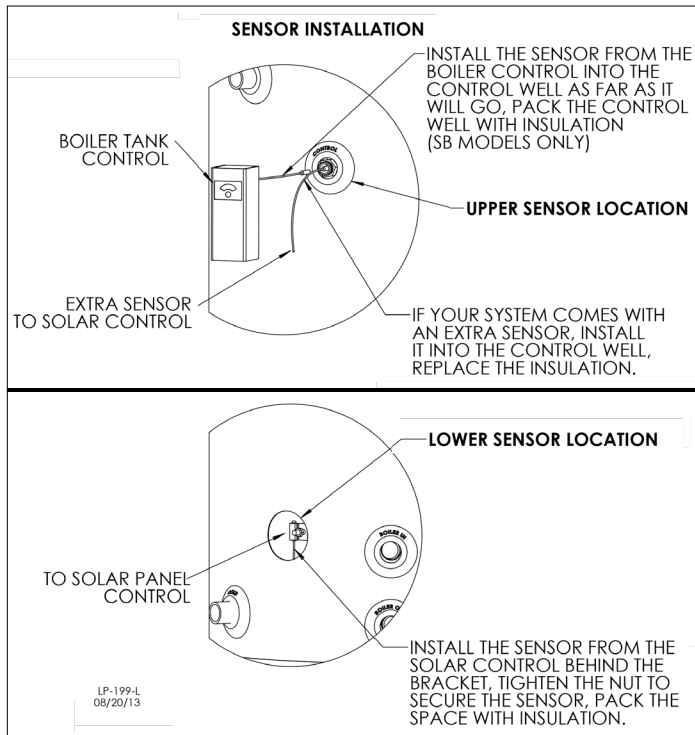


Figure 8 - Sensor Installation Detail

J. Circulator Sizing

The circulator pump must be sized for the related piping and pressure drop of the heat exchanger, and for situations specific to your solar system. The following graph represents the pressure drop of the solar heat exchanger. Consult the solar panel manufacturer for flow requirements to assist in pump selection.

K. Boiler Heat Exchanger (SB Models Only)

To assure the correct flow through the boiler back-up heat exchanger, refer to Figure 9 to correctly size the circulator to the boiler or auxiliary heat exchanger. HTP recommends a flow rate of 1 gpm for every 10,000 BTU based on a 20°F temperature difference between the supply and return of the heat exchanger.

Solar Heat Exchanger Pressure Drop

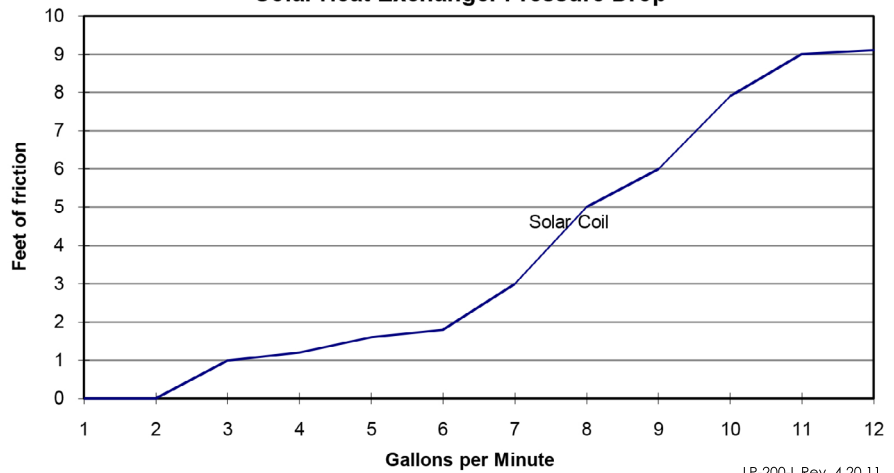


Figure 9 - Pressure Drop through the Solar Heat Exchanger

Example: Boiler is 100,000 BTU / 10,000 BTU = 10 gpm flow rate. The heat exchanger at 10 gpm will require a circulator that will operate at 8 feet of friction.

L. Electrical Connection (SE Models Only)

CAUTION
Tank must be full before unit is turned on. The heating element will be damaged if energized for even a short period of time while tank is dry. This damage IS NOT covered by warranty.
Installation, attachment, or use of any unapproved devices in conjunction with this water heater WILL VOID the warranty. The use of unauthorized energy saving devices may shorten the life of the water heater and possibly endanger property and life. The manufacturer disclaims any responsibility for any loss or injury resulting from the use of such unauthorized devices.
WARNING
Be sure to ground the water heater. The preferred way to ground is with rigid metal conduit between the main panel and the water heater junction box with approved end fittings (check codes on the use of flexible conduit). If making a separate ground, a green ground wire is provided in the water heater junction box. Replace the junction box cover and insulation after you have made the wiring connections.
Do not use SE model water heaters with any voltage other than shown on the model rating plate. Failure to follow these instructions could result in property damage, serious personal injury, or death.

This unit is factory wired to a junction box on top of the water heater. A 4 x 4 x 2 junction box is located on top of the unit for field wiring connection. These heaters are equipped and wired as standard 240 volt AC. The voltage requirement and dedicated wattage load for the heater is specified on the rating label. A minimum 30 amp circuit is required to connect the water heater. Consult your local power company to determine if your electrical service is adequate for the additional load of the heater.

Refer to the wiring diagrams below for field connections. 240V electrical installation should be done by a qualified licensed electrician or by your local electric utility. All wiring must conform to local code and the National Electric Code. Grounding can be accomplished by using approved conduit and fittings or other approved conductive material. A grounding wire is provided on the junction bracket. This grounding wire must be used in the installation.

After the water and electrical connections have been made and the tank has been filled with water and purged of air, turn on power to the heater. The heater is now operational.

