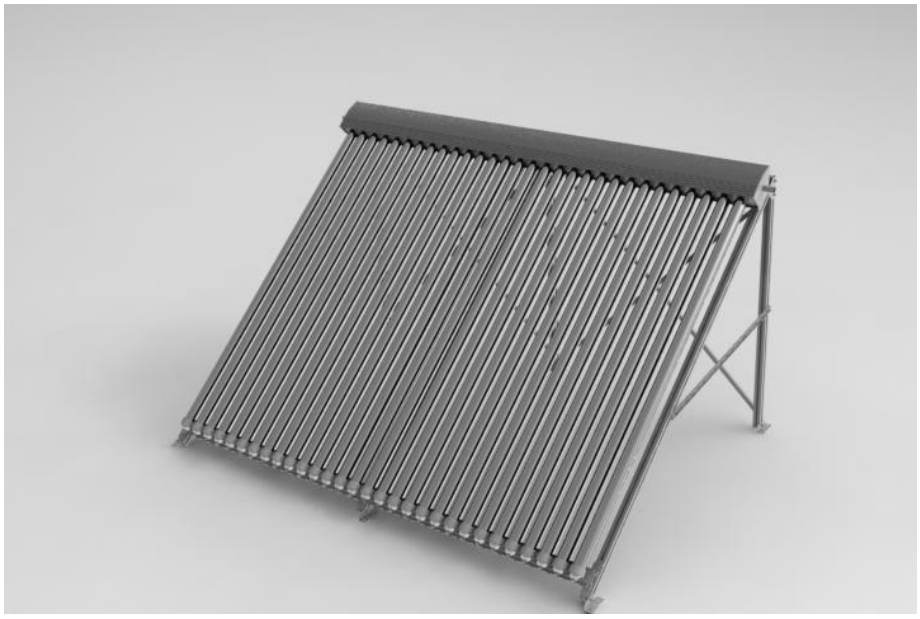
Evacuated Tube Solar Collector



INSTALLATION

MANUAL

HP-30SC

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

120 Braley Rd. P.O. Box 429 East Freetown, MA 02717-0429 www.htproducts.com

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 information concerning the product.

⚠ DANGER

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

⚠ WARNING

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

⚠ CAUTION

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

CAUTION

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

FOREWORD

This manual is intended to be used in conjunction with other literature provided with the Evacuated Tube Solar Collector. This includes all related control information. It is important that this manual, all other documents included with this system, and additional publications including Solar Water Heating System Design and Installation Guidelines, 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.”

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

NOTE TO CONSUMER: PLEASE KEEP ALL INSTRUCTIONS 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, and personal injury. Solar hot water system shall be properly installed in accordance with this manual before use.

INSTALLATION OR SERVICE OF THESE SOLAR PANELS 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, local codes and utility company requirements. Preference should be given to codes and requirements where they differ from the furnished instructions.

Additional publications which should guide the installer include:

Solar Water Heating System Design and Installation Guidelines, SRCC OG-300, from Solar Rating and Certification Corporation, 1679 Clearlake Road, Cocoa, FL 32922-5703.

Code for the installation of Heat Producing Appliances (latest version), is available from American Insurance Association, 85 John Street, New York, NY 11038.

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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INTRODUCTION

ABOUT YOUR EVACUATED TUBE SOLAR COLLECTOR

Your Evacuated Tube Solar Collector is designed to offer reliable hot water heating in mild to cold climates. Evacuated tubes provide insulation around heat pipes, and work with both glycol and drain back solar systems, making these solar collectors an ideal choice in cold climates where flat panel collectors are not an option.

Perhaps most important of all, if an evacuated tube (or tubes) should break, there is no need to shut down your system. The Evacuated Tube Solar Collector will continue to function until the damaged tube(s) can be replaced.

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

- Plumbing Connections
- Piping and Insulation
- Valves Between Your Backup Water System and the Solar System

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

PART 1: GENERAL SAFETY INFORMATION

NOTE: OBTAIN ALL APPLICABLE PERMITS AND OBEY ALL LOCAL CODES.

⚠ CAUTION

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

CAUTION

Install all system components and piping in such a way that does not reduce the performance of any fired rated assembly.

A. METALLIC COMPONENTS

⚠ CAUTION

Always wear leather protective gloves when handling solar collector components. All efforts have been made to make the metal components safe to handle, but there may still be some sharp edges.

B. EVACUATED TUBES

Be careful when handling the evacuated tubes, as they will break if knocked heavily or dropped.

⚠ CAUTION

If exposed to sunlight, hot, and have internal pressure built up, the tubes may explode rather than implode if knocked and broken. This is a rare occurrence, but safety precautions should be taken.

When installed, evacuated tubes may break if struck by a hard object with enough force (e.g. branch falling on roof). DURING INSTALLATION, CONSIDERATION SHOULD BE TAKEN AS TO THE

POSSIBLE PATH ANY BROKEN GLASS MAY TAKE. Where possible, protection should be provided to prevent broken glass from reaching ground level where somebody could walk on it.

THE HOMEOWNER SHOULD BE MADE AWARE BY THE INSTALLER THE LOCATION OF THE SOLAR COLLECTOR AND THE POSSIBLE VICINITY OF BROKEN GLASS IN THE EVENT OF AN EXTREME STORM OR OBJECT FALLING ON THE COLLECTOR.

C. HIGH TEMPERATURES

⚠ CAUTION

In good sunlight, the heat pipe tip on the evacuated tube can reach temperatures in excess of 392^{o} F. Thick leather gloves must be worn when handling hot tubes and heat pipes to prevent serious burns.

⚠ CAUTION

Keep solar hot water system and components away from children and animals.

⚠ CAUTION

In an installed, fully plumbed system, if the pump is stopped during good sunlight, the collector header and piping close to the solar manifold can easily reach temperatures in excess of 320^{o} F. Caution should be taken when handling such components.

DO NOT STORE COMBUSTIBLE MATERIALS (DRY LEAVES, TREE BRANCHES, GASOLINE, ETC) IN VICINITY OF THE SYSTEM.

D. HEALTH AND SAFETY

- ALWAYS WEAR SAFETY GLASSES WHEN HANDLING EVACUATED TUBES.
- WEAR LEATHER GLOVES WHEN HANDLING METAL COMPONENTS.
- WEAR THICK LEATHER GLOVES IF HANDLING HOT HEAT PIPES.
- ADHERE TO SAFETY REGULATIONS WHEN WORKING ON ROOFS (OR AT A HEIGHT).
- ALWAYS OBTAIN ENGINEER APPROVAL FOR INSTALLATIONS IN HIGH WIND REGIONS.
- ASSEMBLY OF THE SOLAR HOT WATER SYSTEM REQUIRES TWO PERSONS WITH THE ABILITY TO LIFT 50 POUNDS EACH.
- BEST TO INSTALL ON A COOL, CLOUDY DAY.
- STORE EVACUATED TUBES IN DARK OR SHADED PLACES UNTIL INSERTION INTO THE MANIFOLD.

⚠ WARNING

If any system components are exposed to the following, do not operate until the affected component has been inspected by a qualified serviceman.

1. FIRE
2. DAMAGE
3. SUBMERSION IN WATER

Any claims for damage or shortage in shipment must be filed immediately against the transportation company by the consignee.

Use of lead solder is expressly prohibited. Use of galvanized steel, CPVC, PVC, PEX, or any other type of plastic pipe is prohibited.

PART 2: IMPORTANT INFORMATION

A. SCOPE OF MANUAL

This manual pertains only to the installation and operation of the HTP Solar Collector. Details for the installation, operation and maintenance of the complete solar gas/electric water heating system including, but not limited to storage tank, gas/electric booster, 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 installation officers, as the solar collector is not permitted to be installed by non-authorized persons.

B. LOCAL STANDARDS

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

C. AUTHORIZED PERSONS

Installation must 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 in section 3, no part of the HTP solar collector may be inspected, repaired, or maintained by anybody other than an authorized person.

D. TERMINOLOGY

The terminology used from region to region differs. To avoid confusion please note the following:

Supply - The plumbing line running from the outlet of the collector back to the tank.
Return - The plumbing line running from the tank (or heat exchanger) to the inlet of the collector. This line incorporates the circulation pump.
Insulation - Solar radiation level, expressed in kWh/m^2/day or Btu/ft^2/day

E. POSSIBLE SYSTEM DESIGNS

1. OPEN LOOP SYSTEMS

For open loop systems, the normal operating pressure should be < 72.5 psi via use of a pressure limiting (pressure reduction) valve on the main cold supply line.

It is acceptable for the system design to allow the solar collector to stagnate to prevent additional heating of the storage tank (i.e. pump stoppage once tank temperature reaches 177^o F). The pressure relief valve must be able to release the pressure increase that occurs when the manifold stagnates, and should be rated to meet the maximum possible heat output of the solar collector(s). Please see Part 6, Section F regarding insulation of piping for high temperatures, and Part 3 for sections regarding overheating.

2. CLOSED LOOP SYSTEMS

For closed loop systems, the solar loop must operate at < 72.5 psi, and have an expansion vessel installed to control water expansion. The system design MUST NOT allow stagnation of the collector as a standard form of controlling tank temperature, as this may cause damage to the glycol.

Any system design must provide means for allowing pressure release at no more than 113 psi. It is recommended that the lever on 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 the PTRV have a copper pipe connected, running the expelled hot water or air to a safe and appropriate drainage location. The PRTV and the drain outlet pipe must not be sealed or blocked. It is normal for the valve to release small amounts of water during heating cycles.

3. DRAIN BACK SYSTEMS

For drain back systems, the solar loop usually operates at < 25 psi, far lower than open or closed loop systems. Drain back systems require larger pumps to move water up and into the solar collectors. But when storage water temperature settings are reached, or freezing outdoor temperatures are detected, the pump shuts off, allowing the heat transfer fluid to drain back into the tank. Thus, the drain back method provides effective overheating and freeze protection, making these systems well-suited for cold and mild climate operation.

Since drain back systems don't operate at high pressures, an expansion vessel is not required. Install a PTRV on the drain back tank, with a copper pipe running expelled hot water and air to a safe and appropriate drainage location. The PRTV and drain outlet pipe must never be sealed or blocked.

