SOLAR WATER HEATING SYSTEM

Operation & Maintenance Manual

Professional/Innovation/Quality

Before installation ❶

Important Information

Local standards

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

Qualified Installer

Installation must be completed by qualified plumbing professionals.

Pressure and Temperature Control and Relief.

Solar loop should be designed for normal operation at<500kpa via use of a pressure limiting (pressure reduction) valve on the mains cold supply line. System design must provide mean for allowing pressure release at no more 800kpa(113psi) and hot water dumping from the solar loop or storage tank once the temperature reaches 99℃(210℉). It is recommended that the lever on the pressure and temperature relief valve (PTRV) be operated once every 6 months ensure reliable operation. It is important to raise and lower the lever gently.

Metallic corrosion

Both copper & stainless steel are susceptible to corrosion when high concentrations of chloride are present. The solar collector may be used for heating of spa or pool water, but levels of free chorine must not exceed 2 ppm in addition the warranty provided on the header when using for spa or pool heating is 2 years, which is the standard for spa and pool heaters. Chloride level present in most reticulated pubic potable water supplies are safe for use in the collector provided there is no use of bore waters in the reticulated supply.

Freeze Protection

Freeze protection should be in corporate into the system by use of a “low manifold temperature” setting on the solar controller, which turns on the pump if the manifold drops below a preset level(eg5℃/41℉). Alternatively a closed loop filled with a glycol-water mix may be used to provide freeze protection. Evacuated tubes are not susceptible to damage in cold weather, and heat pipes are protected against damage caused by freezing of the water inside.

Hail resistance

The glass evacuated tubes are surprisingly strong and able to handle significant impact stresses once installed. Testing and impact stress modeling proves that the tubes are able to withstand impact from the hail up to 25mm/1 in diameter when installed at angle of 40 º

or greater. The ability of the evacuated tubes to withstand impact from hail is greater influenced by the angle of impact and so installing the collectors at low angles do reduce their impact resistance. However, even when laying flat, impact by hail up to 20mm/3/4" in size will not cause breakage.
It is recommended that in areas prone to large hail (>20mm 3/4" the solar collector should be installed at an angle of 40 º or greater to provide optimum protection. As many populated areas in the world fall within the latitude of±30-70 º this angle is generally a common installation anyway.
If in the unlikely circumstance that a tube should become broken it can be easily replaced in a matter of minutes. The solar collector can still function properly with one or more broken tubes, however a reduction in heat output will result (depending upon how many tube are broken).

Warnings and Cautions

When the term "Warning" is used it means that a person could be injured or killed if the procedure is not adhered to. The term "Caution" means that a person has a chance of being injured or worse if the procedure is not adhered to. "Notes" signify something regarding general tips for operation of the unit.6

Pressure Release & Relief Valve

Caution: The closed system solar loop must operate at less than 87 psi and have an expansion tank installed to accommodate expansion from the working fluid.
Caution: The closed loop system design must eject fluid at no more than 113 psi. It is recommended that the pressure relief valve be operated every 6 months to ensure reliability and operation. Please raise and lower the release lever gently and carefully as the working fluid of the system can be extremely hot.
Caution: The solar water tank must be equipped with a temperature/pressure relief valve. It must relieve pressure at no higher than 99°C / 100 psi. The T/P valve should be operated every 6 months to ensure reliability and operation. Please raise and lower the release lever gently and carefully as the working fluid of the system can be extremely hot.

Warning: Failure to operate the pressure temperature relief valves on a regular basis could lead to failure of the component or possible solar storage tank explosion and damage to the solar system.

Water Quality

Water needs to be added to propylene glycol for the working fluid of the system. It is recommended that distilled water be used to help prevent corrosion to the plumbing and system parts and to also ensure efficient heat transfer. The water quality must meet the following requirements:

Total Dissolved Solids	< 600 mg/L or p.p.m
< 600 mg/L or p.p.m	< 200 mg/L or p.pm
Electrical Conductivity	850 µS/cm
Chloride	< 250 mg/L or p.p.m

pH Level	Min 6.5 to Max. 8.5
Magnesium	< 10 mg/L or p.p.m
Sodium	< 150 mg/L or p.p.m

Warning: Do not use ethylene glycol (automotive antifreeze) for your solar loop. This chemical is toxic and may cause death should failure occur within the system causing it to mix in with the water in the tank. Only Food Grade Propylene glycol may be used in a solar water heater system.7

When mixing the propylene glycol with water, do not use a solution of more than 60% propylene glycol to 40% water by volume unless otherwise instructed by the manufacturer. The propylene glycol solution should only be concentrated enough to avoid the coldest possible temperatures in the region. Higher propylene glycol concentrations will reduce the heat transfer and pumping efficiency.

Propylene glycol solutions will gradually become more acidic over time and should be changed out every 3 to 5 years to prevent excessive corrosion to the pipes. If the propylene glycol solution exceeds 250ºF on a regular basis, it should be changed more frequently as propylene glycol will become rapidly acidic when kept above this temperature.

You should obtain a water quality analysis of your water supply prior to installing the solar water tank. Most of the time, these tests can be obtained from your water authority as they are required to perform this test and keep the results on record. If the water comes from a well, a water quality test should still be performed.

If your location has “hard” water, the inside of the solar tank will become coated with lime scale, thus reducing the efficiency and life expectancy of the tank. It is recommended that a sufficient softening device be utilized for effective long term operation of the tank.

The anode rod in the solar water tank is used to protect the inner walls of the tank from corrosion by use of the phenomenon known as galvanic corrosion. The anode rod, which is less noble than stainless steel, will corrode first before the stainless steel walls can corrode. Regular replacement of the rod will greatly extend the life of the tank. This rod should be checked every few years or replaced according to the below anode replacement schedule

Solar water heating tank is initially equipped with a **magnesium anode rod**. Magnesium anode rods dissolve into the water as they corrode and provide healthy minerals to the water supply. Alternatives to the magnesium rods are aluminum or zinc-aluminum combinations. The aluminum-type rods are nobler than magnesium rods and will last a little bit longer than magnesium rods. Aluminum anode rods are preferred if your water supply contains very hard water. Zinc-aluminum (10% zinc, 90% Aluminum) rods can be used if the water has a sulfur dioxide odor. The zinc can help remove this order.

Freeze Protection of the Closed Loop System

The manifold and piping could become damaged from cold temperatures due to expansion of the working fluid in the case of freezing. A Food Grade Propylene Glycol solution should be used for maximum freeze protection in the closed solar loop. Refer to the temperature chart below for the appropriate mixture ratio based on your location. It is best to recognize that solar collectors on a roof will experience the coldest parts of the night and should have a solution able to withstand the coldest possible climate in your area. While the highest concentration may seem the best for the highest freeze protection, the lowest concentration permissible by weather should be used as heat transfer and pumping is more efficient with higher concentrations of water.

Note: No more than 60% propylene glycol should be used as higher concentrations have low heat conduction and high viscosity which may hinder performance of the circulation pump.

Solution (% by *mass)	10	20	30	40	50	60
Freeze Temp (°F)	26	18	7	-8	-29	-55
Boiling Temp (°F)	212	213	216	219	222	225

Freeze Protection of the Copper Heat Pipes

The evacuated tubes and heat pipes are not normally susceptible to damage in mild cold climates. The standard Solar copper heat pipes (0.6mm thickness) are rated for -10°C (14°F) operating temperatures. It is generally acceptable for the heat pipes to endure 5–10°C (9-18°F) lower than their rated minimum operating temperatures for intermediate periods. However, if cold temperatures are expected to normally exceed this minimum temperature requirement, Solar freeze resistant heat pipes should be considered to avoid cracking of the heat pipes.

Goods Packing List ❷

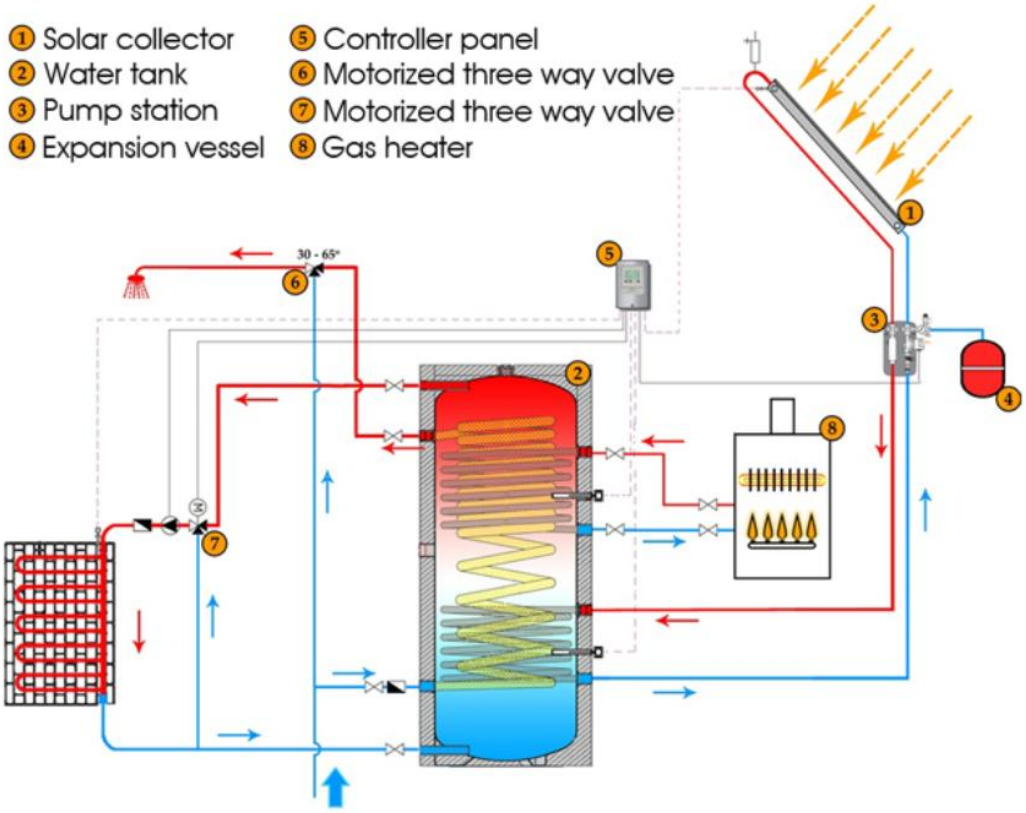
Box with Manifold, mounting frame, optional back legs for stand, tube holders/end caps, mounting feet and thermal conducting compound
Boxes of vacuum tubes with heat pipes and aluminum fines inserted
Box of spare vacuum tubes for breakage insurance during freight
Working Station (pump assembly and electronic controller)
Solar Water Tank (inbuilt electric heater, magnesium anode rod, PT valve, check valve, pressure &thermometers,)