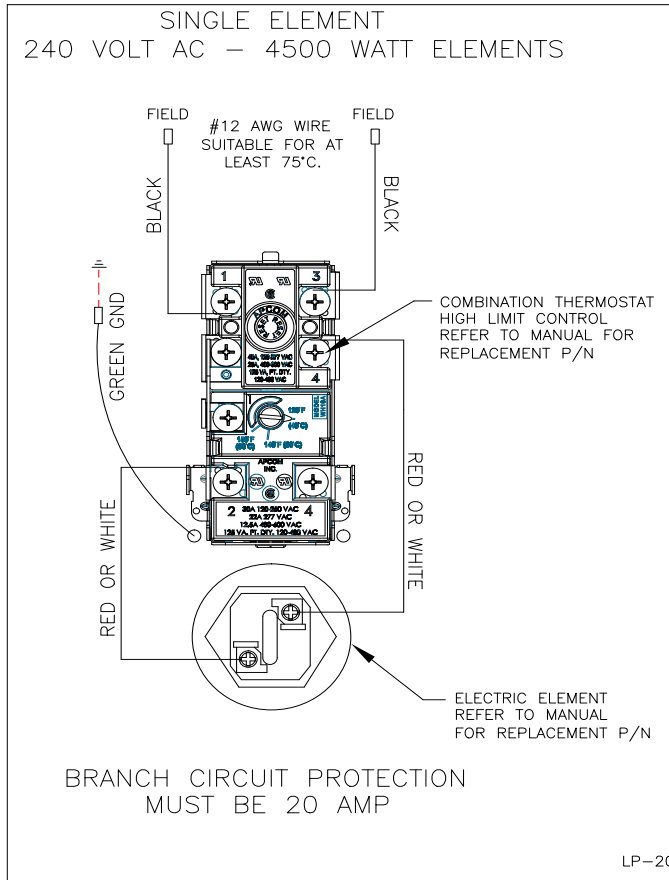


Figure 10 - SE Series Electrical Connection Detail

M. Thermostat Adjustment

The thermostat is located in the front of the heater. The access cover must be removed to adjust the factory default setting of 119°F. This temperature is satisfactory for average household use.

If an adjustment is necessary, turn off the power to the heater, remove the black access cover and insulation. The thermostat protective cover should not be removed. Set the temperature indicator to the desired temperature, replace insulation and access cover. Turn on power to the heater.

N. Combination Thermostat and High Limit Control ECO

This heater is equipped with a combination thermostat and high limit safety. If for any reason the water temperature becomes excessively high, the “High Limit Control (ECO)” breaks the circuit to the heating element. Once the switch opens it must be reset manually. However, THE CAUSE OF THE OVERHEATING CONDITION MUST BE CORRECTED FIRST. Refer to the Troubleshooting section for possible causes. To reset, press the red reset button as shown in Figure 11. Replace the insulation and black access cover before restoring power to the system.

O. Heating Element Replacement Procedure

WARNING

If heating elements need replacement, it is very important to use the same voltage, wattage, and construction. The element sheath must be incoloy and the hex plug must be made of stainless steel.

STEP #1 - Turn off power to the water heater. Use a Phillips Head screwdriver to remove the wires from the element.

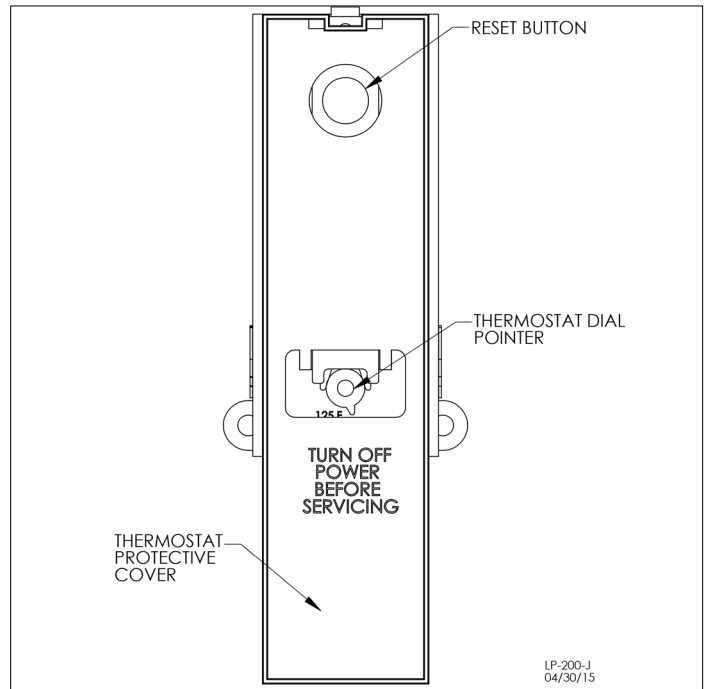


Figure 11 - Thermostat Detail

DANGER

Failure to disconnect the power from the water heater before attempting heating element replacement will result in property damage, severe personal injury, or death due to electric shock.

STEP #2 - Run hot water at a faucet in the system. When it runs cold, shut off the faucet. Then shut off water at the main cold water inlet or, if possible, valve off the water heater from the system. Drain the water from the system, or just the water heater if it can be isolated from the system.

WARNING

Completely drain the water heater before removing and replacing a heating element or elements. Failure to do so will result in a leakage of water and property damage, and could possibly result in moderate to severe personal injury or death.

Water drained from the water heater may be scalding hot. Take care to avoid scalding. Wear gloves and safety glasses, and direct water to a safe drainage location. Failure to comply with this warning could result in property damage, severe personal injury, or death.

CAUTION

DO NOT replace heating element with a generic heating element. Only HTP heating elements are approved for use with this water heater. Failure to follow this warning will result in premature product failure and VOID the warranty.

Step #3 - Remove the element with a 1 1/2” socket wrench or element tool.

Step #4 - Inspect the removed element. Determine whether the replacement element will need a square or circular gasket and washer.

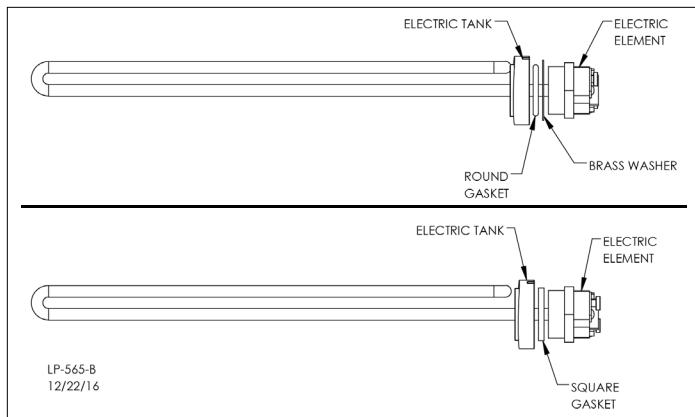


Figure 12 - Heating Element Detail

Step #5 - Ensure thread and opening are completely free of debris. Use a nylon brush to clear away any debris.

Step #6 - Put a small amount of NSF approved lubricant and sealant on the appropriate gasket and/or washer for the installation. Put the gasket and/or washer on the element.

Step #7 - Screw the element clockwise into the tank, and tighten with the 1 1/2" socket wrench or element tool. Be sure gasket seats properly.

Step #8 - Open the main cold water inlet. If the water heater has been isolated from the system, open the valves. Refill the tank with cold water. Open a hot water faucet high in the system to bleed any air pressure from the system. Water will flow freely when air is completely bled.

WARNING

When filling the water heater, open a hot water tap to release air in the tank and piping. The tank must be full of water before the heater is turned on. Failure to ensure the water heater is full before turning it on will result in damage to the water heater, and could result in property damage, serious personal injury, or death. Such damages ARE NOT covered by water heater warranty.