NOTE: The collector and collector plumbing should be sloped down toward the drain back reservoir at ¼" per foot minimum to allow the system to drain.

F. FLUID QUALITY

Water in direct flow through the manifold header must first meet potable water requirements and, in addition, the following:

TOTAL DISSOLVED SOLIDS	<600 ppm
TOTAL HARDNESS	<200 ppm ÷ 17.1 = 11.7 grains
CHLORIDE	<40 ppm
FREE CHLORINE	<5 ppm
MAGNESIUM	<10 ppm

Table 1

In areas with "hard" water (> 200 ppm), lime scale may form inside the header pipe (where a direct flow format is used). In such regions, it is advisable to install a water softening device to ensure the long term efficient operation of the collector, or use a closed loop for the solar circulation loop.

In order to meet health and safety regulations, glycol used should be food grade polypropylene glycol, FDA rated as "generally recognized as safe" (GRAS). If using a glycol/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 should be checked periodically to prevent it from becoming acidic; please refer to the guidelines provided by the glycol manufacturer regarding maintenance of glycol.

G. METALLIC CORROSION

Both copper & stainless steel are susceptible to corrosion when, amongst other factors, high concentrations of chloride are present. The solar collector may be used for heating of spa or pool water, but levels of free chlorine must not exceed 5ppm, otherwise the copper header could corrode.

NOTE: HTP DOES NOT WARRANT THE SOLAR COLLECTOR AGAINST CORROSION RELATED DAMAGE.

H. FREEZE PROTECTION

Freeze protection must be implemented in any regions that 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 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^{o}C / 23^{o}F, a simple low temperature controller based freeze protection may be used (e.g. pump circulates if the manifold temperature approaches freezing). If possible, backup protection in the form of uninterrupted power supply (UPS) or freeze valves (which open to allow water to dribble out) should also be installed.

For areas with temperatures below –5^{o}C / 23^{o}F, a closed loop filled with a polypropylene glycol-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 polypropylene-glycol, FDA rated as GRAS, should be used.

Evacuated tubes are not susceptible to damage in cold weather, and heat pipes are protected against damage that could result from the freezing of the water inside.

NOTE: HTP DOES NOT WARRANT THE SOLAR COLLECTOR AGAINST FREEZE RELATED DAMAGE.

I. COLLECTOR DIMENSIONS & WEIGHTS

MODEL	HP30SC
# OF TUBES	30
WEIGHT (LBS)	252
DIMENSIONS (INCHES)	101 X 79 X 58
NET APERTURE AREA (FT^2)	30.04
STORAGE TANK SIZE (GALLONS)	70 +
NOMINAL FLOW RATE (GAL/MIN)	0.84

Table 2

J. WIND STRESS

When installing the collector, 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.

For flush mounting on a pitched roof, a minimum of two attachment points per front track must be made, each with minimum pull strength of 100kg / 220lb. If this cannot be achieved, additional attachment points must be made to achieve minimum strength levels.

If installing the low, mid, high or fixed angle roof frames, a minimum of two attachment points per front track must be made, each with a minimum pull strength of 150kg / 330lbs. If this cannot be achieved, additional attachment points must be made to achieve minimum strength levels.

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.

K. SNOW LOAD

In areas prone to heavy snowfall, the solar collectors should ideally be installed at an angle of 50^{o} or greater to help promote snow sliding off the tubes. In addition, it is advisable to raise the front of the collector frame 15 – 20 cm off the roof surface, as this sits the collector above moderate snowfall and allows snow to more easily slide out from under the collector. A front track extension can be used for this purpose.

Please refer to local regulations regarding snow loading precautions.

L. STORAGE TANKS

Glass lined storage tanks: Please note that 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.

⚠ CAUTION

To dissipate hydrogen safely, it is recommend 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 appliance. During this process there must be no smoking or open flame or any other electrical appliance operating nearby. If hydrogen is discharged through the tap it will usually sound like air escaping.

M. HAIL RESISTANCE

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

It is recommended that in areas prone to large hail (> 3/4") the solar collector should be installed at an angle of 40^{o} or greater to provide optimum protection. This is generally a common installation angle, as many populated areas in the world fall within 30-70^{o} latitude.

If a tube should break, it can be easily replaced. Though a reduction in heat output will result, the solar collector can still function properly with one or more broken tubes (heat reduction depends upon how many tubes are broken). A broken tube should be replaced by authorized persons only.

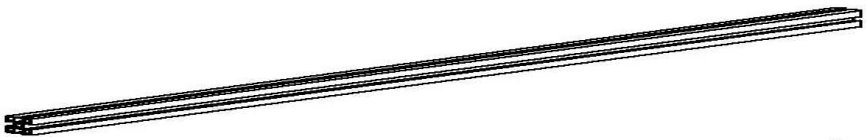
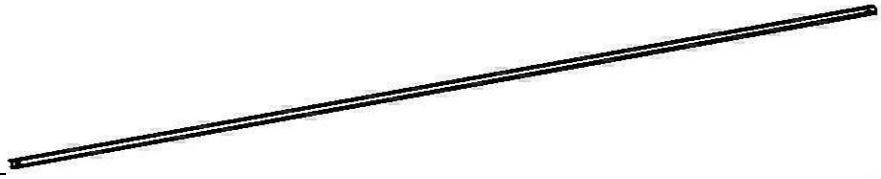
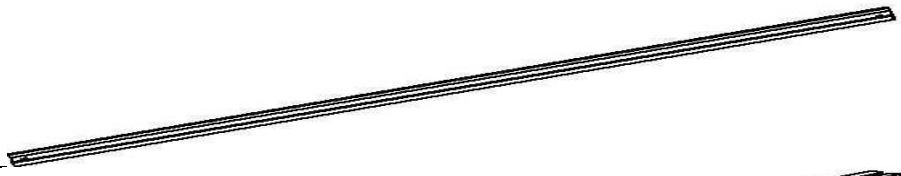
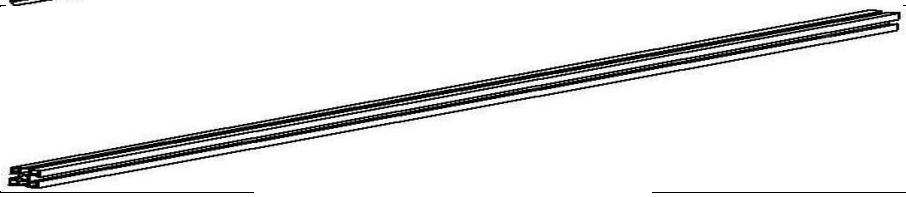
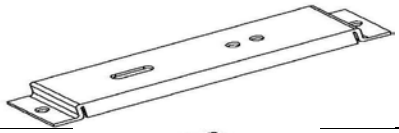
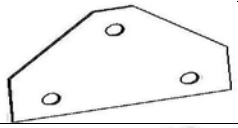
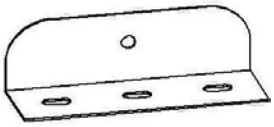
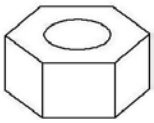
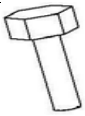
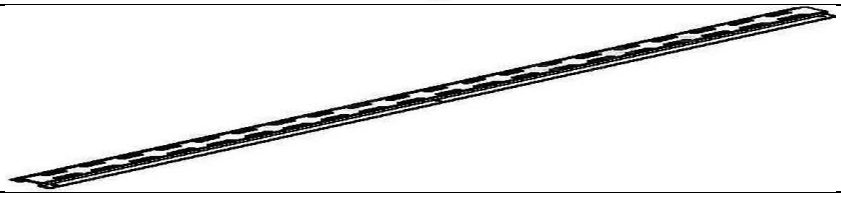
PART 3: INSTALLATION INFORMATION

A. TRANSPORT, UNPACKING, AND INSPECTION

When possible, transport the boxes of evacuated tubes standing upright, taking notice of the THIS WAY UP arrows. If the boxes can only be laid down, always place on a flat, firm surface such as compressed wooden board. If stacking the boxes, do not exceed 3 layers and strap in place to avoid movement. Straps should be padded with thick cardboard or similar padding at corners to avoid cutting into the boxes.

1. COMPONENT LIST

Please familiarize yourself with the components listed on the packing list included in the collector manifold packing box. If any components are missing, and/or additional part(s) are required, please contact your supplier.

PART A: MANIFOLD LEG (3) (SHORTER THAN PART D)	
PART B: BACK BRACE (4) (LONGER THAN PART C)	
PART C: HORIZONTAL SUPPORT BRACE (3) (SHORTER THAN PART B)	
PART D: MANIFOLD ARM (3) (LONGER THAN PART A)	
PART E: CLAMP (6)	
PART F: TRIANGLE PLATE (3)	
PART G: FEET (6)	
PART H: NUT (50)	
PART I-1: SMALL BOLT (40)	
PART I-2: LARGE BOLT (10)	
PART J: BASE TUBE FRAME (1)	

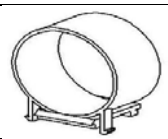
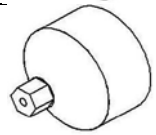
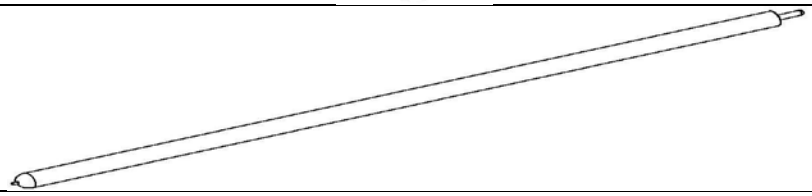
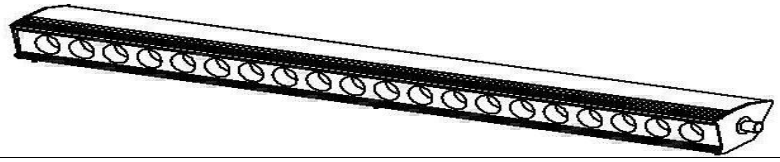
PART K-1: PLASTIC END CAP (FEMALE)	
PART K-2: PLASTIC END CAP (MALE)	
PART L: EVACUATED TUBE	
PART M: MANIFOLD	
PART N: FIT RING	

Table 3

2. TUBE AND HEAT PIPE INSPECTION

Open the tube boxes, which contain the evacuated tubes with inserted heat pipes. Make certain all tubes are intact, and the bottom of each tube is silver. If a tube has a white or clear bottom, it is damaged and should be replaced. The heat pipe should be removed from the damaged tube and inserted into a replacement tube, available at your local HTP dealer.