Automatic air vent, twin tube pre-insulated solar hose and related copper fitting & cutter & flat tool, rail rack, check valve, inter-panel connectors

Others: such as food grade propylene glycol, thermostatic mixing valves submersible water pump for initial charging of the system....and any other accessories request for installation while, did not listed above,please well prepare local.

System design and installation ❸

Please read all installation instruction carefully before beginning system design or installation. The system configuration may need to be customized to suit the specific requirements of the installation. Please ensure that any system design meets local building, water quality regulations.



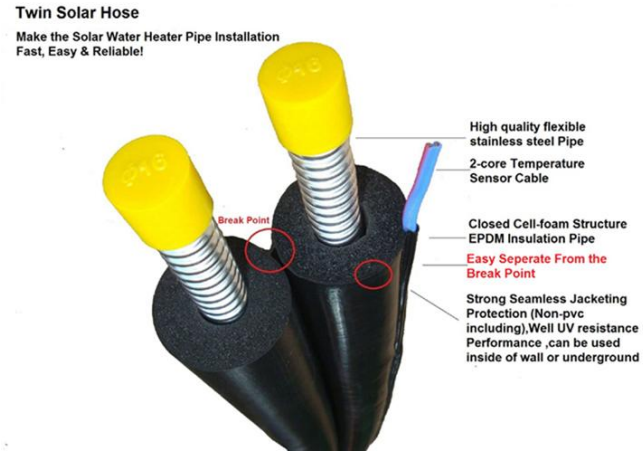
Plumbing

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

Choice of Piping Material

13mm OD, or 15mm OD copper piping is generally used for most solar collector installations. As the flow rate is slow, a large diameter pipe is unnecessary and will only increase system costs and heat loss. AP collectors come standard with two flexible SS pipes (not in all markets). They are designed for connection to the manifold as they are easy to bend and pass through the roof. The end of the flexible pipe is either 1/2" For 3/4 BSP thread, and so can accept standard male BSP thread fittings for connection to copper pipe,in this operation manual we instructed based on PRE-INSULATED twin pipe

line solar hose of 3/4''



Pressure Levels

Regardless of the installation configuration, pressure release values, expansion vessel and /or other pressure control devices must be installed. The solar loop should be designed to operate at no more than 800kPa(PRV may be 850kPa).(800kPa=8bar=116psi) For installation where mains pressure water is used, the system should ideally be designed to operate at a pressure of <500kPa,achieved by use of a pressure limiting reduction value.

Tempering value

It is recommended, and may be required by regulations, that a temperature control device (tempering value) be fitted into the hot water pipe between the water heater and bathrooms and en-suites to reduce the risk of scalding. This is achieved by controlling the water temperature to below 50℃/122℉ (temperature may be adjustable).

3.4 Temperature Sensor Insertion

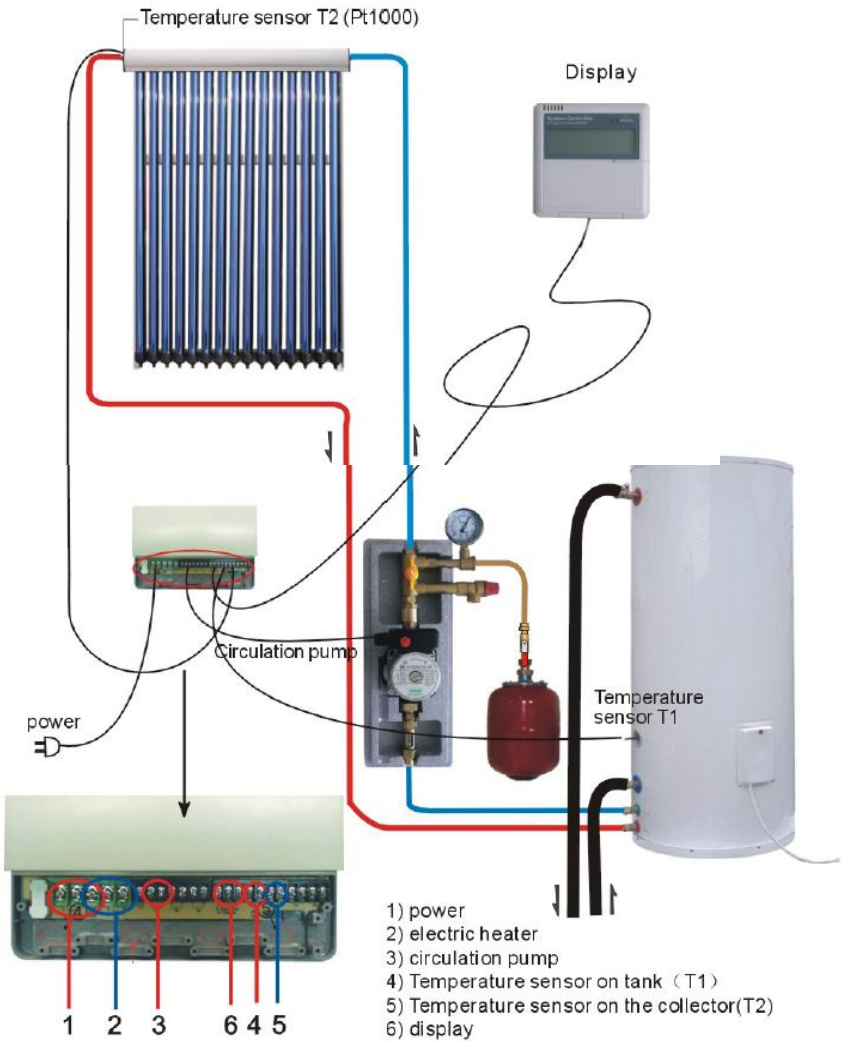
The solar controller's temperature sensor should be coated with a thick layer of thermal paste and inserted into the sensor port to the full depth. If the fit is too loose, slide a piece of copper plate or wire in beside the sensor, Seal the sensor port opening with silicone sealant to prevent water ingress. Ensure that sensor used on the collector are high temperature rated (up to 250℃/486℉), in particular the cable.

Stagnation and Overheating

Stagnation refers to the condition that occurs when the pump stop running, 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 a PTRV is installed on collector inlet or outlet the collector will continue to increase in temperature until the limit of the temperature relief valve is reached, at which point hot water will be dumped from the system. If a PTRV is not installed on the collector, steam will form in the header. Eventually some steam may feed back to the storage tank via the return line. The PTRV on

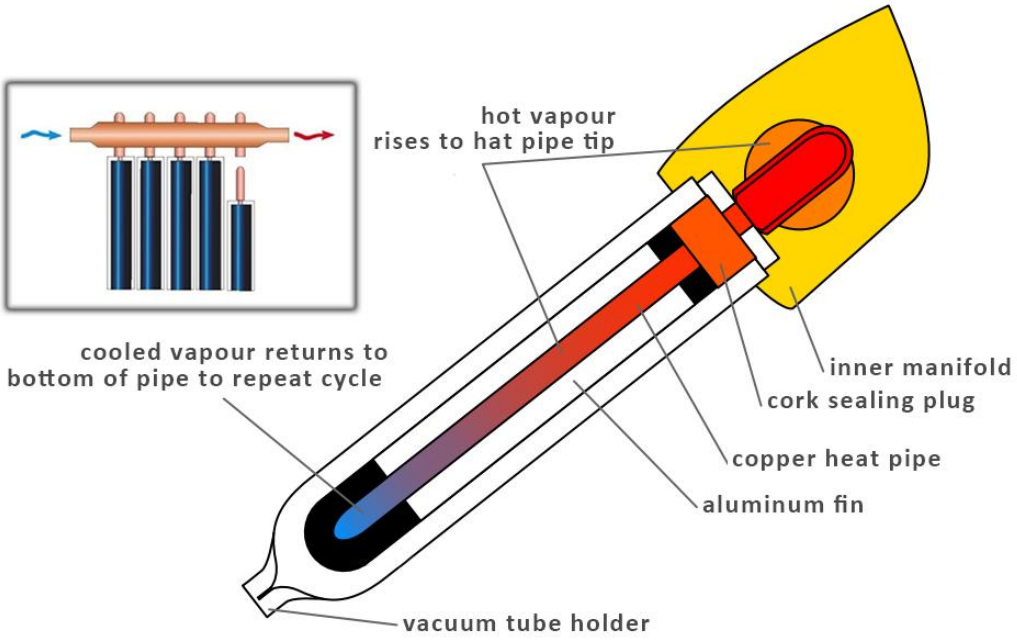
the tank will open to release pressure or heat as required. Under such condition the manifold will normally reach a maximum temperature of around 160℃/3-20℉. Generally the heat returning from the collector in the form of steam is not enough to affect a continue increase in tank temperature(ie heat input<tank heat losses)Under normal use stagnation should rarely occur as a result of pump stoppage, since power blackouts normally happen during storms and not clear sunny weather. High tank temperature protection should only occur when hot water is not used for several days (when on holiday), and only during strong periods of sunlight (summer). If leaving the house for an extended period of time(more than 2-3 days), it is advisable to cover the collector panel or design the system with a heat dissipation device or alternative use for the heat, thus preventing overheating of the system and collector stagnation. Stagnation of the solar collector will NOT damage the solar collector, however insulation used on the piping close to the manifold inlet and outlet should be able to withstand temperatures of up to 200℃/395℉(Eg. Glass wool or mineral wool-with an exterior wrap of aluminum foil, thus protecting against the elements).