Step #9 - Pressure check the tank for leaks around element. If no leaks are found, use a Phillips Head screwdriver to connect the wires to the element.

Step #10 - Turn power back on to the water heater.

CAUTION

Failure to refill the tank before restoring power to the water heater will result in damage to the heating elements and property damage. Such damages ARE NOT covered by warranty.

Part 6 - Fluid Quality

A. Solar Loop Fluid Quality

Fluid in direct flow through the solar collectors must first meet potable water requirements; any fluid circulated through the collectors should be non-corrosive to copper. In addition, water quality must meet the following requirements listed below.

Total Dissolved Solids	< 500 ppm
Total Hardness	< 7 grains
Chloride	< 100 ppm
pH Levels	6.5 - 8.5

In order to meet health and safety regulations, solar system antifreeze fluid should be food grade polypropylene glycol, FDA rated as "generally recognized as safe" (GRAS). Using proper concentrations of glycol, solar systems can be operated at ambient temperatures as low as -60°F. Freeze tolerance limits are based upon an assumed set of environmental conditions. Refer to the DOWFROST specification sheet in the back of this manual for recommended concentrations.

If using a glycol / potable water mix, the water must meet the above requirements, and the glycol content of the liquid must not exceed 50%, unless the manufacture specifies that a different ratio is recommended for use with solar water heaters. Glycol may need to be changed periodically (every 3-5 years) to prevent it from becoming acidic; please refer to the guidelines provided by the glycol manufacturer regarding replacement.

NOTE: The use of glycol not recognized as GRAS is allowed in double wall heat exchanger models ONLY.

B. Fluid Safety Labeling

Included with your solar system is a set of labels which describe component function. These labels alert the owner to potential hazards. Affix these labels by string/wire/tie on valves, and/or "peel and stick" on pipe insulation. Labels on the solar loop system must contain the following warning:

"No other fluid shall be used that would change the original classification of the system. Unauthorized alterations to this system could result in a hazardous health condition." All labeling MUST be in place at final inspection.

C. Freeze Protection

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

For areas with temperatures not falling below -5°C/23°F, a simple low temperature controller may be used to guard against freezing. If necessary, backup freeze protection in the form of an uninterrupted power supply (UPS), or freeze valves (which open to allow water to dribble out) should also be installed.

For areas with temperatures that fall below -5°C /23°F, a closed loop filled with a polypropylene glycol-water mix should be used to provide hard freeze protection. Please refer to glycol manufacturer's specifications about the temperature ranges the liquid can withstand. Only food grade polypropylene-glycol, FDA rated as GRAS, should be used.

NOTE: HTP DOES NOT WARRANT THE SOLAR WATER HEATER, SOLAR COLLECTOR, OR ANY COMPONENTS AGAINST FREEZE RELATED DAMAGE.

NOTE: The use of glycol not recognized as GRAS is allowed in double wall heat exchanger models ONLY.

Part 7 - Start-Up Preparation

CAUTION

DO NOT MOVE ON TO THESE STEPS UNTIL THE ENTIRE SOLAR SYSTEM, INCLUDING ALL PIPING, SOLAR COLLECTORS, SENSORS, PUMP, CONTROLS, AND ELECTRICAL CONNECTIONS, ARE PROPERLY SECURED, INSULATED, LABELED AND INSTALLED.

A. Charging the System Solar Water Heater

Fill the solar tank with water. Do this by opening the cold water isolation ball valve to the solar tank. See Figs. 5 - 7 for valve locations. Inspect all fittings for leaks.

Solar Collector

The solar collector loop should be pressure tested with air (25 psi) before you pressurize the loop with HTF. If using glycol, mix in accordance with the glycol manufacturer's data sheet. The charging process will require a low flow diaphragm pump to fill and pressurize the collector loop.

Connect the discharge side of the pressure pump to the fill valve. See Figs. 5 – 7. Place the pump suction side hose in the glycol solution. Close the ball valve (#11). Connect a second hose to the drain valve (#10) and place the other end of the hose in the empty bucket.

TOTAL COLLECTOR LOOP FLUID CAPACITY IN GALLONS*

1. Collector System 3.5 gallons

2. Collector System 4.5 gallons

***Assumes a total 100' ¾" Type M hard copper pipe run.**

Solar water heater heat exchanger has a 1.75 gallon fluid capacity.

Open the upper fill valve (#18) and allow the pressure from the expansion tank to push the water in the loop back to prime the pressure pump. When the hose in the bucket containing the HTF stops bubbling, you may begin charging the collector loop. With both fill and drain valves open, run the low flow diaphragm pump until the HTF begins flowing into the empty bucket. Quickly switch the hose from the empty/return bucket to the bucket containing the glycol mixture. Continue to circulate the fluid using the pressure pump until the bubbling has stopped and the air has been purged.

After charging the collector loop, shut the lower drain valve (#10) and let the pressure pump drive up the loop pressure to the appropriate level (in glycol systems, in the range of 25 psi). To more accurately calculate the proper pressure, measure the height of the solar collector above the solar water heater and divide this number by 2.31. Then add 20 psi to this number.

CAUTION

The pressure in a glycol loop should not exceed 45 PSI when the system is in operation on a sunny day. Contact your solar contractor if the loop exceeds this threshold.

After pressurizing the solar system, run the circulator and allow the air to purge out of the air vent. Once purged, monitor pressures and check for leaks before insulating pipes. Pressure should then be about 25 PSI.

Above ground piping must be insulated with a wall thickness of at least ¾". A 1" thickness is required in areas prone to hard freeze conditions. Above ground insulation must be protected from ultraviolet degradation. All piping must be supported at a maximum interval of 10 feet and the piping supports must not crimp or compress the insulation.

B. Commissioning the System

After the collector loop has been charged and pressure is around 25 PSI (check gauge on solar heat exchanger) set the solar control to the desired settings. Solar controls come with default settings that will work in most installations. If it is a cloudy day, the circulator pump may have to be activated manually. Once the pump is running and the system is fully purged of air, set the control to the desired settings. It is recommended not to set the storage tank high limit set point any lower than 160°F. A lower set point could lower the performance of the solar water heater and cause overheating of the collector system. You must install a mixing valve on the hot water outlet, as temperature within the storage tank can cause injury.

Part 8 - Service / Maintenance Procedures

A properly maintained solar water heating system can provide years of dependable, trouble-free service. It is suggested that a routine preventive maintenance program be established and followed by the end user with the solar contractor. Listed below is the maintenance check list that outlines the primary components of the solar system that need to be inspected annually.

1. HTF Glycol – It is very important that the quality of the glycol is maintained to avoid damage to the collector loop and related components. See the manufacturer's data sheet for further details.

2. Water quality can affect the operation of the solar heat exchanger over time. In very hard water areas, it is recommended to drain (#14) a few gallons of water from the bottom of the tank to keep the water heater free of sediment.