Heat pipes are bright and shiny when newly manufactured, but will dull and may form dark-grey surface discoloration over time. This mild surface oxidation happens when the pipe is exposed to air. This reaction is completely normal and does not affect the integrity of the pipe.

Do not remove and/or expose the tubes to sunlight until ready to install, otherwise the heat pipe tip will become hot enough to cause serious burns.

NOTE: HTP DOES NOT WARRANT THE TUBE OR HEAT PIPES AGAINST FAILURE AS A RESULT OF DAMAGE INCURRED DURING TRANSPORT OR INSTALLATION.

3. TOOLS AND MATERIALS

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

Electric Drill
Drill Index (w/ ½" and ¾" Wood Bits)
Hack Saw
Tubing Cutter
Tin Snips
Solder Flux
16' Tape Measure
Torch and Striker
Putty Knife
High Temperature Joint Compound
Wire Nuts or Connectors
Miscellaneous Copper Pipe & Fittings (3/4")
1" Copper Tee
1" by ½" Bush

Emory Paper
24" Level
Flashlight
Extension Cord
Slip Joint Pliers
Pipe Wrenches, 10" and 14"
Open End Wrenches, 9/16 & 7/16
Screw Driver 6" Flat Blade
Screw Driver 6" Philips
Wire Stripper or Knife
Wire Cutters
Adjustable Wrenches 8" & 10"

1' Reducer – ½" or ¾"
5/8" x ½" wall & 7/8" x ½" wall insulation
Silicon Caulk and Roof Tar
½" I.D. and ¾" I.D. Type M Copper Tubing
Needle Nose Pliers
Angle Iron
Threaded Rod, Nuts, & Washers
Stainless Screw Clamps
Thermal Adhesive
Aluminum Flashing Sheet
Black Latex Outdoor Paint

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

C. DELTA-T CONTROLLER SETTINGS

Usually a Delta-T ON value of 4-6^{o}C / 7-11^{o}F and Delta-T OFF value of 2^{o}C / 3.6^{o}F is appropriate. These settings may need to be altered slightly according to location and system design. Refer to the instruction manual provided with the chosen solar controller for appropriate settings.

D. STAGNATION AND OVERHEATING

Stagnation refers to the condition that occurs when the pump stops running. This can be due to pump failure, power blackout, or as a result of a high tank temperature protection feature built into the controller, which turns the pump off.

If the system is designed to allow stagnation as a means of preventing tank overheating, the collector and plumbing in close proximity may reach temperatures of >200^{o}C / 395^{o}F; components that may be exposed to these high temperatures, such as valves, plumbing or insulation, should be suitably rated.

If the system is designed to allow stagnation of the collector when the tank reaches a set maximum level, steam may form in the header. In such a system, a temperature relief valve or auto air vent should NOT be installed on the collector outlet, as these options may not be able to withstand the high temperatures and will not allow stable stagnation of the collector (may dump hot water).

The pressure and temperature relief valve on the tank may open to release pressure or heat as required. Under such conditions the collector manifold will normally reach a maximum temperature of around 160^{o}C / 320^{o}F. Any heat returning from the collector is generally not hot enough to cause a continued increase in tank temperatures (i.e. heat input is less than tank heat losses), and therefore is able to meet requirements in force in some regions limiting tank hot water dumping. A crackling noise may be heard down the supply line when hot water is used, as the pressure in the system drops and steam forms. This is normal.

E. CORRECT SYSTEM SIZING TO AVOID OVERHEATING

The system should be sized so that overheating of the tank is difficult to achieve in a single day, even during hot, sunny periods. If the system is over-sized, such that excessive heat is often produced during summer months, a heat dissipater unit, or alternative cooling/dissipation system should be installed.

F. SOLAR FOR CENTRAL HEATING – PREVENTING OVERHEATING

If a system has been designed to provide a contribution to space heating, it will sometimes provide more heat in the summer than is required for hot water supply alone. In such cases, it is advisable for the home to have a hot-tub, Jacuzzi or pool, a large storage tank or underground thermal store. If these options are not viable, a heat dissipater unit(s) should be installed. Drain back systems provide the best solution to overheating by allowing the heat transfer fluid to drain back into the tank when domestic heating needs have been satisfied. See also the following point regarding reduction of summer heat output.

G. COLLECTOR ANGLE, PLANE, AND DIRECTION

1. COLLECTOR ANGLE

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

2. COLLECTOR PLANE

The collector manifold is normally installed on the flat horizontal plane, but may be installed at an angle, such as sideways on a pitched roof. The collector must not be installed up-side-down (tubes pointing upwards) or with tubes lying horizontally. The heat pipes will not function.

3. COLLECTOR DIRECTION

The collector should face the equator. In the Northern hemisphere this is due south, and vice versa. Facing the collector in the correct direction and correct angle is important to ensure optimal heat output. A deviation of up to 10^{o} from due North or South is acceptable, and will have minimal effect on heat output.

Given the formula above, a solar collector installed at 30^{o}N latitude should face due south at an angle of 40^{o}.

4. TO EASE OVERHEATING

Apart from installing a smaller collector, a good method of reducing summer heat output is to angle the collector for optimal winter absorption. This is achieved by installing the collector at an angle of around 15^{o} above the latitude angle (e.g. 45^{o} at 30^{o}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 surface area of the collector exposed to sunlight is reduced, in effect reducing overall heat production considerably (by about 15%). This option is ideal for installations where solar thermal is being used for space heating.

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. EXPANSION TANK: MINIMIZING WATER WASTAGE

⚠ WARNING

In any hot water system, expansion of water will occur as it heats. When water expands, it has to be controlled, as it cannot be compressed like air. See below for requirements pertaining to your application.

1. OPEN LOOP SYSTEMS

Open loop systems have a check valve/non-return valve on the cold main. This expanded water is released via the pressure relief valve, which is mounted on the tank or solar collector loop. To prevent this wasteful dumping of water, it is recommended to install an expansion vessel.

2. CLOSED LOOP SYSTEMS

Closed loop systems should always be installed with an expansion vessel. Refer to the solar expansion vessel manufacturers' guidelines regarding correct sizing.

3. DRAIN BACK SYSTEMS

Expansion tanks are not required in drain back system design.

K. LIGHTNING PROTECTION

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

L. PIPE CONNECTIONS AND PIPE SIZE

HTP solar collectors are provided as standard with 1" NPT copper pipe inlet and outlet. For domestic heating applications with 1 or 2 collectors, nominal ½" piping is suitable. For applications using 2 or more solar collectors in series, it is advised to use nominal 3/4" piping. For connection of banks of collectors, larger pipe sizes should be used as required for the given application, with consideration made to flow rates, pressure drop and pump sizing.

The material used for the solar loop must be able to withstand the operating temperatures and pressures to which the system may be exposed, due to normal or extraordinary conditions (e.g. pump failure or power outage). Copper pipe is the most widely used piping material for solar applications. If it is decided to use synthetic piping for the plumbing, HTP strongly recommends that copper pipe is used for at least the most first 12feet of line connecting to both the inlet and outlet of the collector.

M. CONNECTION OF MULTIPLE COLLECTORS

When connecting collectors in series (maximum of 150 tubes), flexible connections should be used between each collector in order to allow for expansion and contraction of the copper header with temperature changes. Failure to use flexible connections between consecutive END port collectors may result in damage to the header if the system stagnates.

NOTE: The collector and collector plumbing should be sloped down toward the drain back reservoir at ¼" per foot minimum to allow the system to drain.

NOTE: HTP DOES NOT WARRANT THE COLLECTOR AGAINST DAMAGE RESULTING FROM POORLY MANAGED HEADER EXPANSION AND CONTRACTION.

N. POTABLE WATER

If the system is direct flow, meaning that potable water is flowing through the collector, any components used in the system must meet potable water requirements.

O. MOUNTING FRAME

HTP solar collectors are supplied with an adjustable, extruded aluminum frame, which allows installers to change the angle of the collector to maximize efficiency. Feet are supplied to fasten the panel securely to the roof. It is important that frame attachment points and externally supplied fasteners are of suitable structural strength and corrosion resistance. Be sure to tighten all hardware securely.

P. CUSTOMIZING THE FRAME

The standard frame can be adjusted to various angles and used creatively to suit a range of different installation formats.

Q. GALVANIC REACTION BETWEEN STAINLESS AND ZINC GALVANIZED STEEL

⚠ CAUTION

Zinc galvanized components should NOT be installed in direct contact with stainless steel, as galvanic reaction between the two metals can cause premature oxidation of the zinc coating and steel underneath.

1. If roof surface is galvanized steel, refer to Corrugated Roof installation guidelines.

2. Avoid using galvanized steel bolts. Use stainless steel components instead.

However, if galvanized components ARE used, avoid direct contact between the two metals by using rubber/plastic separators.