Circuit installation illustration



Installation of Evacuated Tube Solar Collector ❹

Structure of heat pipe with glass tube



Riwatt Solar heat pipe series solar collector are always connected with existing heating supply device. The selective coating on the inner cover of the evacuated tubes converts solar energy into heat energy and transfers heat to the heat pipe by aluminum fins. The liquid in the heat pipe changes into vapour which rises to the condenser. The heat then passes through the heat exchanger and the vapour becomes liquid, returning to the base of the heat pipe. The heat conducts to the heat transfer liquid (anti-freezing liquid or water) via a copper pipe. This transference of heat into the liquid creates a continuous circulation as long as the collector is heated by the sun.

Unpack and inspect

Tube inspection

Before installing the riwatt solar collector, the most important part for you to first open is the vacuum tube

carton(s), which contain both vacuum tubes and heat pipes combined. Check to make sure the vacuum tubes are all intact, and the bottom of each tube is still silver. If a tube has a white or clear bottom, it is damaged and should be replaced (See below intact and damaged tube comparison). Each vacuum tube contains aluminum heat transfer fins which hold the heat pipe in place in the center of the vacuum tube.our heat pipes are centrally located and pre-inserted into the vacuum tubes to reduce your installation time and costs.

Heat pipes

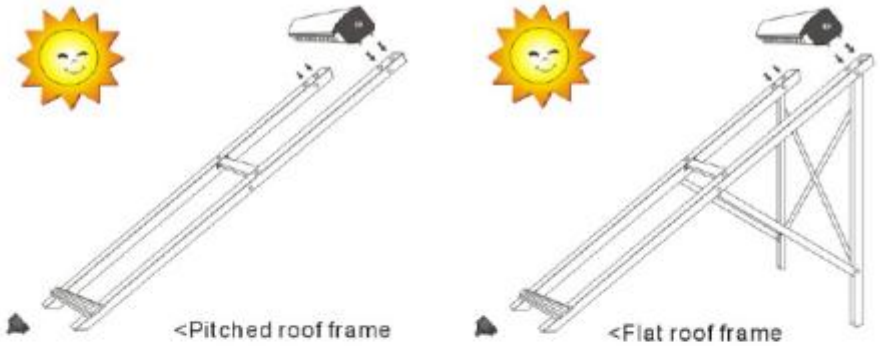
If heat pipes are bent during handing, don't worry as they are not easily damaged. Just ensure they are relatively straight before insertion into the evacuated tube.

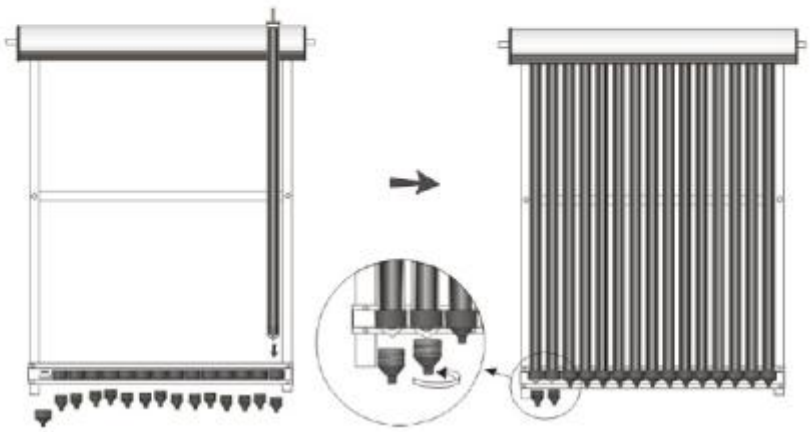
Frame

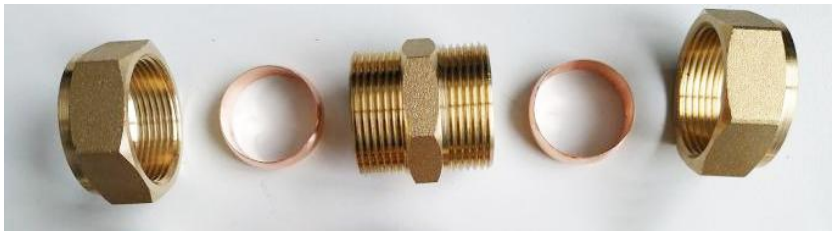
Unpack the standard frame kit that is packed together with the manifold, if a flat roof frame or low pitched roof frame is being used, those components will packed separately from the manifold. It may be necessary to purchase bolts or other fasteners to suit the installation surface. The attachment plates and bolts required to attach the manifold and bottom track are already in place on the frame front tracks. For each frame front track, there are two extra sets of bolts that can be used for securing the roof attachment straps.

Manifold Connections

There are two connections on the manifold, an inlet and an outlet. The fluid can flow in either direction. The flow of the fluid should be oriented so that the outlet of the manifold is also where the solar collector temperature sensor is installed. This is especially important for systems which have many collectors linked together since there can be great temperature differences between the inlet of the collectors and the outlet of the collectors.





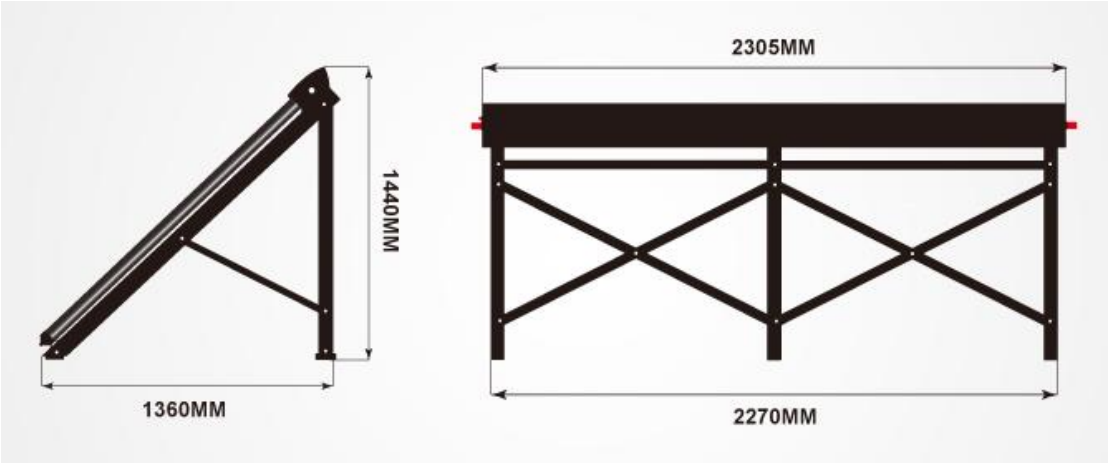


Note: please install air vent valve on the loop between riwatt solar collector and water tank.

Note: The manifold must be elevated at a minimum of 5° above the vacuum tubes in order for rapid transfer of the heat from the tubes to the manifold to through the use of evaporation of the special fluid inside of the heat pipes.

30 Tubes Solar Collector In serial Connection

30 Tubes Solar Collector dimension



Wind Stress

When installing the collector, consider orienting the collector for wind resistance and take notice to the stresses on the attachment points. The installation must be made according to building codes/regulations regarding the installation of the unit.

Caution: When installing in windy conditions take precautions as the unit can be caught by the wind and damage to the unit or persons can occur.

It is the responsibility of the installer to ensure that the frame mounting area is of suitable strength. When applicable, a building inspector or equivalent should authorize the location of the installation to ensure that it will be done within all relevant regulations. Proper safety techniques should be practiced when installing the unit. If there are any doubts, contact your building inspector.

Caution: Placement of the solar unit should consider the possibility of broken tubes and glass shards falling on people or animals from incidental contact

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Snow Loading

In areas where significant amounts of snow accumulation can occur, it is recommended that the solar collectors be elevated. Please refer to local and other regulations regarding snow loading precautions.

Accessory Frame Construction

Below are photos of the solar collector frame to reference when building the frame. For the flat roof stands, the back legs on the frame are optional and can be removed if you wish to mount the collector flush to the roof. Our slope roof frames may also be used for flush to the roof installations and also have the special ability of mounting underneath the tiles on a tile roof for a leak-proof design.