3. Clean and inspect the solar collector (#1). Dirt or film may settle on the surface and affect performance. Check collector supplier for cleaning procedures.

4. Check piping and component insulation for deterioration.

5. Check solar tank sensors and the boiler back up aquastat sensors (#s 15 and 23). Assure these sensors are secure and have not moved or loosened.

6. Inspect the T&P valve (#19) on the water heater. Lift the release handle lever. Make sure discharge is directed to an open drain.

WARNING

Never open the pressure relief valve while the system is in operation or hot water is present. Allow to cool prior to opening. Failure to do so could result in serious personal injury or death.

7. The area near the water heater must be kept free of flammable liquids such as gasoline, paint thinners, adhesives, or other combustible materials.

8. The electric element may need cleaning. A hissing sound while operating indicates the element has built up deposits. Cleaning should only be done by a qualified plumbing or heating contractor.

CAUTION

If the heating element needs replacement, it is VERY important to use the same voltage, wattage, and construction. This element must be stainless steel and the hex plug be made of brass. This replacement part is available from HTP and should not be purchased from outside sources.

A. Shutdown Procedures

The solar system is designed to be easily isolated for emergency repairs or routine maintenance. To isolate the water heater, simply shut down supply water shut off valve (#24) which isolates the water heater from the pressurized cold water supply.

The collector loop can be isolated from the solar storage tank by closing (#6 and #11). If the pressure in this loop drops, or you find a glycol leak, shut these valves and contact your installation contractor. Turn the circulating pump off on your solar control.

B. Vacation Shutdown

Solar water heaters can build up very high temperatures when there is no daily draw on the system. The best way to dissipate heat in the system is set the control to run the circulator pump 24 hours a day to cool off the storage tank at night. The collector will radiate heat back to the atmosphere at night, preventing the system from stagnating at very high temperatures.

C. Estimated Life of Components

Proper care and maintenance will determine the life expectancy of the individual components of the solar system. Refer to manufacturer's warranty information to determine coverage of individual components. To obtain warranty service, call your local service or installing contractor.

D. Temperature and Pressure Relief Valve

A temperature and pressure relief (T&P) valve is designed for emergency safety relief and shall not be used as an operating control. A T&P valve functions by discharging water in an emergency. Therefore, it is essential that a discharge line be piped from the valve in order to carry the overflow to a safe place of disposal. The discharge line must be the same size as the valve outlet, must pitch downward from the valve, and terminate at least 6" above a drain where any discharge will be clearly visible.

▲ WARNING

Following installation of the T&P Relief Valve, the valve lever MUST be operated AT LEAST ONCE A YEAR by the water heater owner to ensure that waterways are clear. Certain naturally occurring mineral deposits may adhere to the valve, blocking waterways and rendering the valve inoperative. When the lever is operated, hot water will discharge if the waterways are clear. PRECAUTIONS MUST BE TAKEN TO AVOID PERSONAL INJURY FROM CONTACT WITH HOT WATER AND TO AVOID PROPERTY DAMAGE. BEFORE operating lever, check to see that a discharge line is connected to the valve, directing the flow of hot water from the valve to a proper place of disposal. If no water flows when the lever is operated, replacement of the valve is required. TURN THE WATER HEATER "OFF" **AND CALL A PLUMBER IMMEDIATELY.**

Part 9 - Troubleshooting

Owners are advised to contact the installer whenever in-depth interaction with the solar system is required.

A. Leaks

For leaks in the potable water system or solar storage tank, close the cold water inlet and unplug the solar controller. This will isolate the solar system until repairs can be made.

B. Other Problems

A noisy pump could be an indication of worn bearings, obstructions, or a leak in your system. Call your installer for diagnosis of the problem, repair of the system, and/or replacement of components.

▲ WARNING

For your safety, DO NOT attempt repair of electrical wiring, thermostat, heating element or other operating controls. Refer repairs to qualified service personnel. Failure to do so could result in serious personal injury or death.

C. Operating Suggestions for the User

A properly designed solar hot water system provides solar energy for approximately 70 – 90% of annual hot water needs. Listed below are some suggestions that will maximize the benefits of your solar hot water system.

1. Showers - If possible, take showers during the day, or in the early evening. Use low flow showerheads to reduce water consumption.
2. Dishwashing – Run your dishwasher during the day, after showers, to ensure as much hot water as possible is available for showers.
3. Laundry – Spread clothes washing over the week instead of washing all at the same time.
4. Single Lever Faucets – When using cold water, make sure the lever is all the way over in the cold position. This prevents hot water from inadvertently flowing from the solar storage tank.

▲ WARNING

The risk of scald injury increases as you increase water temperature. Use a water tempering or mixing valve and extreme caution when using hot water to avoid scald injury. Consult codes for conformance. Failure to follow the instructions in this warning statement could result in serious personal injury or death from scalds.

Be sure to disconnect electrical power before performing service. Failure to do so could result in electrical shock, property damage, serious personal injury, or death.

Problem	Reason	Remedy
No Hot Water	1. Improper Wiring	Rewire per Wiring Diagram
	2. No Power - Blown Fuse or Tripped Circuit Breaker	a. **Replace or repair b. **Provide adequate circuit or reduce load
	a. Shorted Wiring b. Circuit Overloaded c. Improper Wiring d. Grounded Element or Thermostat	c. ** Rewire per diagram d. **Replace
	3. Manual Reset Limit (ECO) Open	Refer to "Operation" Section
	a. Thermostat Defective b. Thermostat Out of Calibration c. Heat Build-Up Due to Loose Wires d. Defective Limit (ECO)	a. **Replace b. **Lower setting or replace c. **Tighten wire connections d. **Replace
	4. Solar System Incorrectly Installed	**Check installation
Not Enough Hot Water	5. Defective Element	**Replace element
	6. Leaking Plumbing or Open Hot Water Faucet(s)	**Ensure all faucet(s) are closed. Check water meter
	1. Heater Undersized	Reduce rate of hot water use
	2. Defective Element	**Check amperage, replace element
	3. Defective Thermostat or Wired Incorrectly	**Check wiring or replace
Water Too Hot or Not Hot Enough	4. Solar System Incorrectly Installed	**Check installation
	5. See #6 above in "No Hot Water"	See #6 above in "No Hot Water"
	1. Thermostat Setting Too High or Low	Change setting as required
	2. Thermostat Out of Calibration	**Replace
Noisy Heating Element	3. Solar System Incorrectly Installed	**Check installation
	4. Grounded Element	**Replace
	Scale Built Up on Element	**Remove and clean

Table 5 - Troubleshooting - See Water Heater Installation Manual for More Detailed Maintenance Information - ** USER - For your safety, DO NOT attempt repair of electrical wiring, thermostat, or operating controls. Refer repairs to qualified service personnel.