PART 4: COLLECTOR INSTALLATION

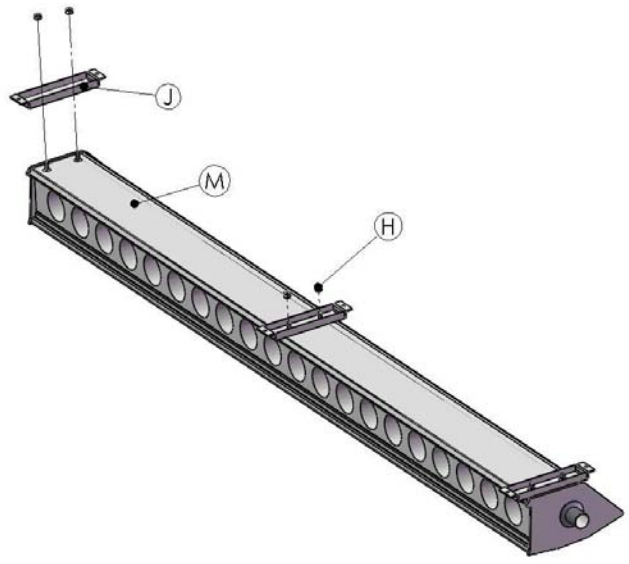


Figure 1 – Clamp to Manifold

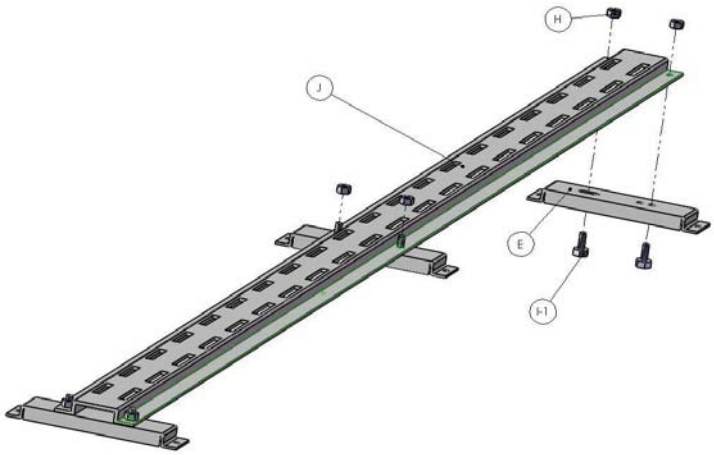
A. INSTALLING CLAMP TO MANIFOLD

1. Place the manifold flat so the bolts are facing up.
2. Remove nuts attached to bolts on manifold.
3. Secure clamps to the bottom of the manifold using a ½" ratchet.

⚠ WARNING

Ensure the surface is solid and able to withstand in excess of 150kg / 330lbs of pull force that may be encountered during high winds. Consult a structural engineer if in doubt.

B. INSTALLING CLAMP TO BASE TUBE FRAME



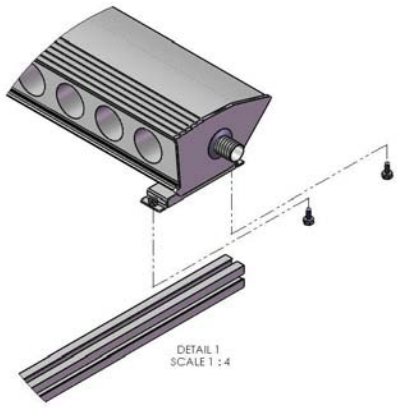
1. Secure clamps to the base tube frame using short bolts.
2. Tighten the bolts with ½" ratchet.

Figure 2 – Clamp to Base Tube

C. INSTALLING MANIFOLD AND BASE TUBE FRAME TO MANIFOLD ARMS

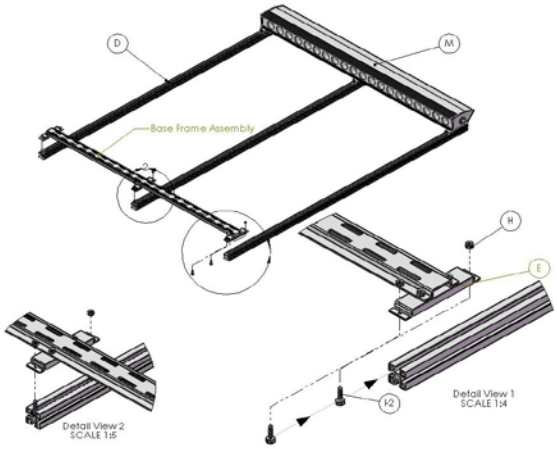
1. Space out manifold arms so the rails line up with the clamps on the manifold and the base tube frame.
2. Slide in the short bolts in the arms first.
3. Slide small bolts into the rail before securing any nuts. Align so the ends of the clamps are flush along the end of the rails.
4. Secure manifold to manifold arms.

Figure 3 – Manifold and Base Tube Frame to Manifold Arms



5. Secure the bolts with nuts and tighten with ratchet.
6. Line up the clamps on the base tube frame to the manifold arms.

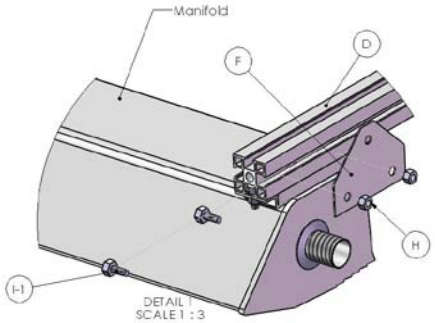
Figure 4 – Manifold to Base Tube Detail



7. Slide in short bolts in the arms first.
8. Secure the bolts with nuts and tighten with ratchet.

Figure 5 – Assembly and Detail

D. INSTALLING TRIANGLE PLATE ASSEMBLY



1. Slide two short bolts in the manifold arm.
2. Align the edge of the triangle plate to the edge of the manifold arm.
3. Secure the triangle plate to the manifold arm with nut, tighten with ratchet.
4. Repeat for the next two arms.

Figure 6 – Triangle Plate Assembly Detail

E. INSTALLING LEGS TO ASSEMBLY

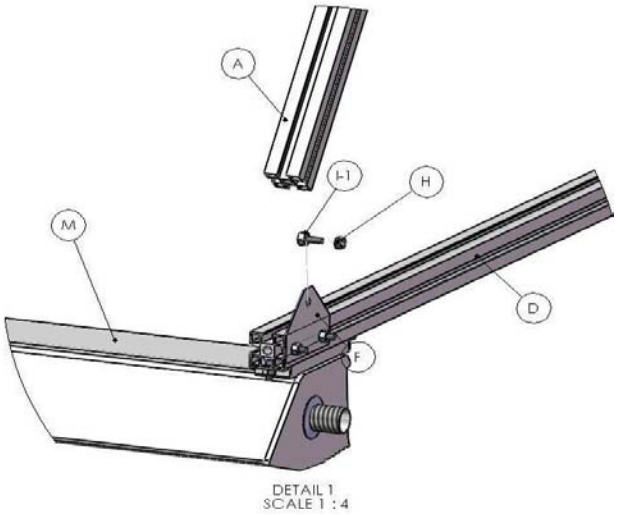


Figure 7 – Leg Installation Detail

1. Slide manifold legs onto the top bolt of the triangle plates.
2. Align the edge of the manifold leg with the corner of the top edge of the triangle base plate. The legs should be able to pivot about the bolt without interference.

FOR FLAT MOUNTING, SKIP TO PAGE 23, PART H

TILT / ANGLED MOUNTING

F. INSTALLING FEET TO ASSEMBLY

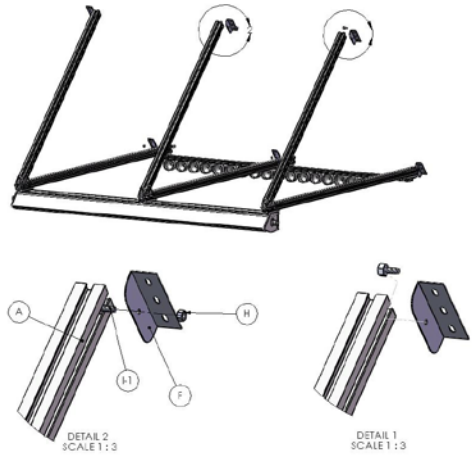


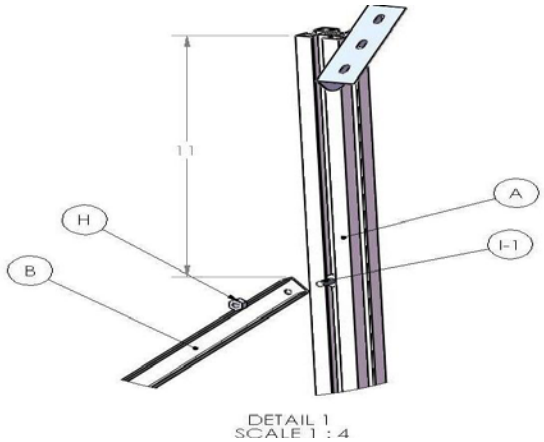
Figure 8 – Feet Installation

1. Place feet on the side of the manifold leg facing outward. The foot on the middle leg can be placed on either side.
2. Align so bottom of the foot is flush along the bottom of the manifold leg.

3. Attach feet to manifold arms.
4. Align so foot is flush to the bottom of the manifold arms in the same direction as the feet on manifold legs.

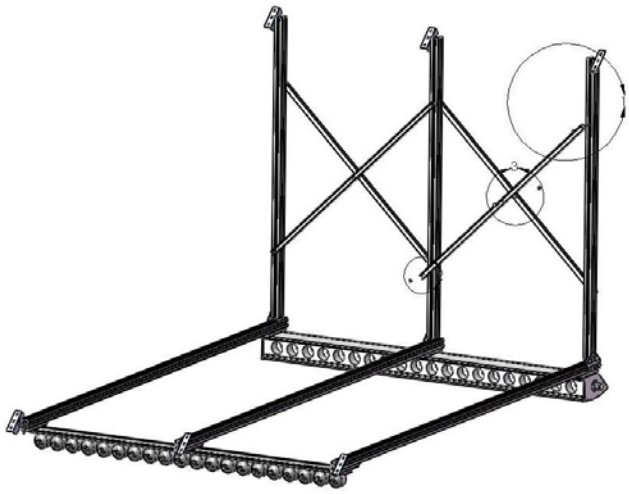
Figure 9 – Installation Detail

G. INSTALLING THE SUPPORTS



1. Attach back brace across manifold legs.
2. Align so both are 11 inches from the edge of the manifold legs.

Figure 10 – Support Detail



3. Attach the remaining back brace supports across the previous ones, creating an X.
4. Affix the back brace supports together with a large bolt through the middle of both supports.

Figure 11 – Back Brace Installation

5. Attach horizontal supports at the midpoints of manifold legs and arms.
6. These supports can be adjusted along either support in order to create the desired angle.