Step1: first install the nylon cap on the bottom track, then screw off the jacket from the nylon cap.
Step2: put the anti-dust rubber ring on the vacuum tube (mild dish washing liquid &water will be very useful), then paint the heat conduction resin on the heat pipe condenser.
Step3: insert the vacuum tube inside the nylon cap.(be careful: don't touch the vacuum tube on the ground, or it will be broken)
Step4: Hold the vacuum tube tightly, then insert it inside the opposite hole which on the manifold slowly.
Step5: screw the jacket on the nylon cap.

Note: It is best to make the bolts hand-tight on initial building of the frame. Secure the bolts tightly using a wrench when everything is pieced together and verified to fit correctly.

Note: The Flat Roof / Ground Stand has holes drilled specifically for the left and holes drilled specifically for the right side of the frame. Be sure to check where the holes are drilled for the cross-members to ensure that each piece is connected to the proper side of the frame, otherwise the cross-members will not have holes to mount to properly

Collector Direction

The collector should face the equator, which if in the Northern hemisphere is due South, and vice versa. Facing the collector in the correct direction and at the correct angle is important to ensure optimal heat output from the collector, however a deviation of up to 10°from due North or South is acceptable, and will have minimal effect on heat output.

Collector Angle

It is common for riwatt collectors to be installed at an angle that corresponds to the latitude of location. See also point2.2.7 Installing at an angle less that 20°is not recommended and the heat pipes perform best in the range of 20-70℃ While adhering to this guideline, an angle of latitude +/-10°is acceptable, and will not greatly reduce solar output. Angles beyond this range may be used, but a decrease in heat output will result. An angle lower than the latitude will enhance summer output, while a greater angle will enhance winter output.

Location
The collector should be position as close as possible to the storage cylinder to avoid long pipe runs. Storage cylinder positioning should therefore consider the location requirements of the solar collector. The storage cylinder should also be located as close as possible to the most frequent draw off pipe

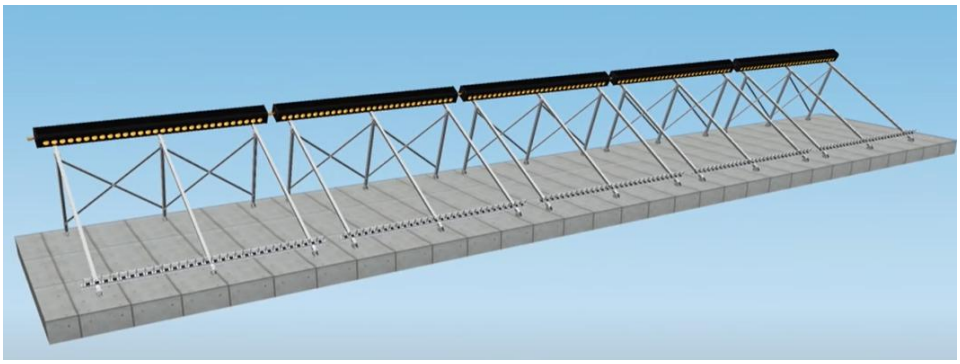
runs.

SPECIAL ATTENTION ❶:

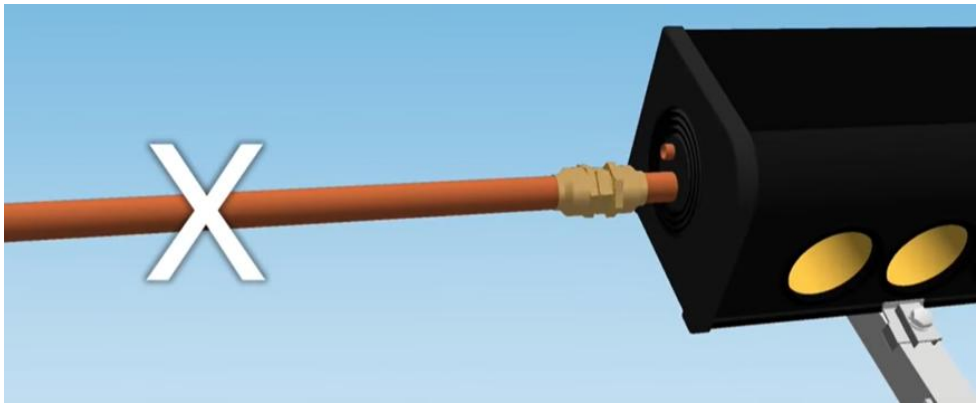
1. If the vacuum tube turn to milk color at the bottom, please remove this tubes. Due to this tube without VACUUM inside the tube, is it not workable anymore.

SPECIAL ATTENTION❷:

2. Recommend a maximum of 5* 30 tubes collectors can be installed in serial without a flexible connection



3. connection to the system pipe must allow movement that will occur during heat expansion and contraction also, all solar line piping should be insulated to prevent heat loss.

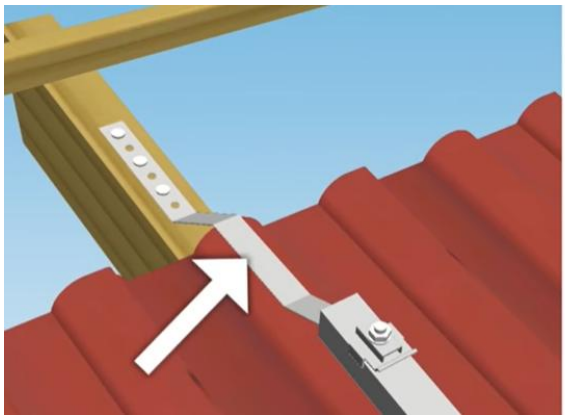


SPECIAL ATTENTION❸:

How to mount solar collector on different type of roof?

Tiled Roof Installation

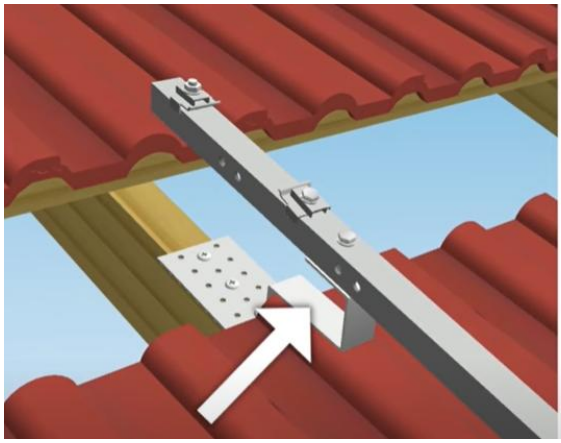
For tiled roofs use roof straps to attach the frame to the battens/purling. Roof straps shall pass beneath the tiles and be securely fixed directly to the rafters or trusses with a minimum of three screws 40 mm long per fixing. Roof straps can also be attached to roof rails by drilling through them.



Roof Straps

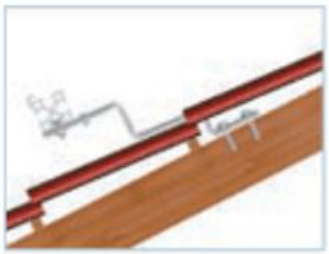
For flush mounting on a tiled roof in low wind regions, roof straps can be used.

The straps runs from the Front Track, under the tile and are secured to the rafter.



Roof Hooks

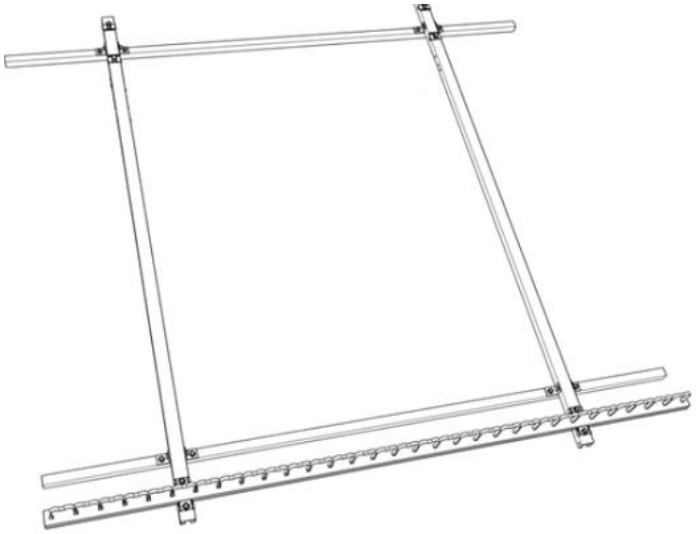
In high wind regions or whenever using Angled Frames, Roof Hooks should be used as they provide much greater anchoring strength.