CAUTION

If draining of the water heater is necessary, open the T&P valve or a hot water tap to prevent vacuum buildup in the tank and piping.

Part 10 - System Parts Listing

A. Estimated Component Life

These water storage tanks are designed for 12 – 20 years of use. When installed and maintained as directed by this manual, one can expect many years of trouble-free service from this solar system. However, all components in this system are subject to installation conditions. For example: Where hard water is present, mineral deposits can shorten the life of components. Periodic maintenance as prescribed by this manual ensures that these components are well protected from such damage.

B. Warranties and Disclaimers

NOTE: WE EXCLUDE ANY WARRANTY FOR, OR LIABILITY FROM ACTS OF NATURE, INCLUDING FREEZE DAMAGE.

Warranty periods for tank components are listed in the table below:

Manufacturer	Item	Model #	Component Coverage	Tank Coverage*
HTP, Inc.	Stainless Steel Solar Water Heater w/ Back-Up Heat Exchanger	SSU-60SB	1 Year	Residential Lifetime Commercial Seven (7) Years
		SSU-80SB		
		SSU-119SB		
	Stainless Steel Solar Water Heater w/ Back-Up Electric Element	SSU-60SE		
		SSU-80SE		
		SSU-119SE		

Table 6 - Warranty Periods - *See Standard Product Installation Manual for Product Specific Warranty Details

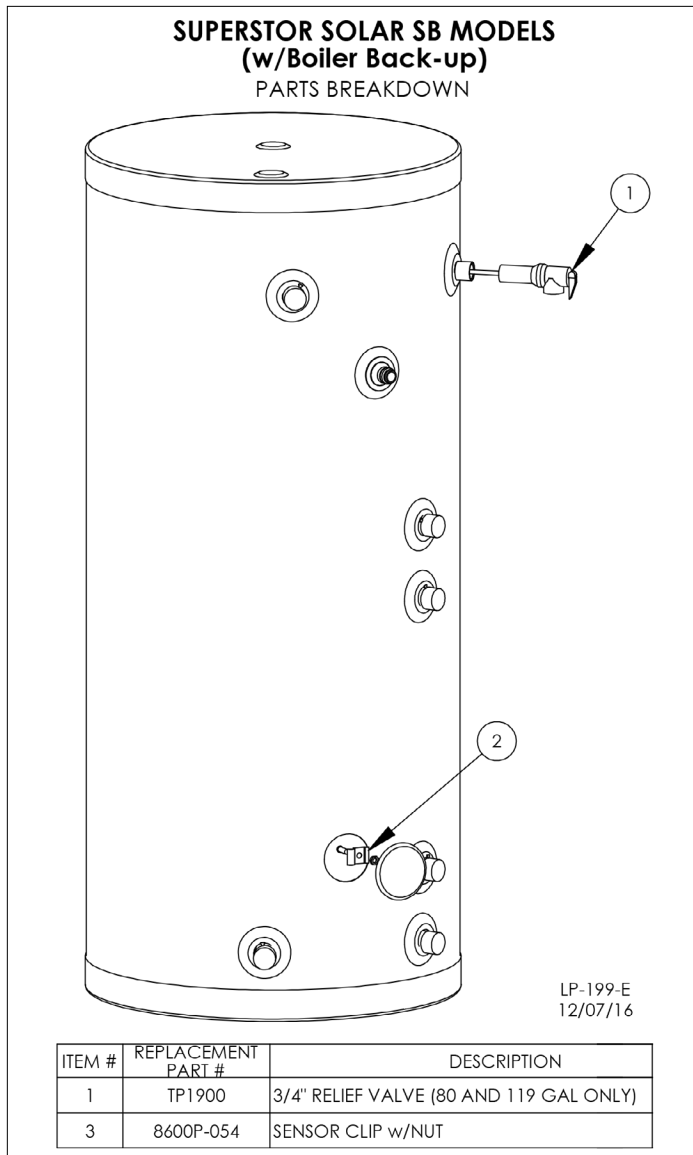


Figure 13 - Replacement Parts, SB Models

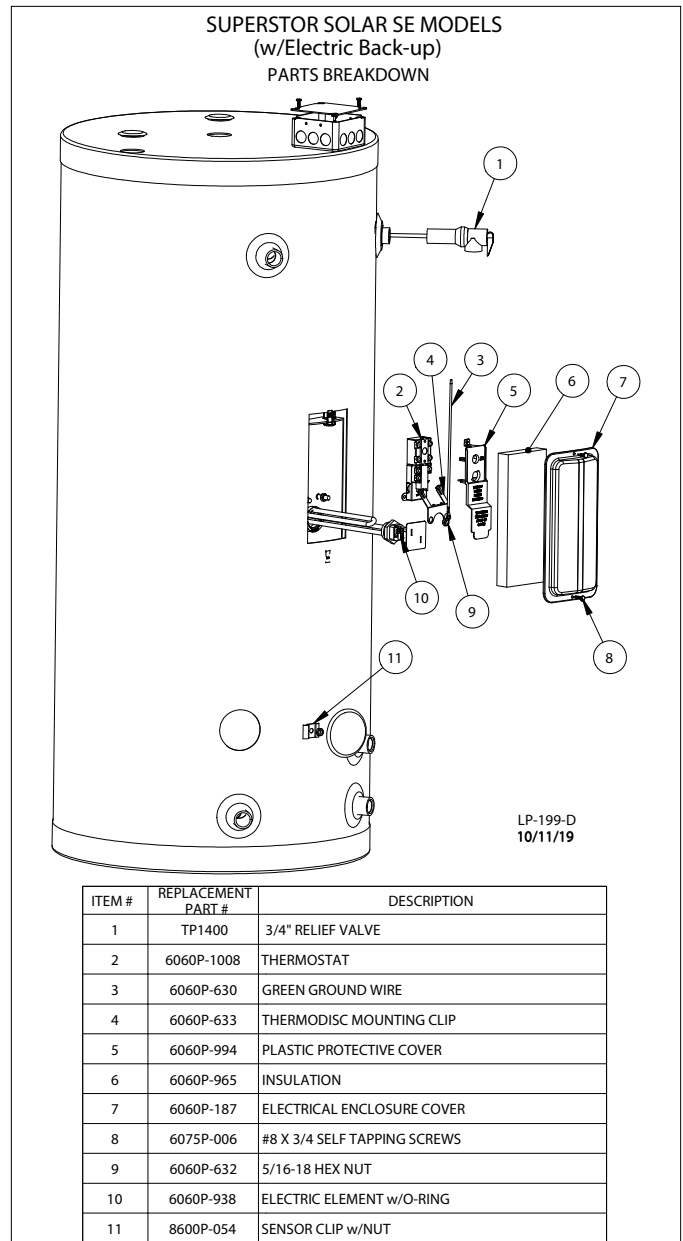


Figure 14 - Replacement Parts, SE Models

NOTE: If the heating element needs replacement, it is VERY important to use the same voltage, wattage, and construction. Use only HTP elements. Failure to do so may lead to early element and/or water heater failure, and WILL VOID the warranty.