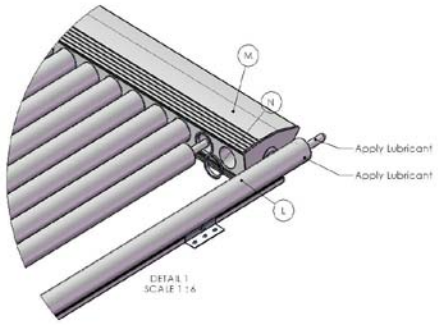
Figure 12 – Horizontal Support Installation

H. FLUSH / FLAT MOUNTING

Face feet outwards and attach to the manifold arms. Feet on the middle support can face either side.

Figure 13 – Flush / Flat Mounting

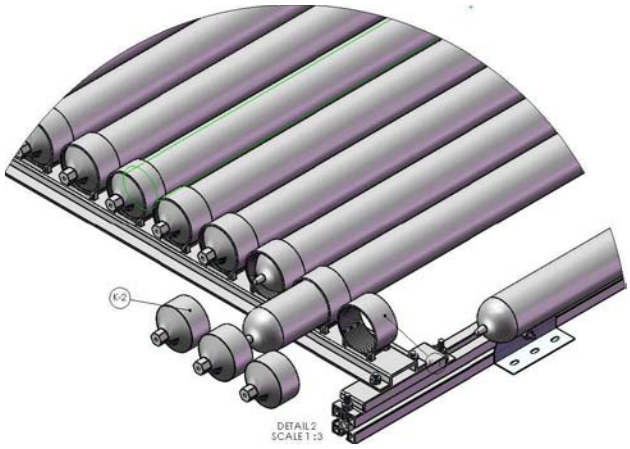
I. INSTALLING EVACUATED TUBES



NOTE: DO NOT INSTALL EVACUATED TUBES UNTIL COLLECTOR MOUNTING AND SYSTEM PLUMBING IS COMPLETE.

1. Unscrew plastic end caps.
2. Insert fit ring into hole in manifold.
3. Apply a small amount of liquid soap or other non-flammable lubricant around the marked area to ensure smooth insertion.

Figure 14 – Lubricant Detail



4. Place evacuated tube through end cap and screw into manifold.
5. Screw plastic end cap back into place.

Figure 15 – End Cap Detail

CAUTION
Do not spray water into the evacuated tube(s).

When evacuated tubes are fully installed, wipe clean with liquid glass cleaner and cloth/paper towels.

PART 5: ROOF / WALL ATTACHMENT SUGGESTIONS

⚠ WARNING
Working on the roof is extremely dangerous! Plan the installation out carefully such that a safe distance from the edge of the roof can be maintained. Sure footing is also required. Be sure to wear sturdy, rubber soled shoes. NO SANDALS OR FLIP FLOPS! Harnessing equipment may be required for installation on higher pitched roofs, and can provide a greater degree of safety for lower ones.

⚠ WARNING
Be sure that the roof is dry before you begin installation. Be sure that any ladders used are set firmly against the side of the building and mounted properly. Have someone hold the ladder for you while you climb.

⚠ WARNING
Be aware of any electric or water lines before drilling into the roof. Plan your installation so that they may be avoided.

A. ROOF ATTACHMENT

In order to meet strength requirements in areas with winds up to 130mph / 208kmh, and category “D” exposure, collectors should be mounted into roof studs using lag bolts. Any other installation format should be approved by a local engineer.

B. FLUSH PITCHED ROOF INSTALLATION

1. TILED ROOF ATTACHMENT

For tiled roofs, carefully plan the location of the manifold, frame tracks and plumbing in order to minimize the number of tiles that need to be removed (and returned into place). Tiles may have holes cut to allow the roof straps or bolts to pass through. Any holes must be covered and/or sealed with standard roofing materials to avoid leaks.

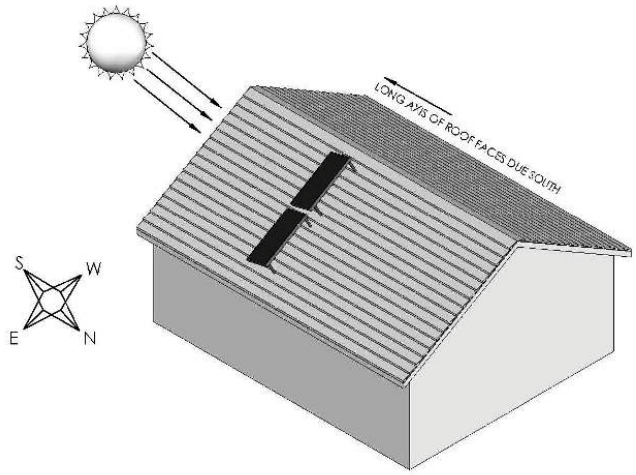


Figure 16 – Collector Orientation

For tiled roofs, 2' / 60cm or 3' / 100cm long roof attachment straps can be used (2 per front track). One end of each strap should be secured to the underside of the frame front tracks using bolts and nut lock assemblies; the other end secured to structurally secure roof framing using 0.3" / 8mm diameter or thicker stainless steel bolts or screws. Please ensure that roof-anchoring points are of suitable structural integrity. Once the upper straps are attached and tightened, adjust the bottom straps to ensure that they too are providing support to the frame.

2. CORRUGATED IRON ROOF ATTACHMENT

For installation on a corrugated iron roof, a thick rubber pad can be used to separate the frame from the roof and also seal the drill hole. Use a standard corrugated iron roofing screw to secure the collector front feet directly to the roof's wooden frame (additional holes may need to be drilled in the frame front track to properly secure the collector).

If the roofing screw is zinc galvanized steel, it should have a rubber/nylon washer, to prevent direct contact with the stainless steel frame. The rubber pad will form a tight seal against the roof, preventing any water ingress. Addition of some silicone sealant beneath the pad and inside the hole is advisable to help waterproof the installation. This mounting method is also suitable when attaching a low or mid angle solar collector.

3. ASPHALT SHINGLE ROOF

For installation on an asphalt shingle roof, the same corrugated roof method outlined above can be used, the lone difference being that an extra thick rubber pad should be used to compensate for collector feet sinking into the asphalt.

C. LOW PITCHED ROOF INSTALLATION

When installing a tilt/angled collector on a low pitched roof, follow the attachment instructions above. The HTP Evacuated Tube Solar Collector's horizontal supports easily slide along the manifold arms and legs into the proper installation angle. Minimum pitch must be no lower than 25^{o} for panels to perform properly.

D. FLAT ROOF INSTALLATION

Use .4" / 10mm diameter or larger stainless steel lag bolts to fasten the collector feet to a flat roof. If standing water may gather on the roof around the collector, ensure that all mounting and plumbing holes are thoroughly sealed and waterproofed.

⚠ WARNING

Ensure the surface is solid and able to withstand in excess of 150kg / 330lbs of pull force that may be encountered during high winds. Consult a structural engineer if in doubt.

E. WALL MOUNTING

Wall attachment methods depend largely on wall material. For brick or concrete walls, secure collector feet with stainless steel expansion bolts. For wood or synthetic boarding, stainless steel screws that can penetrate into the wall framework may be suitable for mounting. If the strength of these screws is a concern, use bolts that run directly through the wood with a large washer or metal plate positioned before the nut.

⚠ WARNING

Always consider the weight of the collector and the structural integrity of the wall. HTP requires that installations be inspected and approved by authorized building inspectors and comply with state and local codes.

Take note to adhere to the maximum collector angle of 80°, otherwise heat pipe performance may be reduced.

Also, consider possible shading from eaves, particularly in the summer. This may be included in system design to minimize summer heat output. Another advantage of installing under an eave overhang is to minimize snow buildup on the collector in areas with regular snowfall. Even with snow sitting on the bottom of tube, the heat pipes will work effectively to conduct heat, as the inner tube temperature becomes fairly even for the full length of the tube due to heat transfer by the aluminum fins.

If installing on a wall such that the collector is above a walkway, please consider the danger associated with broken glass that could fall if the tubes were ever damaged (e.g. during an extreme storm, a tree branch falls on the collector). It may be necessary for a barrier to be installed below the collector to catch any such falling materials.

PART 6: PLUMBING CONNECTIONS

Once the frame has been mounted and the manifold attached, the manifold header may be connected to the system plumbing.

If the collector (including evacuated tubes) is to be installed prior to plumbing connection (e.g. on a new house), high temperature resistant covers should be placed over the header inlet and outlet to prevent any contaminants entering the header (e.g. aluminum foil). The solar collector will not be damaged by a short period of stagnation (<14 days).

A. TEMPERATURE SENSOR INSERTION

The temperature sensor port is located beside the inlet and outlet ports. Generally the temperature should be sensed at the outlet of the manifold. Ensure that sensors and cable used on the collector are high temperature rated (up to 200^{o}C / 395^{o}F).

The solar controller temperature sensor should be coated with a thin layer of thermal paste and inserted into the sensor port to the full depth. If the fit is too loose, slide a piece of copper or stainless steel plate/wire in beside the sensor.

Ensure that the insulation is watertight. Use silicone sealant if required to ensure a watertight seal against the manifold.

B. HEADER CONNECTION

⚠ CAUTION

Never use dielectric unions or galvanized steel fittings when connecting to a stainless steel storage tank or heater. Use only copper or brass fittings. Teflon thread sealant must be used on all connections.

Non-Galvanized Connections / Pipe Fitting: To ensure a sound seal, use plumbing thread glue or Teflon tape, approved for used in glycol based system design. Tighten using two wrenches, taking care not to stress the copper pipe. Do not over tighten.

Brazing/Sweating/Soldering to the header is acceptable, but care must be taken to avoid exposing the manifold casing to the torch flame. Ideally place a wet cotton cloth around the base of the header pipe to reduce the temperature of the copper pipe in contact with the silicone rubber seal.

C. AIR PURGE

Once the inlet and outlet are connected to the plumbing system, the collector loop should be purged of air.

Open Loop: For a system without an auto-air vent installed, a drain valve on the supply line should be installed along with a ball valve on the tank side. With the ball valve closed, the drain valve can be opened to allow air to escape as water pressure forces through the line.

⚠ CAUTION

Released water may be hot. Steam may release as well.