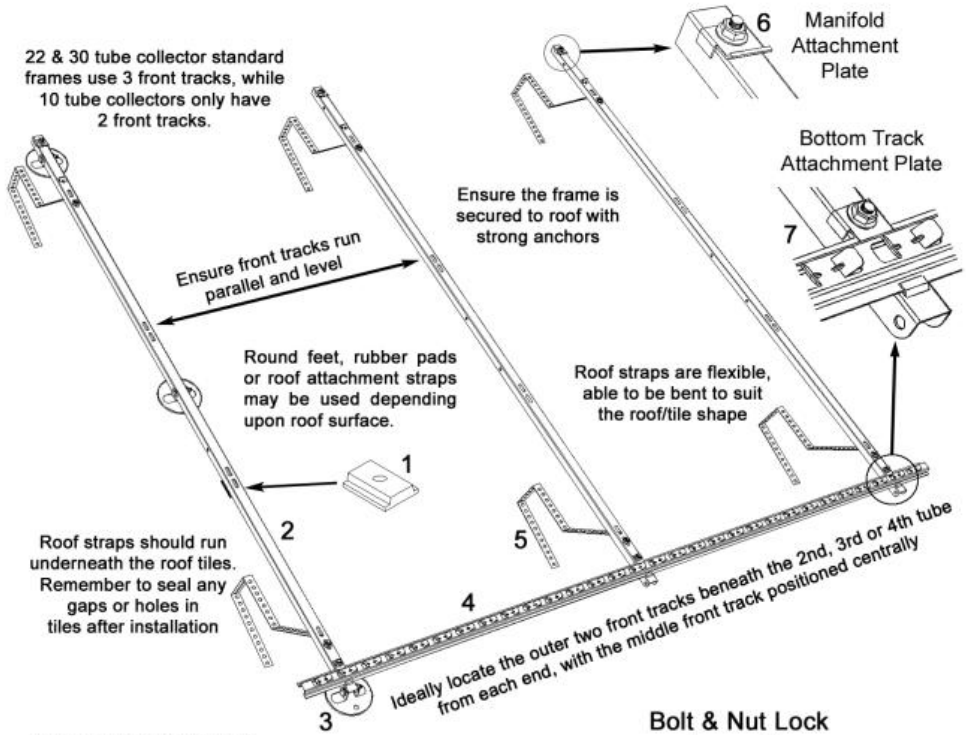



Flush Mount Frame Connection Installation

The figure below shows a standard flush mount frame with: 2 or 3 x front tracks. Note the image also shows the roof rails and bottom track.



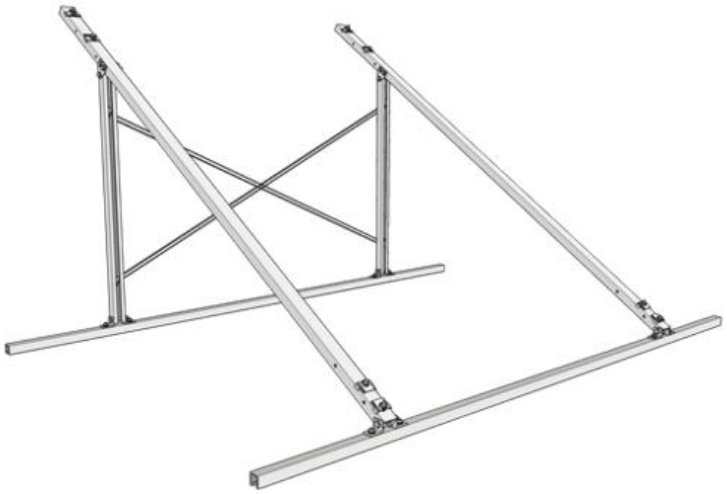
Standard Frame Assembly



Standard Components
1. Rubber Pad
2. Front Track
3. Round Foot
4. Bottom Track
5. Roof Strap
6. Manifold Attachment Plate
7. Bottom Track Attachment Plate
8. Bolt & Nut Lock Assembly

Bolt & Nut Lock Assembly

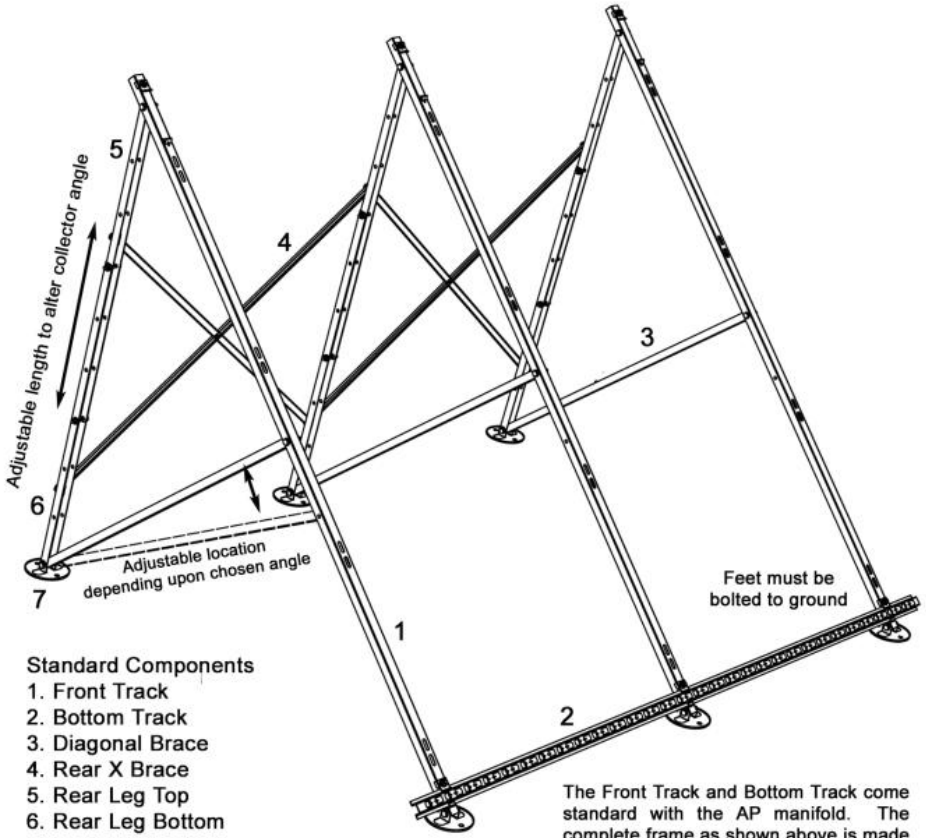
Riwatt Solar Collector for Flat Roof Installation



Flat Roof Frame Assembly

22 & 30 tube collector A-frames use:
- 3 sets of front track, rear legs and diagonal brace
- 2 sets of rear X brace assembly

10 tube collector A-frames use:
- 2 sets of front track, rear legs and diagonal brace
- 1 set of rear X brace assembly



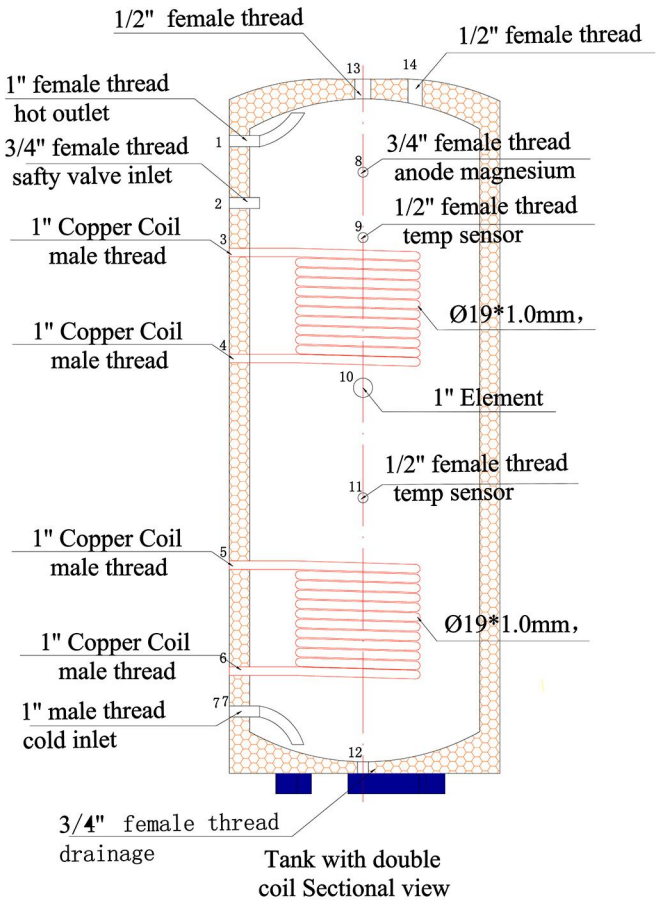
Standard Components
1. Front Track
2. Bottom Track
3. Diagonal Brace
4. Rear X Brace
5. Rear Leg Top
6. Rear Leg Bottom
7. Round Foot

The Front Track and Bottom Track come standard with the AP manifold. The complete frame as shown above is made by combining the Standard Frame with a Flat Roof Frame kit.

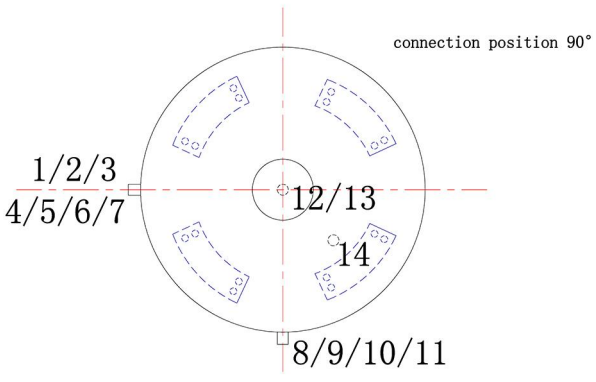
Solar water Tank ❺

Caution: Ensure that the solar water tank is installed in an area where the weight of the tank full of water can be supported. Be sure to install a drain pain under the tank. We will not be responsible for water or structural damage due to improper placement or plumbing techniques.

Caution: Do not turn on the water heating element until the tank is filled with water or damage to the heating element will result.