Product Information



DOWFROST

Inhibited Propylene Glycol-based Heat Transfer Fluid

DOWFROST* heat transfer fluid contains specially formulated packages of industrial inhibitors that help prevent corrosion. Because propylene glycol fluids have low acute oral toxicity, DOWFROST propylene glycol-based fluids are often used in applications where contact with food or beverage products could occur.

Recommended use temperature range: -45°C (-50°F) to 120°C (250°F)

Suitable applications: secondary cooling and heating, freeze and burst protection of pipes, various deicing, defrosting, and dehumidifying.

For health and safety information for this product, contact your Dow sales representative or call the number for your area on the second page of this sheet for a Material Safety Data Sheet (MSDS).

Typical Concentrations of DOWFROST Fluid Required to Provide Freeze and Burst Protection at Various Temperatures

Temperature °C (F°)	Percent DOWFROST Fluid Concentration Required	
	For Freeze Protection Volume %	For Burst Protection Volume %
-7 (20)	18	12
-12 (10)	29	20
-18 (0)	36	24
-23 (-10)	42	28
-29 (-20)	46	30
-34 (-30)	50	33
-40 (-40)	54	35
-46 (-50)	57	35
-51 (-60)	60	35

NOTE: These figures are examples only and may not be appropriate to your situation. Generally, for an extended margin of protection, you should select a temperature in this table that is at least 3°C (5°F) lower than the expected lowest ambient temperature. Inhibitor levels should be adjusted for solutions of less than 30% glycol. Contact Dow for information on specific cases or further assistance.

ATTENTION: These are typical numbers only and are not to be regarded as specifications. As use conditions are not within its control, Dow does not guarantee results from use of the information or products herein; and gives no warranty, express or implied.

Typical Freezing and Boiling Points of DOWFROST Fluid†

Wt. % Propylene Glycol	Vol. % Propylene Glycol	Wt. % DOWFROST	Vol. % DOWFROST	Freezing Point °C (°F)	Boiling Point °C @ 101 kPa (°F @ 760 mmHg)	Degree Brix††	Refractive Index 22°C (72°F)
0.0	0.0	0.0	0.0	0 (32.0)	100.0 (212)	0.0	1.3328
5.0	4.8	5.2	5.2	-1.6 (29.1)	100.0 (212)	4.8	1.3383
10.0	9.6	10.5	10.0	-3.3 (26.1)	100.0 (212)	8.4	1.3438
15.0	14.5	15.7	15.1	-5.1 (22.9)	100.0 (212)	12.9	1.3495
20.0	19.4	20.9	20.3	-7.1 (19.2)	100.6 (213)	15.4	1.3555
25.0	24.4	26.1	25.5	-9.6 (14.7)	101.1 (214)	19.0	1.3615
30.0	29.4	31.4	30.7	-12.7 (9.2)	102.2 (216)	22.0	1.3675
35.0	34.4	36.6	36.0	-16.4 (2.4)	102.8 (217)	26.1	1.3733
40.0	39.6	41.8	41.4	-21.1 (-6.0)	103.9 (219)	29.1	1.3790
45.0	44.7	47.0	46.7	-26.7 (-16.1)	104.4 (220)	31.8	1.3847
50.0	49.9	52.3	52.2	-33.5 (-28.3)	105.6 (222)	34.7	1.3903
55.0	55.0	57.5	57.5	-41.6 (-42.8)	106.1 (223)	38.0	1.3956
60.0	60.0	62.7	62.7	-51.1 (-59.9)	107.2 (225)	40.6	1.4008
65.0	65.0	68.0	68.0	a	108.3 (227)	42.1	1.4058
70.0	70.0	73.2	73.2	a	110.0 (230)	44.1	1.4104
75.0	75.0	78.4	78.4	a	113.9 (237)	46.1	1.4150
80.0	80.0	83.6	83.6	a	118.3 (245)	48.0	1.4193
85.0	85.0	88.9	88.9	a	125.0 (257)	50.0	1.4235
90.0	90.0	94.1	94.1	a	132.2 (270)	51.4	1.4275
95.0	95.0	99.3	99.3	a	154.4 (310)	52.8	1.4315

† Typical properties, not to be construed as specifications

†† Degree Brix is a measure of the sugar concentration in a fluid and is important in fermentation and syrups applications. Although there is no sugar present in DOWFROST heat transfer fluids, the glycol affects the refractive index of the fluid in a similar fashion.

^a Freezing points are below -50°C (-60°F).

NOTE: Generally, for an extended margin of protection, you should select a temperature in this table that is at least 3°C (5°F) lower than the expected lowest ambient temperature. Inhibitor levels should be adjusted for solutions of less than 30% glycol. Contact Dow for information on specific cases or further assistance.

*Trademark of The Dow Chemical Company

DOWFROST

Inhibited Propylene Glycol-based Heat Transfer Fluid

Typical Properties of DOWFROST Fluid†

DOWFROST Heat Transfer Fluid	
Composition (% by weight)	
Propylene Glycol	96
Performance Additives	4
Color	Colorless
Specific Gravity	
15/15°C (60/60°F)	1.050–1.060
pH of Solution	
(50% glycol)	9.0–10.0
Reserve Alkalinity (min.)	10.0 ml

†Typical properties, not to be construed as specifications. Complete sales specifications are available on request.

Saturation Properties of DOWFROST Fluid at 30% Propylene Glycol Concentration by Volume

Temp. °C (°F)	Specific Heat kJ/(kg)(K) (Btu/lb°F)	Density kg/m³ (lb/ft³)	Therm. Cond. W/mK [Btu/hr ft² (°F/ft)]	Viscosity mPa·s (cps)
10 (50)	3.821 (0.913)	1033.71 (64.53)	0.4344 (0.2510)	4.5068 (4.51)
40 (104)	3.903 (0.933)	1019.56 (63.65)	0.4622 (0.2670)	1.6295 (1.63)
65 (149)	3.972 (0.949)	1004.26 (62.69)	0.4771 (0.2757)	0.9144 (0.91)
90 (194)	4.041 (0.966)	985.77 (61.54)	0.4846 (0.2800)	0.6040 (0.60)
120 (248)	4.123 (0.985)	959.35 (59.89)	0.4838 (0.2795)	0.4246 (0.42)

Saturation Properties of DOWFROST Fluid at 40% Propylene Glycol Concentration by Volume