Once the drain valve no longer releases air, close it. Then open the ball valve so that normal operation can begin.

If an auto-air vent is installed on the outlet of the collector, air will automatically eliminate from the solar line. If using a manual air vent, open it until all air is eliminated.

Low Pressure Open Loop: Run the pump at the highest speed settings, forcing air out of the manifold and back into the tank. If an auto-air vent is installed on the outlet of the collector, air will automatically eliminate from the solar line. If using a manual air vent, open it until all air is eliminated.

Closed Loop: The solar loop should be filled with glycol/water mix, vented and pressurized. The exact process will depend on the design of the loop and components used – refer to relevant instructions specific to the pump station/heat exchanger.

D. PLUMBING CHECK

Once plumbing is confirmed leak free and all air has been purged, the heat pipes and evacuated tubes may be installed.

E. GLYCOL FREEZE PROTECTION

Only use food grade polypropylene glycol, FDA rated as GRAS (Generally Recognized As Safe), with additives that provide resistance to breakdown during high temperatures. Glycol (pH) should be checked periodically and replaced as specified by the manufacturer.

F. INSULATION

Heavily insulate all piping running to and from the manifold with high quality insulation of at least 0.6" thickness, thicker in cold climates. Heat loss from the piping can be significant. Particular attention should be taken to insulate any possible points of heat loss.

Ensure the insulation is tight against the manifold casing, thus minimizing heat loss from the inlet and outlet. High quality silicone sealant should be used to prevent water from entering the temperature probe port and/or in between the piping and insulation foam.

Insulation foam exposed to direct sunlight should be protected against UV related degradation by wrapping/covering with UV protective material, such as adhesive back aluminum foil, PVC conduit or similar.

For systems designed to allow stagnation, high temperature rated insulation such as glass wool or mineral wool should be used on piping close to the collector (6'). Glass wool insulation may come with an external foil wrap, but any cuts made during installation should be sealed with watertight, UV stabilized material such as adhesive backed aluminum foil.

Circulation pumps can be a source of significant heat loss and should be insulated. Some pumps come standard with a molded foam casing which has good insulation properties. If the pump does not have any insulation, the same foam insulation used on the pipe can be used to cover the pump, secured in place with good quality nylon cable ties or adhesive tape.

Note: Certain pumps are not designed to be insulated. Please contact the pump manufacturer if in doubt.

All internal and external piping should be insulated. This includes at least the 3" closest to the hot water outlet of the tank, as this copper pipe is a significant point of passive heat loss.

G. PUMP SELECTION

When selecting a pump, there are two basic solar designs to consider: pressure glycol and closed loop drain back. In pressure glycol systems, two factors determine pump size. These are:

- Flow Rate in gpm (gallons per minute)
- Head Loss

In drain back systems, an additional factor must be considered along with the previous two:

- Lift

Each HP-30SC collector has a flow rate of about .84 gpm.

When determining pumping head loss, consider the following:

- Head loss pumping through panel(s).
- Head loss pumping through piping and fittings.
- Head loss pumping through heat exchanger.
- (Drain back only) Determine the vertical lift from the water level in the drain back tank to the top of the solar panels. (Vertical lift is the same as head loss.)

Refer to Figure 17 for pressure drop figures with a 40% propylene glycol solution. When using distilled water as heat transfer fluid, there is a further 20% reduction in pressure drop.

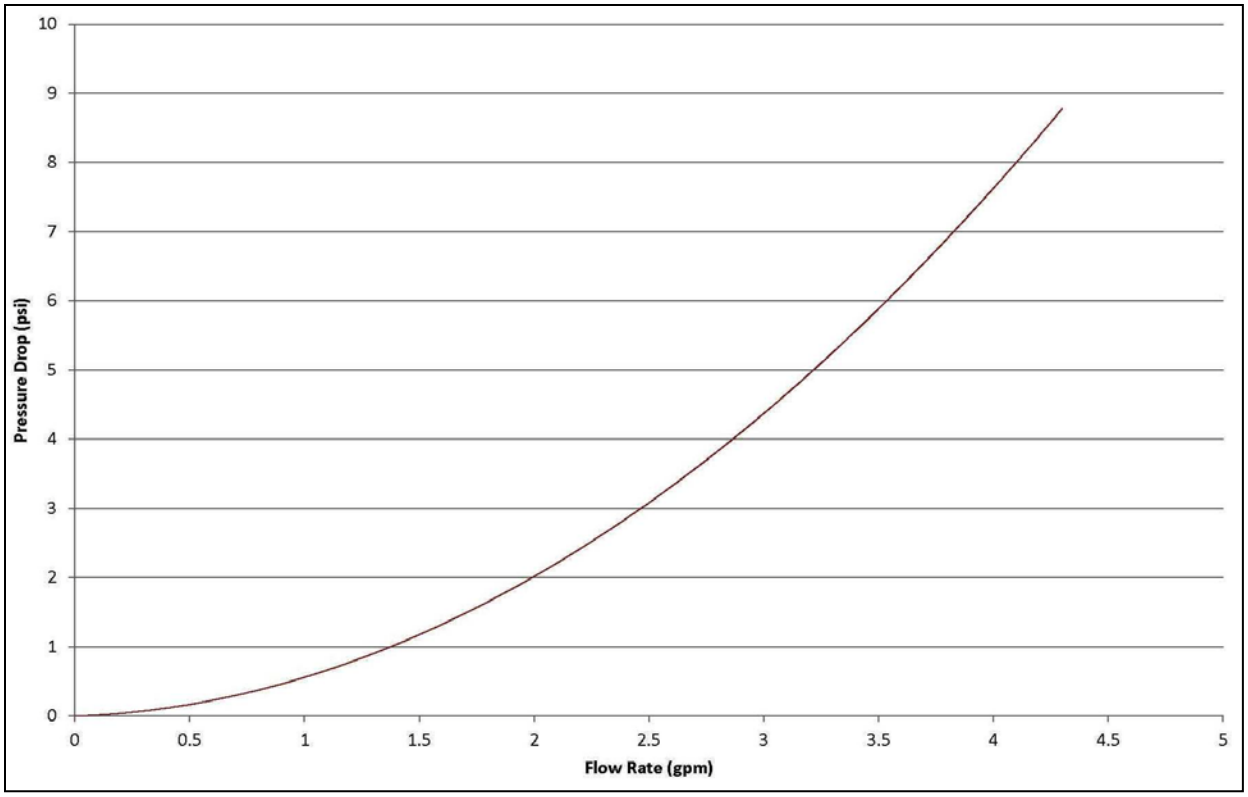


Figure 17 – Pressure Drop through HP-30SC with 40% Propylene Glycol Solution

After determining gpm flow rate and total system head loss, a properly sized pump can be chosen. See recommendation from pump supplier to determine the proper pump for your job. Incorrect pump size will reduce or fail to deliver solar contribution.

To further increase solar production, use a variable speed solar pump controller (p/n 8600-047).

PART 7: SYSTEM PIPING DIAGRAMS

A. DRAINBACK TANK WITH BACKUP WATER HEATER

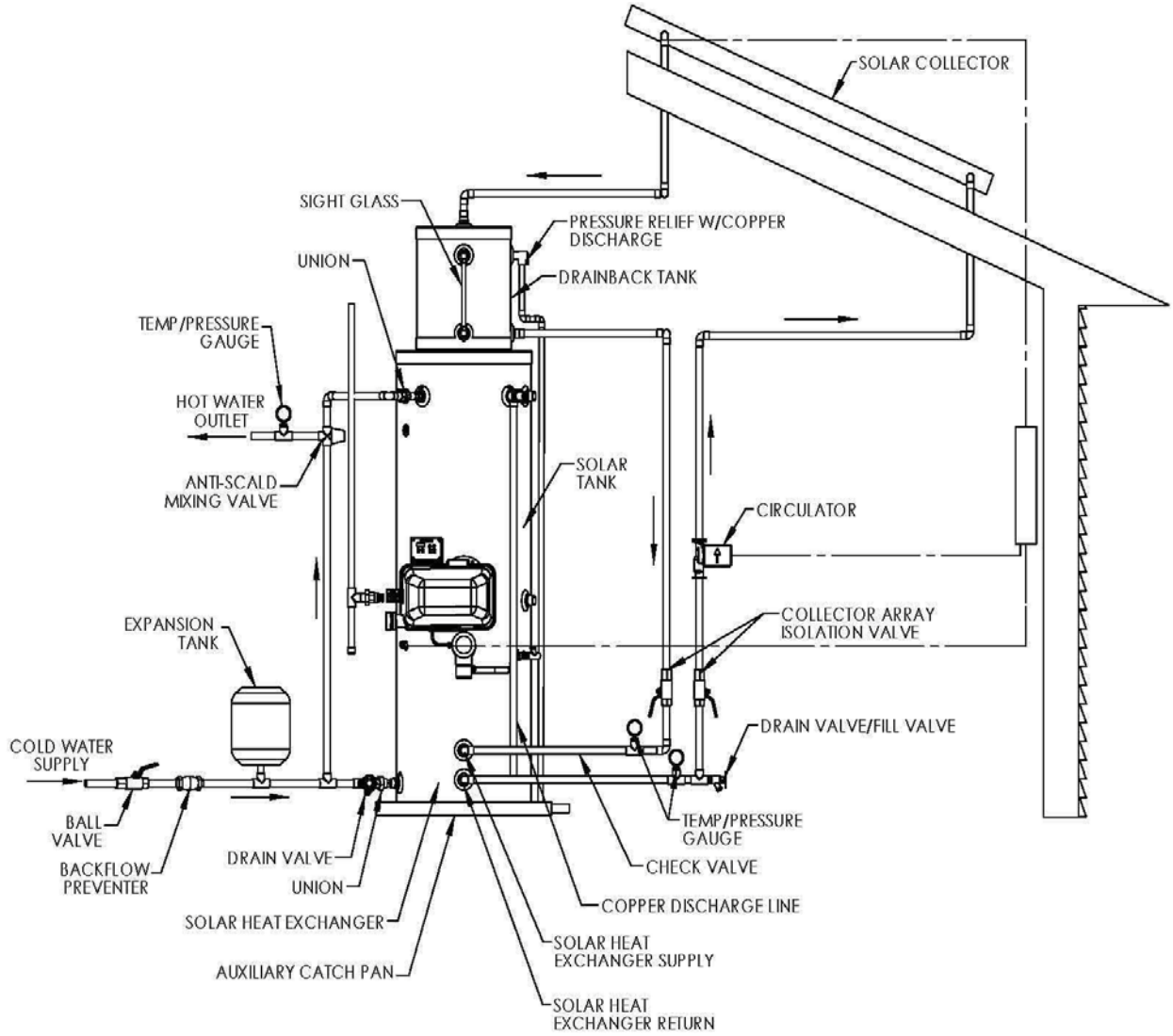


Figure 18 – Drain Back Tank with Solar Water Heater* - LP-204-C

*This drawing is meant to show system piping concept only. The installer is responsible for all equipment and detailing according to local codes.