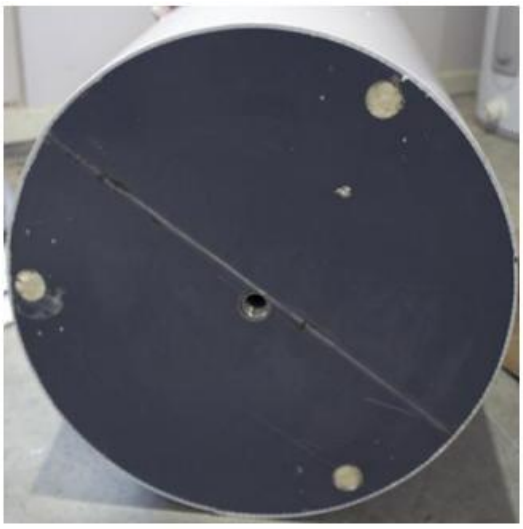
Tank with double coil Sectional view



Top View

Mounting Feet

Attach the bottom plastic or rubber feet to the tank so it stands a few inches from the floor. Screws are provided in the tank packaging.



Bottom of Duda Solar Tank with Threaded Holes for Mounting Feet & Drain Port

Cold water Inlet Port

The cold water inlet port is for your city or well water supply to the tank. This enters in through the bottom side of the tank. Above this port is the solar loop inlet and outlet. The recommended cold water supply pressure is psi. The cold water inlet pressure should not exceed 100 psi. Test your water pressure to be sure it does not exceed the maximum. Use a pressure regulation device to control the water inlet pressure if needed.

Lower Circulation Loop Ports

The solar loop is to be connected so that the return from the collector passes through the hot circulation inlet and out the hot circulation outlet to the working station.

Caution: Do not over-tighten the nut that holds the upper and lower coils in place. Doing so can twist the copper coil which will restrict fluid flow within the coil. Over-tightening can also crush the seal between the coil and the tank resulting in domestic water leakage through the port.

Note: It is best to connect to the coils with an elbow traveling downward to prevent a thermo siphon phenomenon from cooling the tank during no sun hours. The hot fluid inside of the coil will be unable to exit the coil beyond the downward bend of the elbow where cooler fluid will be resting since higher density/colder fluids sink while the hotter/lower density fluids rise to the top.

Elbows used on Solar Loop Connections to Tank to Prevent Thermo Siphon Effects

Bottom temperature Sensor Port

The bottom temperature sensor port is for detecting the temperature of the water which the bottom coil heats via the solar loop. This is recognized as T2 on the controller. Apply a little bit of the thermal conducting compound supplied with the manifold and slide it into this port.

Electric Water Heating Backup

The part you will find is the thermostat housing for the backup water heating element. Remove the screws to the panel to access the water heating element, wiring and thermostat sensor. Make sure that the thermostat sensor is installed inside of the temperature sensing port that is covered by the thermostat housing.

There is a water heating element pre-installed into the tank. It is usually a 3000w/220 VAC element. A 220v/240v AC power source should be used to activate this element for proper usage. This element can be easily removed and replaced with any element of your choosing from a local plumbing store which utilizes a 1" screw thread type connection. The port is 1" and uses an O-ring gasket to seal into the port, which is common for most standard water heating elements. The thermostat is capable of handling 110 VAC heating elements if desired.

Caution: The maximum power rating on the thermostat housing is 25 amps. Do not use water heating elements that will draw more than 25 amps or it can burn out the on/off switch and destroy the thermostat housing.

Wire your power source through the electrical housing and connect to the thermostat and then to the

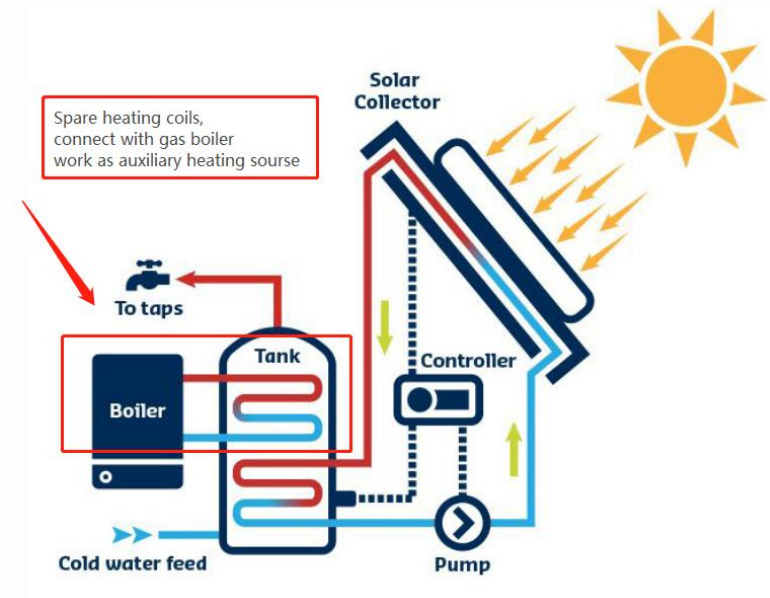
water heating element. Only one wire needs to go to the thermostat while the other can go directly to the element. The circuit on both wires must have full continuity in order for the element to operate (when the thermostat engages). The element should be grounded to the tank by one of the screws which connects to the tank.

Note: If you prefer to control the water heating element with the electronic controller, a high power relay must be used. Be sure that the relay matches the appropriate output voltage of the controller.

Caution: Do no exceed the rated amperage capacity of the relay.

Upper Circulation Loop Ports (Optional)

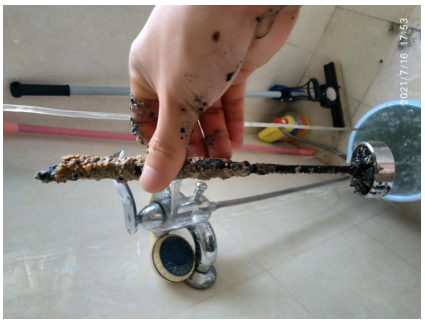
The upper coil of the tank can be used for a variety of applications. It can be used for alternate backup heating methods such as a boiler or external gas heater. It can also be used for retrieving heat for other systems such as radiant floor heating. Connect to this coil the same as the lower coil. Depending on the application, it may be advisable to use elbows on the top coil to prevent a thermo siphon from occurring.



Note: While dual coil tanks are useful for some applications, it is best to use a single coil tank for general water heating applications. Most single coil tanks have a longer bottom coil than do the dual coil tanks. Use of a dual coil tank for a single coil tank application may result in some minor thermal efficiency losses in the circulation loop.

Magnesium Rod / Anode rod

The anode rod port already has a new magnesium rod pre-installed. This rod should be checked regularly for corrosion and be replaced as needed to ensure a long lasting life to the tank. The rod can be replaced with an aluminum rod if the water supply is very hard water or with a zinc-aluminum rod if the water has a sulfur dioxide smell.



Hot Water Outlet

There is a hot water outlet port on the top side of the tank and also on the top of the tank. Use a plug to block off flow from one of the unused ports if applicable. Connect piping from the hot water outlet to your hot water supply to the building.

Note: It is strongly recommended to connect an elbow facing downward to the hot water outlet prior to connecting to the piping of the building to avoid a thermosiphon which will cause significant heat loss to the tank, especially through the night when water is not used. An alternative way to prevent the thermosiphon phenomenon is to install a spring loaded (vertical) check valve directly to the hot water outlet.

Hot Water Outlet with Elbow to Prevent Unnecessary Thermo Siphon

Drain port (Bottom side of the tank)

On the very bottom of the tank there is a drain port. It is recommended that piping and a ball valve be installed to this port for when the tank needs to be drained. This can be very useful when checking the anode rod or when the tank needs to be serviced. Connect an elbow directly to the drain port, run piping far enough out from under the tank and install a valve for easy draining access. The valve should be able to eject water to the drain pan or have a garden hose fitting attached so that a garden hose can be used to direct draining water outside. In order for the tank to fully drain, the exit point for the water must be lower than the bottom of the tank.

Note: It is best to open the T/P valve when draining the tank to allow adequate air flow into the tank.

Thermostatic Mixing Valve

WARNING: Solar water heaters heat whenever the sun is out. If the hot water is not used, it will continue heating the water to the point of boiling and may cause scalding or serious burns. Extremely

hot water may damage appliances such as dish washers or laundry machines if a thermostatic mixing valve is not installed.

CAUTION: Adults may suffer slight burns from hot water from open taps. Children and elderly people may not have the proper reaction time to remove hands from a tap before severe scalding may occur. Households with children and elderly people should take additional precautions against scalding, such as installing thermostatic mixing faucets and showers.

Maximum temperatures for the tank can be set by the controller. But when the sun is available with free heat, it is normally not desirable to shut the heating down for the day. To combat the risk of scalding from extra hot water or damage to appliances, a thermostatic mixing valve must be installed to the hot water outlet.

1" Thermostatic Mixing Valve Connected to Hot Water Outlet and Cold Water Inlet

The thermostatic mixing valve must be used in a solar water heater to prevent scalding at the faucet. Since the sun can vary based on weather and time of year, solar systems will experience anywhere from mild to extreme hot water. Install the thermostatic mixing valve on the hot water outlet in conjunction with a cold water source so that it will mix in cold water automatically. This will ensure that the water exiting from the solar water tank will not exceed the maximum temperature set by the valve.

To adjust the temperature on the valve: turn the knob clockwise to decrease the maximum output temperature or counter-clockwise to increase the maximum temperature. The Markings show the approximate mixed temperature output in degrees Celsius.