Temp. °C (°F)	Specific Heat kJ/(kg)(K) (Btu/lb°F)	Density kg/m³ (lb/ft³)	Therm. Cond. W/mK [Btu/hr ft² (°F/ft)]	Viscosity mPa·s (cps)
-20 (-4)	3.569 (0.853)	1053.16 (65.75)	0.3635 (0.2100)	48.9043 (48.90)
10 (50)	3.668 (0.877)	1042.14 (65.06)	0.3936 (0.2274)	7.2173 (7.22)
40 (104)	3.768 (0.900)	1026.49 (64.08)	0.4150 (0.2398)	2.2389 (2.24)
65 (149)	3.850 (0.920)	1009.90 (63.05)	0.4262 (0.2463)	1.1762 (1.18)
90 (194)	3.933 (0.940)	990.10 (61.81)	0.4313 (0.2492)	0.7462 (0.75)
120 (248)	4.032 (0.964)	962.08 (60.06)	0.4294 (0.2481)	0.5084 (0.51)

Saturation Properties of DOWFROST Fluid at 50% Propylene Glycol Concentration by Volume

Temp. °C (°F)	Specific Heat kJ/(kg)(K) (Btu/lb°F)	Density kg/m³ (lb/ft³)	Therm. Cond. W/mK [Btu/hr ft² (°F/ft)]	Viscosity mPa·s (cps)
-30 (-22)	3.339 (0.798)	1064.83 (66.48)	0.3246 (0.1875)	172.8273 (172.83)
-20 (-4)	3.378 (0.807)	1061.71 (66.28)	0.3336 (0.1927)	73.0193 (73.02)
10 (50)	3.493 (0.835)	1049.25 (65.50)	0.3560 (0.2057)	10.6481 (10.65)
40 (104)	3.609 (0.863)	1032.17 (64.44)	0.3716 (0.2147)	3.1103 (3.11)
65 (149)	3.706 (0.886)	1014.40 (63.33)	0.3792 (0.2191)	1.5483 (1.55)
90 (194)	3.802 (0.909)	993.42 (62.02)	0.3821 (0.2208)	0.9339 (0.93)
120 (248)	3.918 (0.936)	964.00 (60.18)	0.3792 (0.2191)	0.6029 (0.60)

For further information, call...

In the United States and Canada: 1-800-447-4369 • FAX: 1-989-832-1465

In Europe: +32 3 450 2240 • FAX: +32 3 450 2815

In the Pacific: +886 22 547 8731 • FAX: +886 22 713 0092

In other Global Areas: 1-989-832-1560 • FAX: 1-989-832-1465

www.dowfrost.com

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VISCOSITY: The HTF viscosity over the service temperature range is based on a specific gravity 15/15°C (60/60°F) 1.053-1.063. DOWFROST inhibited glycol-based fluid has an effective operating temperature range of -50°F to 250°F. At temperatures below -50°F, increased viscosity (>1,000 centipoise) can make use of DOWFROST impractical unless larger pumps are installed. At the upper end of the operating range for DOWFROST fluid, a maximum bulk temperature of 250°F is recommended. Film temperature should not exceed 300°F. DOWFROST fluid can tolerate brief temperature excursions up to 100°F above the maximum recommended temperatures. However, extended exposure of the fluid to temperatures in excess of 50°F above the maximum recommended temperatures will result in accelerated degradation of the glycol and inhibitor systems. In addition, the film temperature should remain within 50°F of the bulk fluid temperature and the pressure at all points in the system should be at least 5 psi greater than the vapor pressure exerted by the fluid to avoid localized boiling and resulting precipitation. At temperatures above 150°F, the system must be closed to avoid rapid oxidation of the propylene glycol, inhibitor depletion, and subsequent increased corrosion. Automatic make-up water systems should be avoided in order to prevent undetected dilution or loss of glycol and consequent loss of freeze and corrosion protection.

FLAMMABILITY: When mixed with water, DOWFROST is not flammable, as the fluid has no measurable flash point (Pensky-Martens Closed Cup) in concentrations up to 80% glycol. Undiluted DOWFROST has a flash point of 214°F (Pensky-Martens Closed Cup). It is possible to ignite solutions of propylene if enough water has been vaporized and the concentration of propylene glycol increases to greater than 80 percent.

INSPECTION AND TREATMENT OF HEAT TRANSFER FLUID: You can quickly determine the condition of your fluid by examining its appearance and odor. Any drastic variation from the initial fluid specifications, such as a black or dark-grey color, presence of an oily layer, burnt odor, or any heavy sludge in the fluid may indicate the need for replacement.

TESTING THE FLUID pH LEVEL: Control of pH between 8 and 10 is important to minimize corrosion and glycol degradation. Using narrow range pH paper, such as pHDrion Control paper with a 7.2 to 8.8 pH range, is an easy and reliable way to read your pH level. A pH tester can also measure alkalinity or acidity and give you an indication of the reserve alkalinity or inhibitor level of the fluid. The desirable pH range should fall between 8.0 and 10.0. Adjustments can be made using a 50% solution of sodium hydroxide or potassium hydroxide if the pH is approaching the acidic range (below 8.0). An inexpensive pH tester is available from Misco Products. The accuracy of this product is +/- 0.5 pH. Contact Misco Products at 1-800-358-1100 and ask for the Dow discount.

SPILL, LEAK, AND DISPOSAL PROCEDURES: Using appropriate safety equipment, small spills may be soaked up with common absorbent material. For large spills, the fluid should be pumped into suitable containers located in diked areas. Residual material should be cleaned up with water. Concentrate can be handled according to local, state, and federal regulations.

EMERGENCY OVERVIEW

POTENTIAL HEALTH EFFECTS

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

FIRST AID: FLUSH EYES WITH PLENTY OF WATER

SKIN CONTACT: Prolonged contact is essentially non-irritating to skin. A single prolonged exposure is not likely to result in the material being absorbed through the skin in harmful amounts.

Repeated exposure may cause flaking and softening of skin.

FIRST AID: WASH OFF IN FLOWING WATER OR SHOWER

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

FIRST AID: NONE REQUIRED

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

FIRST AID: REMOVE TO FRESH AIR.

IF EFFECTS OCCUR, CONSULT A PHYSICIAN.

NOTE TO PHYSICIAN: NO SPECIFIC ANTIDOTE.