B. CLOSED LOOP SYSTEM WITH ELECTRIC BACKUP AND BOILER

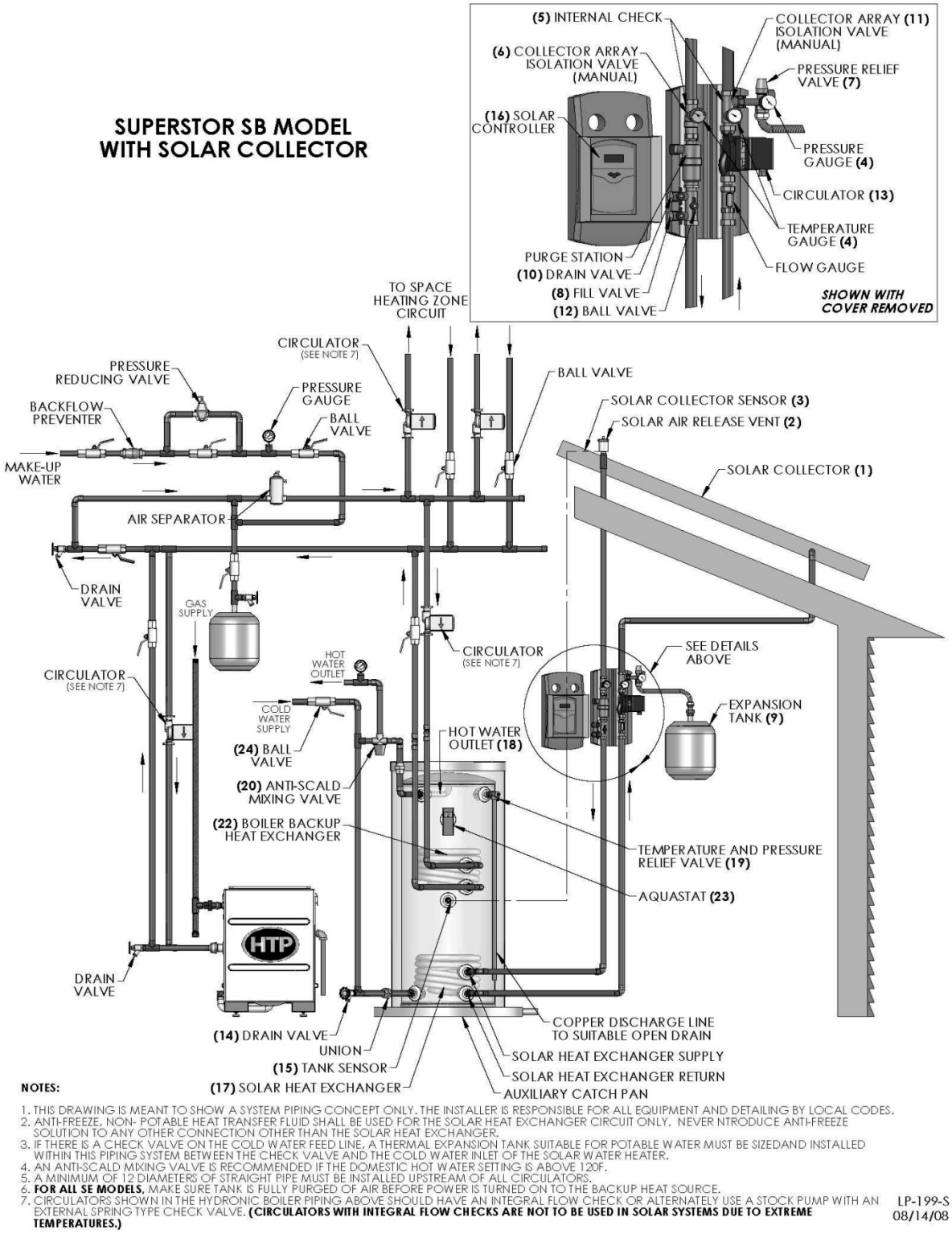


Figure 19 – Closed Loop System with Electric Backup and Boiler* - LP-199-S

*This drawing is meant to show system piping concept only. The installer is responsible for all equipment and detailing according to local codes.

PART 8: MAINTENANCE

Under normal conditions, the solar collector is maintenance free. Other system components, such as the pump and glycol (if used), may require periodic inspection and changing/maintenance. Please refer to the documentation provided by the manufacturer of these other components.

NOTE: APART FROM THOSE MAINTENANCE ITEMS OUTLINED BELOW, ANY SYSTEM INSPECTION, MAINTENANCE OR REPAIR SHOULD ONLY BE COMPLETED BY AUTHORIZED PERSONS. THE SOLAR COLLECTOR WARRANTY COVERAGE MAY BE VOIDED IF NON-AUTHORIZED PERSONS ATTEMPT TO MAINTAIN OR REPAIR THE SOLAR COLLECTOR OR ASSOCIATED COMPONENTS.

The following basic maintenance may be completed by the HOME OWNER:

A. CLEANING

Regular rain should keep the evacuated tubes clean, but if particularly dirty they may be washed with a soft cloth and warm, soapy water or glass cleaning solution, ONLY if the solar collector is located in a position which DOES NOT REQUIRE climbing onto the roof or use of step-ladder. If the tubes are not easily and safely accessible, high-pressure water spray is also effective.

If cleaning is required and the above outlined methods are not suitable, the company that supplied and installed the solar collector should be contacted.

B. LEAVES

During autumn, leaves may accumulate between or beneath the tubes. Please remove these leaves regularly to ensure optimal performance and prevent a fire hazard. (The solar collector will not cause the ignition of flammable materials). Such cleaning may only be completed by the homeowner if the tubes are easily and safely accessible.

The following maintenance may ONLY be completed by AUTHORIZED PERSONS:

C. BROKEN TUBE

If a tube is broken it should be replaced as soon as possible to maintain maximum collector performance. The system will still operate normally and safely with a broken tube. Any broken glass should be cleared away to prevent injury. Protective gloves must be worn when handling broken glass.

⚠ CAUTION

Handling broken glass must be done with extreme caution. Failure to do so may result in serious injury.

D. INSULATION

The plumbing pipes running to and from the collector should be heavily insulated. This insulation foam should be checked periodically (at least once every 3 years) for damage. For any insulation exposed to sunlight, ensure protective cover/wrap/foil is in good condition. Replace as required.

E. DRAINING THE COLLECTOR

If maintaining the system, or in preparation for extremely cold conditions (extended snow cover), draining of the manifold may be required. To drain the collector of fresh water (direct flow system):

1) Turn off the water supply to the solar storage tank.

2) If the storage tank or other system components are being concurrently drained, refer to their instruction manuals for details. If storage tank is not being drained, isolate piping to and from the solar collector (isolation valves should already be installed). Immediately open drain valves on both lines (or undo fittings). Never leave the isolation valves in the off position while the collector is full of water and exposed to sunlight. The water will heat and cause a pressure increase which may rupture fittings/connections.

NOTE: In good weather the water may be hot or have built up pressure, so take care when opening the drain valve.

3) Allow the manifold to sit in a vented state for 5 – 10 min to boil dry (may take longer in poor weather).

4) Always leave one drain valve or fitting open. Otherwise the system may build up pressure when it heats. For draining of other types of systems, please refer to specific instructions for the system.

⚠ WARNING

Draining the collector must be done with caution, as released water may be scalding hot. Take care when opening the drain valve. Failure to do so could result in property damage, serious injury, or death due.

APPROXIMATE TIME / TEMPERATURE RELATIONSHIPS IN SCALDS	
120°F	More than 5 minutes
125°F	1 ½ 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 ½ seconds
155°F	About 1 second

Table 4

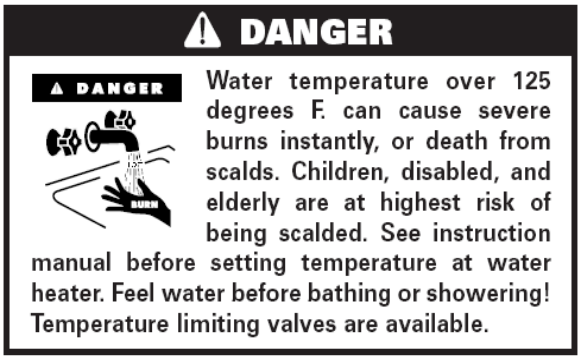


Figure 20 – Scald Warning Label

F. OTHER COMPONENTS

Other parts of the system, such as the pump and storage tank, should be serviced/inspected according to the manufacturers own maintenance guidelines.

G. STAGNATION

When going on vacation or not using your solar water heating system for a significant length of time (> 14 days), take care to prevent stagnation. Drain the solar system and cover the collectors to prevent stagnation damage.

PART 9: TROUBLESHOOTING

Inspection items with an (**H**) in front may be completed by the homeowner, but only if investigation is clearly SAFE and EASY. Any information obtained during an investigation can then be relayed to the company who supplied and installed the system. Any other system troubleshooting, adjustments, or repairs may be completed ONLY by authorized persons.

A. NO HOT WATER

If there is no hot water, it will generally be related to the gas or electric heating system, not the solar collector. The collector simply pre-heats water, with final boosting completed by the electric element or gas booster system. For a retrofitted solar system, please contact the manufacturer/installer of your gas/electric water heater. For a new solar water heating system, please contact the company that supplied and installed the system.