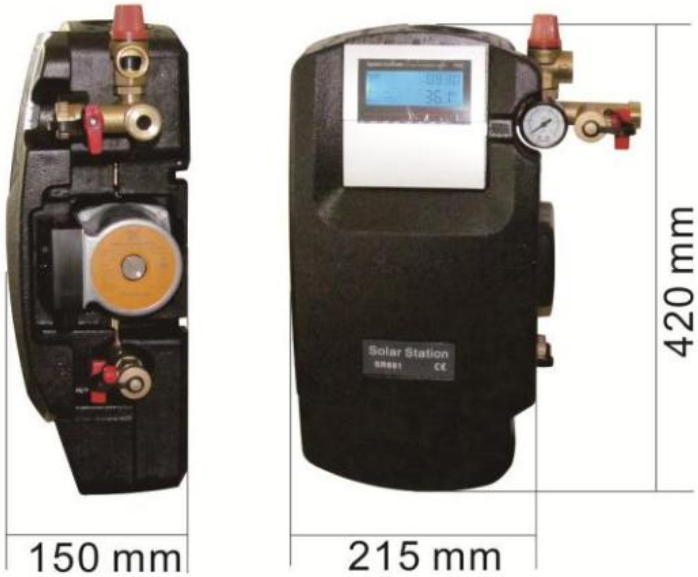
The consumer product safety commission recommends a maximum of 120°F output temperature. This is approximately 50°C. Some appliances such as dishwashers may require higher input temperatures. In this case, it may be preferred to add a tee to the hot water outlet on the tank and use a secondary thermostatic mixing valve for supplying such appliances. Alternatively, the thermostatic mixing valve on the tank can be set to the maximum appliance temperature while thermostatic faucets and

showers are used to regulate the water temperature to lower temperatures when coming in contact with humans. Thermostatic mixing valve faucets and showers can also be quite convenient as the exact desired temperature can be selected every time and the user does not need to spend time adjusting the water accordingly each time of use.

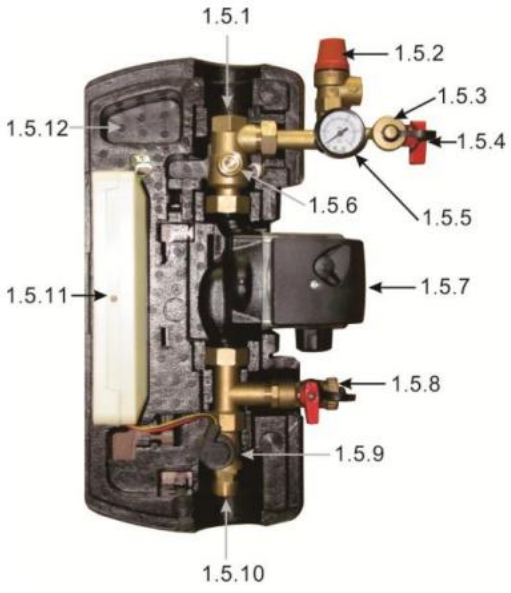
SR881 Working Station (Pumping Station) ❻

The Solar Water Heater System comes with the SR881working station or its equivalent.
The SR961s working station is an advanced device which circulates the working fluid of the closed loop with a varying flow rate from the collector to the tank based on collector, tank and return temperature coming from the tank. It has higher performance in heat gathering and is energy efficient in operation.

SR881 Working Station A 3 – speed RS high temperature fluid pump with pressure gauge, pressure relief valve, flow meter, shut-off valve(s), check valve and charging valves are incorporated into the system. The pump station is
encased with a foam insulation that helps retain heat. The metal casing helps protect electronic components from getting damaged by external forces.



Long screws or bolts may be used for mounting the working station to a wall. It should be mounted in the lower part of the closed loop system, preferably near the water tank for easy access to sensor ports. Be sure to mount the working station without obstruction to the charging valves, pressure relief valve and expansion tank port.



1.5 Specification of components

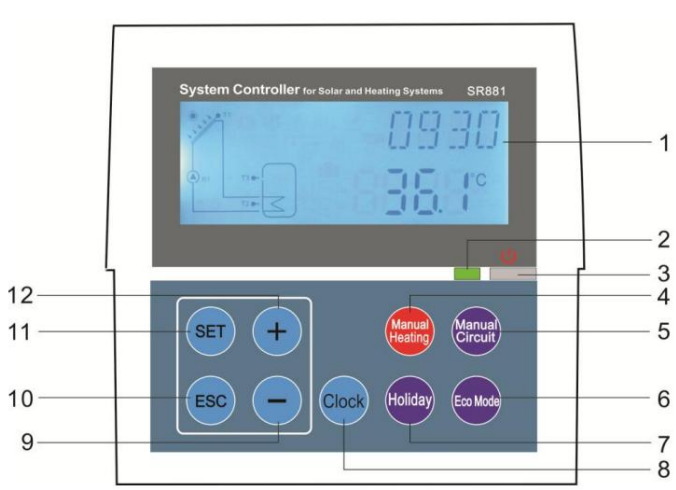
1.5.1 Return outlet connection (to collector): 3/4 IT

1.5.2 Safety valve: 6bar

1.5.3 Filling connection 3/4 male thread

1.5.4 Connection of expansion vessel 3/4 male thread

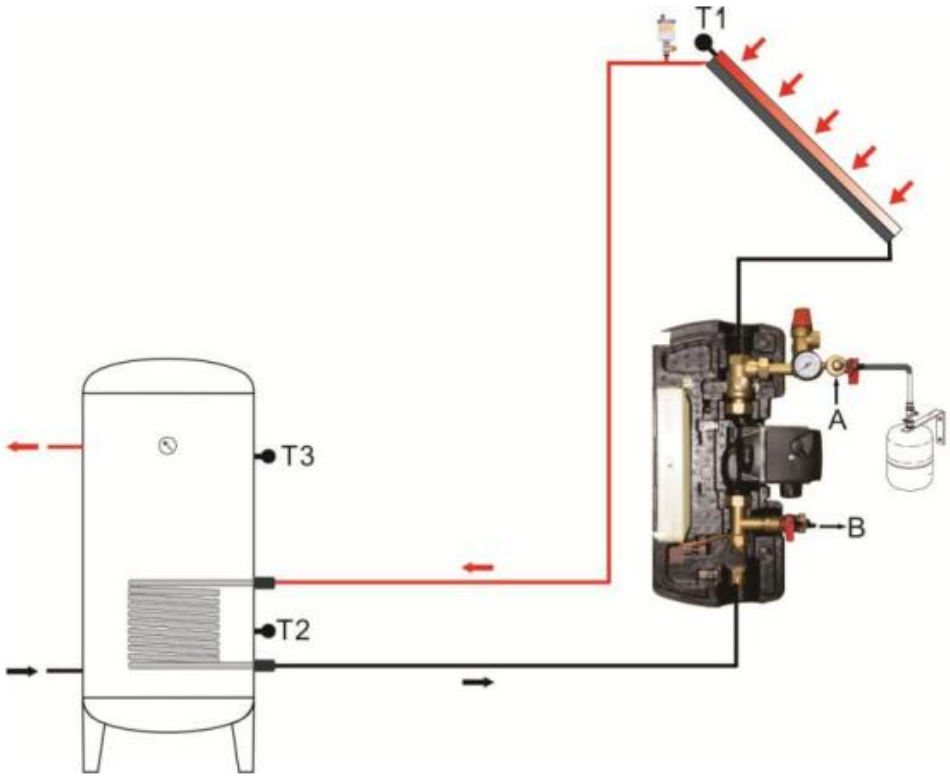
1.5.5 Manometer: 0-6bar
1.5.6 Non-retum valve: opening pressure 200mmH2O
1.5.7 Circuit pump: Wilo 15-6 or Grundfos 15-65
1.5.8 Filling connection 3/4 male thread
1.5.9 Digital flow meter 1-16L /min (alternative mechanical flow counter2-12L/min)
1.5.10 Flow outlet connection (from tank):3/4' IT
1.5.11 Wire terminal of controller
1.5.12 EPP insulation case



Nr.	Button
1	LCD Display screen
2	Power indication lamp
3	"On/Off"
4	"Manual Heating"
5	"Manual Circuit"
6	"Eco Mode"
7	"Holiday"
8	"Clock"
9	Downwards adjust "-"
10	"Exit"
11	"Set"
12	Upwards adjust "+"

Flushing and filling the solar system Steps:

●Disconnect the expansion vessel from the solar thermal system.
Connect the pressure hose of a flushing and filling station to the fill ball valve A of the solar pump station
●Connect the flushing hose of a flushing and filling station to the drain ball valve B of the solar pump station
●Open the filling ball valve and drain ball valve
Flush the solar thermal system using the flushing and filling station for at least
1 5minutes to remove all air from the system.
●During the flushing, bleed the solar thermal system several times at the air stopper until the discharged solar fluid is free of air bubbles.
●Close the drain ball valve of the flushing and filling station, and continues run the filling pump and increase the system pressure to approx.3-4 bar, system pressure can be read from the manometer.
●Close the flushing ball valve B of the solar pump station, and then close the filling valve A，and then stop the flushing and filling station.
●Check the manometer to see whether the system pressure reduces and eliminate leaks where necessary.
●Reconnect the expansion vessel to the solar thermal system.



Controller

Three sensors are provided with the controller.

The black wire sensor is the pt1000. This high temperature sensor is to be used for the solar collector temperature detection and must be connected to T1 on the solar controller / working station. It withstands the high temperatures of the collector and works differently from the 10k sensors and cannot be interchanged.

Note: Be sure to put the pt1000 sensor into the side of the manifold which is also the outlet for the closed loop. Secure the wire appropriately so that there is no risk of the sensor falling out of the sensor port during operation due to external forces such as wind.

Note: Apply some thermal conducting paste to the tip of the probe to aid in rapid temperature detection with the
sensor.