SUPPORTIVE CARE. TREATMENT BASED ON

JUDGEMENT OF THE PHYSICIAN IN RESPONSE TO

THE REACTION OF THE PATIENT. CONSULT DOW CHEMICAL

24 HOUR EMERGENCY 1-989-636-4400

Solar System Replacement Parts		
Part	Company	Model
Controller	Steca	TRO301
	Goldline	GL-30
	Heliotrope	Thermal Delta T
	Caleffi	
Pump	Taco	007
	Grundfos	15-58F
	Wilo	
Expansion Tank	Amtrol	Extrol #30
	Caleffi	
Check Valve	Watts	Series 600*
		*(Alternate Approved Equivalent)
Pressure Relief Valve	Watts	3L (75 psig)
	Conbraco	
Air Vent	Taco	417*
		*(Alternate Approved Equivalent)
Mixing Valve	Taco	500 Series
	Watts	1170 Series
	Honeywell	AM101 Series
	Cache Acme	Heatguard 110 Series
	Caleffi	
Piping		Copper
Heat Transfer Fluid	Dow Chemical	DOWFROST (DOWFROST HD Approved for Use with DW Models)
		Potable Water

Figure 15 - Replacement Parts for Solar System

Approved Systems				
System Models	Model Number	Solar Collector Company	Model	# of Collectors
2007019A 2007021A	PR-60-32-EB PR-60-32-BB	AET	AE-32 MSC-32	1
		HTP	SS-32 SS-32-FP	
2007019B 2007021B 30004189	PR-80-40-EB PR-80-40-BB DB-80-40-EB	AET	AE-40 MSC-40	1
		HTP	SS-40 SS-40-FP	
2007019C 2007021C 30004188 30004186	PR-119-64-EB PR-119-64-BB DB-80-64-EB DB-119-64-EB	AET	AE-32 MSC-32	2
		HTP	SS-32 SS-32-FP	
30004187 30004185	DB-80-80-EB DB-119-80-EB	AET	AE-40 MSC-40	2
		HTP	SS-40 SS-40-FP	
30004184	DB-119-96-EB	AET	AE-32 MSC-32	3
		HTP	SS-32 SS-32-FP	

Figure 16 - Approved Systems

	This product certified by: Solar Rating & Certification Corporation™ www.Solar-Rating.org 		HTP, Inc. 272 DUCHAINE BLVD NEW BEDFORD, MA 02745 USA
	Solar Energy Factor (SEF _D)	SRCC Cert. No.	Model No.
2.7	2007019C	PR-119-64-EB	
2.1	2007019B	PR-80-40-EB	
1.7	2007019A	PR-60-32-EB	
2.3	2007021C	PR-119-64-BB	
1.9	2007021B	PR-80-40-BB	
1.7	2007021A	PR-60-32-BB	
1.9	30004189	DB-80-40-EB	
2.9	30004188	DB-80-64-EB	
4.2	30004187	DB-80-80-EB	
2.4	30004186	DB-119-64-EB	
3.2	30004185	DB-119-80-EB	
4.5	30004184	DB-119-96-EB	

The installed system is marked above.

Table 7 - Approved Systems: **INSTALLER: Make a note of the installed system in the table above.**

Model Number Key: The first two letters refer to the type of system, followed by solar storage tank gallons, square footage of collectors, and back-up type. For example: PR-80-40-BB refers to a Pressurized System with 80 gallons of storage, a 40 square foot solar collector, and a Boiler Back-up.

SRCC OG-300 LABEL SET

The following labels must be attached to the relevant valves in the system in order for it to be considered OG-300 compliant. This page should be laminated, each label cut from it, punched in the margin at the left hand side and affixed to the appropriate valve with a wire tie, plastic ties are inappropriate due to high operating temperatures. Failure to affix these labels will void the SRCC OG-300 system certification.

VALVE 6 COLLECTOR ARRAY ISOLATION VALVE

VALVE 6 IS NORMALLY OPEN DURING OPERATION. IT IS CLOSED TO ISOLATE THE STORAGE TANK FROM THE COLLECTOR ARRAY SHOULD THE STORAGE TANK NEED SERVICING OR REPLACING.

VALVE 11 COLLECTOR ARRAY ISOLATION VALVE

VALVE 11 IS NORMALLY OPEN DURING OPERATION. IT IS CLOSED TO ISOLATE THE STORAGE TANK FROM THE COLLECTOR ARRAY SHOULD THE STORAGE TANK NEED SERVICING OR REPLACING.

VALVE 8 COLLECTOR ARRAY FILL/DRAIN VALVE

PLEASE CONSULT YOUR INSTALLATION MANUAL FOR SPECIFIC FREEZE TOLERANCE INFORMATION.

A 60% CONCENTRATION OF DOWFROST PROPYLENE GLYCOL AND DISTILLED WATER CAN PROTECT YOUR SUPERSTOR SOLAR SYSTEM TO TEMPERATURES AS LOW AS -65° F. LOWER CONCENTRATIONS OF DOWFROST AND DISTILLED WATER WILL PROVIDE A LOWER LEVEL OF FREEZE PROTECTION.

VALVE 24 COLD WATER SUPPLY BALL VALVE

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

VALVE 8 COLLECTOR ARRAY FILL/DRAIN VALVE **(WARNING HOT)**

VALVE 8 IS NORMALLY CLOSED. WHEN OPEN, IT IS USED TO CHARGE AND DRAIN THE SOLAR COLLECTOR LOOP PIPING.

THE HEAT TRANSFER FLUID USED IN THIS SYSTEM IS DOWFROST PROPYLENE GLYCOL. IT MUST BE HANDLED AND DISPOSED OF IN ACCORDANCE WITH THE DOW CHEMICAL COMPANY MATERIAL SAFETY DATA SHEET. A COPY OF THE MSDS HAS BEEN PROVIDED WITH YOUR INSTALLATION MANUAL. 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 CAREFUL WHEN DRAINING THIS FLUID. IT MAY BE DISCHARGED AT A VERY HIGH TEMPERATURE AND/OR PRESSURE.

VALVE 10 COLLECTOR ARRAY FILL/DRAIN VALVE **(WARNING HOT)**

VALVE 10 IS NORMALLY CLOSED. WHEN OPEN, IT IS USED TO CHARGE AND DRAIN THE SOLAR COLLECTOR LOOP PIPING.

THE HEAT TRANSFER FLUID USED IN THIS SYSTEM IS DOWFROST PROPYLENE GLYCOL. IT MUST BE HANDLED AND DISPOSED OF IN ACCORDANCE WITH THE DOW CHEMICAL COMPANY MATERIAL SAFETY DATA SHEET. A COPY OF THE MSDS HAS BEEN PROVIDED WITH YOUR INSTALLATION MANUAL. 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 CAREFUL WHEN DRAINING THIS FLUID. IT MAY BE DISCHARGED AT A VERY HIGH TEMPERATURE AND/OR PRESSURE.

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Customer Installation Record Form	
The following form should be completed by the installer for you to keep as a record of the installation in case of a warranty claim. After reading the important notes at the bottom of the page, please also sign this document.	
Customer's Name	
Date of Installation	
Installation Address	
Product Name / Serial Number(s)	
Comments	
Installer's Code / Name	
Installers Phone Number	
Signed by Installer	
Signed by Customer	
Installation Notes	

IMPORTANT

Customer: Please only sign after the installer has fully reviewed the installation, safety, proper operation, and maintenance of the system. If the system has any problems please call the installer. If you are unable to make contact, please call your sales representative.

Distributor / Dealer: Please insert contact details.