B. REDUCED SOLAR CONTRIBUTION

Solar contribution is directly related to the amount of solar radiation and the volume of hot water used. During the winter, and periods of rainy or particularly overcast weather, the amount of energy produced by the solar collector will be greatly reduced.

As a general rule, the solar collector is sized to provide close to 100% of your summer hot water needs, which, depending on your location and hot water usage patterns, may result in between 40% - 70% of your annual hot water energy needs. During the winter, increased cloud cover and reduced solar radiation levels may result in solar contribution as low as 20%. This is normal.

If, given similar environmental conditions, you feel the solar contribution (as indicated by energy savings) has considerably reduced, there may be a problem with your solar heating system. This may be due to an incorrectly configured controller, pump malfunction or problem with the boosting system. In such cases please contact the company who supplied and installed the system.

INVESTIGATION
(H) 1) Does the circulation pump appear to be operating? In sunny weather the circulation pump should come on for 1 - 2 minutes every 3 - 5 minutes. The pump may run very quietly, so you may need to touch the pump, or piping running to and from the pump, with a solid object to feel for motor operation (slight vibration). **NOTE: Do not use fingers! The pump may be hot!**

(H) 2) Are all the evacuated tubes intact? If a tube has been damaged or discolored it will reduce system performance and should be replaced. If a tube is damaged, do not attempt to remove it. Contact the company who supplied and installed the system.

(H) 3) Are there any apparent leaks in the plumbing to and from the collector? Any water trails down the roof, or around the storage tank?

C. REGULAR WATER DUMPING

During normal daily hot water use, if the temperature relief valve on the tank or collector is regularly dumping hot water (more than just a dribble), it may indicate a problem with the system.

POSSIBLE CAUSES
1) The system has been sized incorrectly (oversized). This will be most apparent in the summer months, when solar radiation levels are high.

2) A problem exists with the electric heating thermostat (electric boosting only).

3) Check expansion tank size. If undersized, water expansion may cause the relief valve to activate.

INVESTIGATION
(H) To test the system, run the hot water tap in the bathroom or kitchen for 5 minutes to release some heat from the system (**CAUTION:** The water will be hot, so be careful). After this period, if the tank or collector still regularly dumps hot water, there is a problem. Please contact the company who supplied and installed the system to organize a service call.

D. INSTALLED COLLECTOR DETAIL

1. ANGLED COLLECTOR

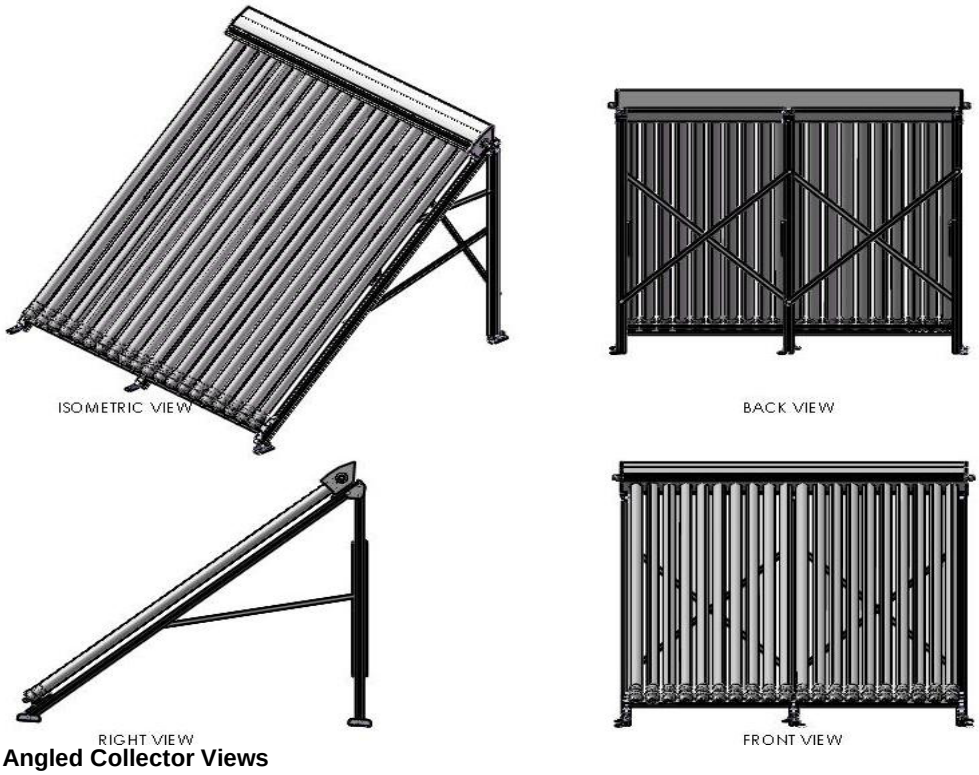


Figure 21 – Angled Collector Views

2. FLUSH COLLECTOR

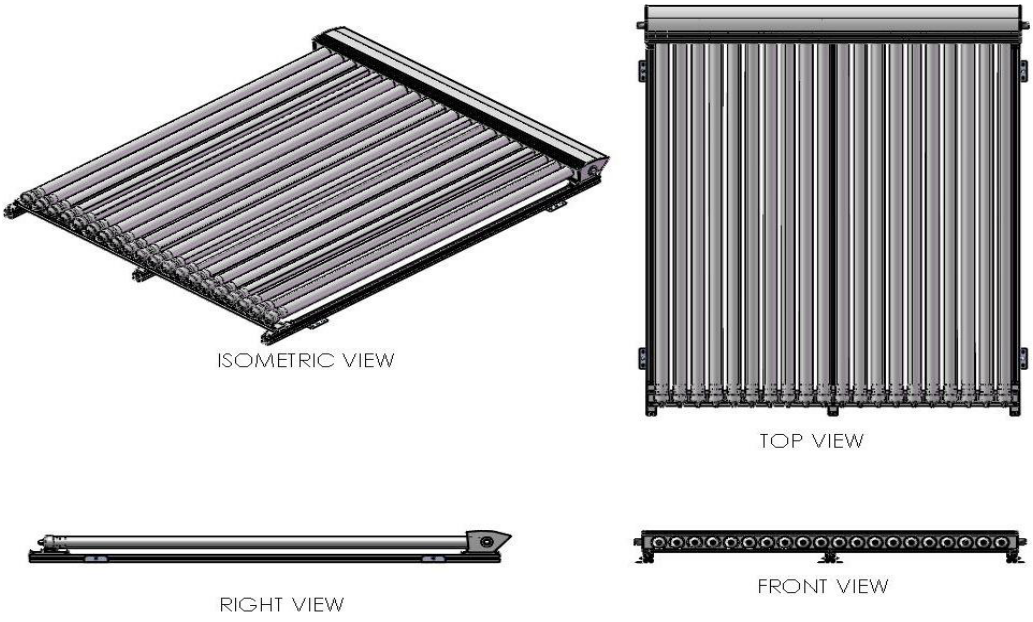


Figure 17 – Flush Collector Views

PART 10: INSTALLATION CHECKLIST

The following list is a guide only. Specific items will depend on the nature of the installation.

1	COLLECTOR FACES AS CLOSE AS POSSIBLE TO DUE NORTH/SOUTH.	Y	N
2	MANIFOLD IS NOT SIGNIFICANTLY SHADED THROUGHOUT THE DAY.	Y	N
3	MANIFOLD IS NOT LIKELY TO BE STRUCK BY FALLING OBJECTS SUCH AS BRANCHES OR FALLING FRUIT.	Y	N
4	COLLECTOR IS INSTALLED AT AN ANGLE OF BETWEEN 20^{o} – 80^{o}, PREFERABLY AT LATITUDE ANGLE.	Y	N
5	IN AREAS PRONE TO LARGE HAIL (>3/4"), COLLECTOR IS INSTALLED AT AN ANGLE OF 40^{o} OR GREATER.	Y	N
6	FRAME IS SECURED TO STRUCTURALLY SOUND ROOF/WALL.	Y	N
7	PLUMBING IS LEAK FREE.	Y	N
8	PLUMBING PIPE RUNS ARE WELL INSULATED.	Y	N
9	INSULATION ABOVE ROOF LEVEL IS PROTECTED AGAINST SUNLIGHT WITH FOIL WRAP OR EQUIVALENT.	Y	N
10	CONTROLLER IS CONFIGURED CORRECTLY WITH FREEZE SETTING ON (IF REQUIRED).	Y	N
11	SYSTEM IS FITTED WITH PRESSURE RELIEF VALVE ON THE COLLECTOR OUTLET AND/OR STORAGE TANK.	Y	N
12	PRESSURE RELIEF VALVE WILL DUMP ONLY ONTO HIGH TEMPERATURE RESISTANT MATERIAL AND WILL NOT POSE A DANGER OF SCALDING PEOPLE.	Y	N
13	PUMP, CONTROLLER, AND ALL ELECTRICAL CONNECTIONS ARE PROTECTED FROM WATER.	Y	N
14	EVACUATED TUBES HAVE BEEN CLEANED.	Y	N
15	INSTALLATION RECORD FORM HAS BEEN GIVEN TO CUSTOMER AND BASIC OPERATION EXPLAINED.	Y	N
16	FUNCTIONAL CHECKS FOR CONTROLLER AND PUMP HAVE BEEN COMPLETED.	Y	N
17	WATER QUALITY HAS BEEN CHECKED (IF APPLICABLE).	Y	N

Table 5 - All items should be ticked Y for the installation to be considered completed and satisfactory.

MAINTENANCE NOTES

HTP 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:	
Installation Address:	
Date of Installation:	
Installer's Code/Name:	
Product Serial Number(s):	
Comments:	
Installer's Phone Number:[1]	
Signed by Installer:	
Signed by Customer:[2]	

IMPORTANT NOTES:

1. Please only sign if you are happy with the service provided by the installer and the system is working properly. If you are not satisfied, call your HTP Sales Representative.

2. In the case that the system has any problems, please call the installer. If you are unable to make contact, or are unhappy with the response, please contact your HTP Sales Representative.

Distributor/Dealer: Please insert contact details.