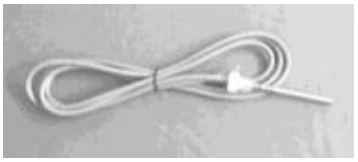
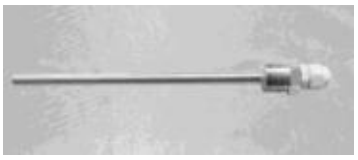
The 2 gray wire sensors are to be installed into the top and bottom ports on the solar tank. T2 is the bottom sensor; T3 is the top sensor.

One of the various options of the controller is to circulate water from the tank, through the piping in the house and back to the tank. This keeps the water hot at all times so there is no waiting period for hot water when the tap is opened. This function can also be set with time intervals so that hot water is not wasted during non-use hours (while sleeping or gone to work).

In order to use this feature, a 2nd circulation pump is required. A 3rd 10k (gray) sensor and a thermowell will be required (must be purchased separately). Install the 3rd sensor into the thermowell and put the thermowell into the return hot water pipe. The thermowell is typically installed into the pipeline just before returning to the tank using a tee to allow insertion into the pipeline. The controller can then sense when the pipe has cooled off in order to operate the circulation pump to provide the pipes with more hot water

Copper Thermowell

SR881 Working Station Accessories List

Products name	Specification	Products picture
A01: High accurate Pt1000 sensor for collector	PT1000, Φ6*50mm	
A02 High accurate sensor for tank and pipe	NTC10K, B=3950, Φ6*50mm	
A05 304 stainless steel thermo-well	304 stainless steel with thread 1/2’ OT, Size: Φ8*200	

Electrical Installation

Please refer to the working station manual for instructions on wiring the device and connecting the temperature RTD sensors.

Caution: Prior to operating the pump, ensure that any shut-off valves in the closed loop are on the on position. If the pump operates with a closed shut-off valve, it can cause excessive heat build-up and burn out the pump. The SR961s and similar models have a pump protection mode where if it cannot achieve flow within 3 minutes of operation, it will shut down the circulation mode

Pressure relief Valve

The pressure relief valve is located at the top right of the working station enclosure. It has a knob which is used to test its functionality and for manual draining. A drain hose or pipe should be attached to this valve so that if the valve opens, fluid can be directly to an appropriate container.

Pressure Relief Valve for Closed Loop

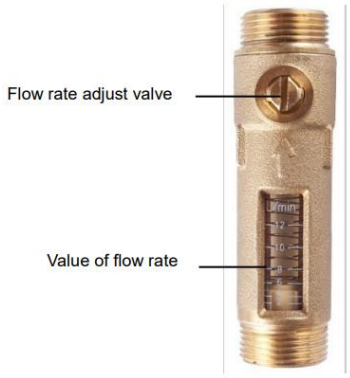
Flow Meter

The SR961s working station has an integrated flow meter with digital display. The flow rate is shown on the bottom portion of the display screen. It will measure the flow in liters per minute when the

pump is operating and when flow is occurring.

Other controllers may use a mechanical flow meter which utilities a float inside of a pipe. The flow meter shows the flow of the solar loop in liters per minute. A white washer floats up to the appropriate level indicator to show the approximate flow when the pump turns on. The bottom of the flow meter (inlet to the working station) should be connected to the outlet of the coil on the solar tank so that the colder glycol solution enters the working station (after heat transfer to the tank).

On these mechanical flow meters is typically a tempering valve which can be used to restrict the flow of the fluid to the suction side of the pump. This valve should normally be set to full open (vertical position) by use of a flat head screwdriver unless the application requires higher temperature fluid to approach the tank (not normal).



Fissol mechanical flow meter（2-12L/min）

Backup Heating function

Our tanks come with a electric water heating backup. The controller has a backup heating function as well which can be used for this electric water heating element or another backup source such as an external gas heater. The advantage to using the controller for electric backup heating is it can be set with a timed function so that it will not activate the backup heating during times when water is not used i.e.: 4am. This can help save electricity by allowing the sun to continue the heating on the next day rather than relying on the element when the hot water is not even needed.

Caution: The controller will have a limited amount of output current which can activate a water heating element. For any high power applications which the controller cannot handle, a high power relay must be utilized. The controller will activate the relay so that high current passes through the relay to the element without passing through the controller.

Temperature/Pressure Relief

The T/P valve should be installed into the T/P port or top of the tank. Connect piping to the outlet of the T/P valve to direct ejected fluid to the drain pan or directly to the sewer. Test functionality of the valve when the tank is initially filled with water prior to operation and also every 6 months. Replace with a 100 psi maximum T/P valve if it is found not to function correctly.

How to Cut, Connect and Join Stainless Steel Solar Pipe & Fittings? ❼

Step 1

Cut the Solar hose to your desired length with the pipe cutter

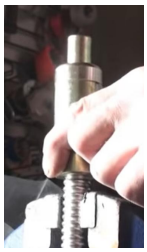
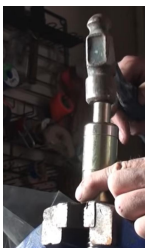
Step 2

Put a brass nut onto the solar hose first before
putting the end of solar hose into the flange tool.

Step 3

Use a hammer to flatten the end of the solar hose.

Warning: Very important to get a flat end of the solar hose to realize the perfect sealing performance!

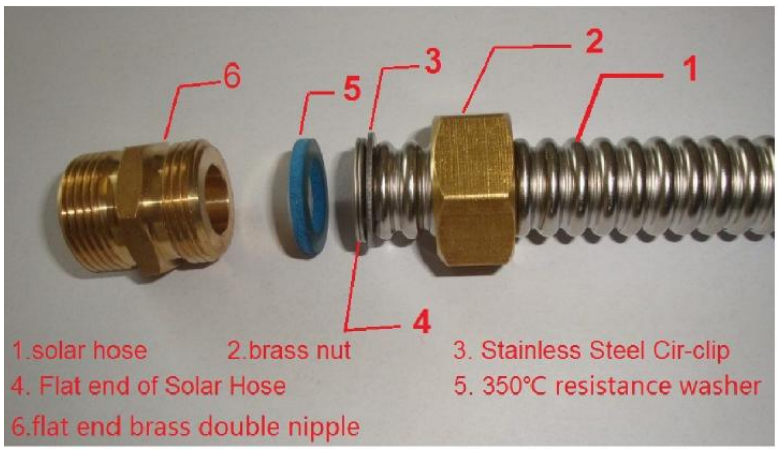



Step 4

Squeeze the stainless steel Cir-clip on the Solar Hose

Step 5

Screw the Brass nut ,washer and the brass double nipple together with spanner.



Step 6

The final Assembly should look like this.

1.8. System design and installation

Please read all installation instruction carefully before beginning system design or installation. The system configuration may need to be customized to suit the specific requirements of the installation. Please ensure that any system design meets local building, water quality regulations.

Maintenance and Troubleshooting 8

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. If the tubes are not easily and safely accessible, high pressure water spray is also effective.

Leaves

During autumn days, leaves may accumulate between or beneath the tubes. Please remove these leaves regularly to ensure optimal performance and to prevent a fire hazard.

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 even with a tube broken. Any broken glass should be cleared away to prevent injury.

To replace a tube:

●Remove the tube clip, slide the broken tube out and carefully pick up any glass pieces. Please wear protective gloves when handling the broken glass. When removing the tubes, the rubber ring in the manifold casing may pop out. Just return the ring into place before inserting the new tube. Avoid touching the glass wool insulation with bare hands, as it can cause mild skin irritation. The new tubes should already have heat transfer fins inserted, so slide the new tube into place taking care to guide the heat pipe into the slot between the fin and the glass wall. Normally the heat pipe does not need to be removed from the manifold.

Trouble Shooting:

Problem	Cause	Remedy
Heat pipe solar collector low working performance	a) Less solar insolation in your geography area	a) Add other assistant energy sources, such as gas heating or electric heating system.
	b) Solar collector is covered by shade so can't receive enough sunlight	b) Relocated in unshaded area
	c) Vacuum tube broken	c) Replace a new fine vacuum tube
	d) Heat pipe didn't be installed correctly	d) Pull out the heat pipe and daub some silicon grease on the heat pipe's condenser then reinsert it into the manifold
	e) Solar collector installed by a wrong angle	e) Adjust the solar collector and make sure the installation angle is from 15℃ to 75 ℃
	f) Pipe line don't seal and insulated very well, so there is more energy loss	f) Check and seal the pipe line and keep the pipeline insulated very well.
	g) Working station's gauge shows pressure gauge pressure lower than 2~3 Mpa (500bar) or even lower	f) Re-charging the loop with liquid, to make sure maintain at least 5~6Mpa.

Warranty ❾

We guarantees the electronic components for one year, the collector manifold and solar water heater tank for 5 years, the vacuum tubes for 10 years,the date of purchase. Only products with manufacturer defects will be replaced. we will not replace equipment which has been damaged, corroded or misused. we will not be held liable for other damages associated with a fault or defect to include labor or other costs. we will not pay for shipping costs associated with the return of defective merchandise but will cover shipment of replacement devices to the customers within the 48 contiguous states if original merchandise is deemed defective.

Disclaimer ❿

This manual provides important information regarding the safe installation and operation of your system. It is not intended for this manual to be a complete resource for the installation and safe operating procedures for installing and operation of your system. For the reason of safety, we recommends that this system be installed by a professional installer only. we are in no way to be held responsible for failure to follow your local safety regulations and codes for your specific locality. we will only be held liable for product replacement.

Simple/secure/smart