

## **HHNS Solar Evacuated Tubes**

### **1.1 Local Code**

Installation must be completed in accordance within regulation of all national and local codes

### **1.2 Qualified Installer**

Installation must be completed by qualified solar, heating or plumbing professional.

### **1.3 Pressure and Temperature and Relief**

Solar loop should be designed for normal operation of Less Than 72 Psi (500Kpa) via the use of a pressure-limiting valve on the main cold supply line. System design must provide mean for allowing pressure release of no more than 116 Psi (800Kpa) and hot water dumping from the solar loop once the temperature reaches 210 degree F (99 degree C). It is recommended that the lever on the pressure and temperature relief valve be operated once every 6 months to ensure reliable operation. It is important to raise and lower the lever gently.

### **1.4 Metallic Corrosion**

The Solar Collector may be used for heating of a spa or pool water, but levels of free chlorine must not exceed 2 PPM . Additionally, the warranty for Solar Collectors when used for a spa or pool heating is 2 years.

### **1.5 Freeze Protection**

Freeze protection should be incorporated where outside temperatures fall below freezing at any time. When freezing is a concern, a closed loop glycol-water mix should be used to protect against freezing.

### **1.6 Hail Protection**

The glass-evacuated tubes are very strong and able to handle significant impact stress once installed. Testing and impact stress modeling proves that the tubes are able to withstand impact from hail of up to 1 inch (25mm) when tubes are installed at an angle of 40 degrees or more. The ability of the tubes to withstand impact is greater when the tubes are installed at higher angles, thus the lower the installed angle – the reduction in resistance. However, even when laying flat, impact of hail up to ¾ inches (20 mm) will not cause breakage. The solar collectors can still function properly even with one or more tubes broken, however a reduction in heat output will result.

### **2.1 Tube Inspection**

Open the tube boxes, which contain both the evacuated tubes and heat pipes. Check to make sure that the evacuated tubes are all intact and that the bottom of each tube is silver. If a tube has a white or clear bottom, it is damaged and should be replaced. Each

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evacuated tube contains a pair of metal heat transfer fins. As soon as the evacuated tube is removed from the box, please put on the rubber tube caps, which are located in the manifold box. This will protect the bottom tip of the glass tube from being broken if knocked. Do not remove and/or expose tubes to sunlight until you install them, otherwise the inner tube and heat transfer fin will become very hot. The outer glass surface will not become hot.

## 2.2 Heat Pipes

If the heat pipes are bent during handling, don't worry as they are not easily damaged. Just ensure that they are relatively straight before inserting them into the evacuated tubes.

## 2.3 Frame

Unpack the standard frame kit that is packed together with 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 the 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.

## 3.1 Plumbing Connection

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

## 3.2 Choice of Piping Material

The manifold pipes (hot / cold) are 22mm. Our Caleffi Stainless Steel SolarFlex pipe ([http://www.houseneeds.com/shop/solar/caleffi\\_solarflex\\_main.asp](http://www.houseneeds.com/shop/solar/caleffi_solarflex_main.asp)) in either ½ inch or ¾ inch with compression fittings works well with this and allows attachment to the manifold without sweating any pipes. If you decide to sweat on too these pipes, you must take care not to overheat any of the rubber fittings on the end manifold. Failure to do this will void the warranty of the manifold.

## 3.3 Pressure and Temperature and Relief

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### 3.4 Domestic Water Temperature

Domestic water should never be allowed to be delivered over 120 degree F. This can be achieved by using a mixing valve set to 120 degrees F on the hot side of the domestic hot water tank.

### 3.5 Temperature Sensor Insertion

The solar controllers temperature sensor should be coated with a thick layer of thermal paste and inserted into the sensor manifold port to the full depth. If 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 sensors used on the collector are high temperature rated up to 486 degrees F (250 degree C) including the cable.

### 4. Stagnation and Overheating

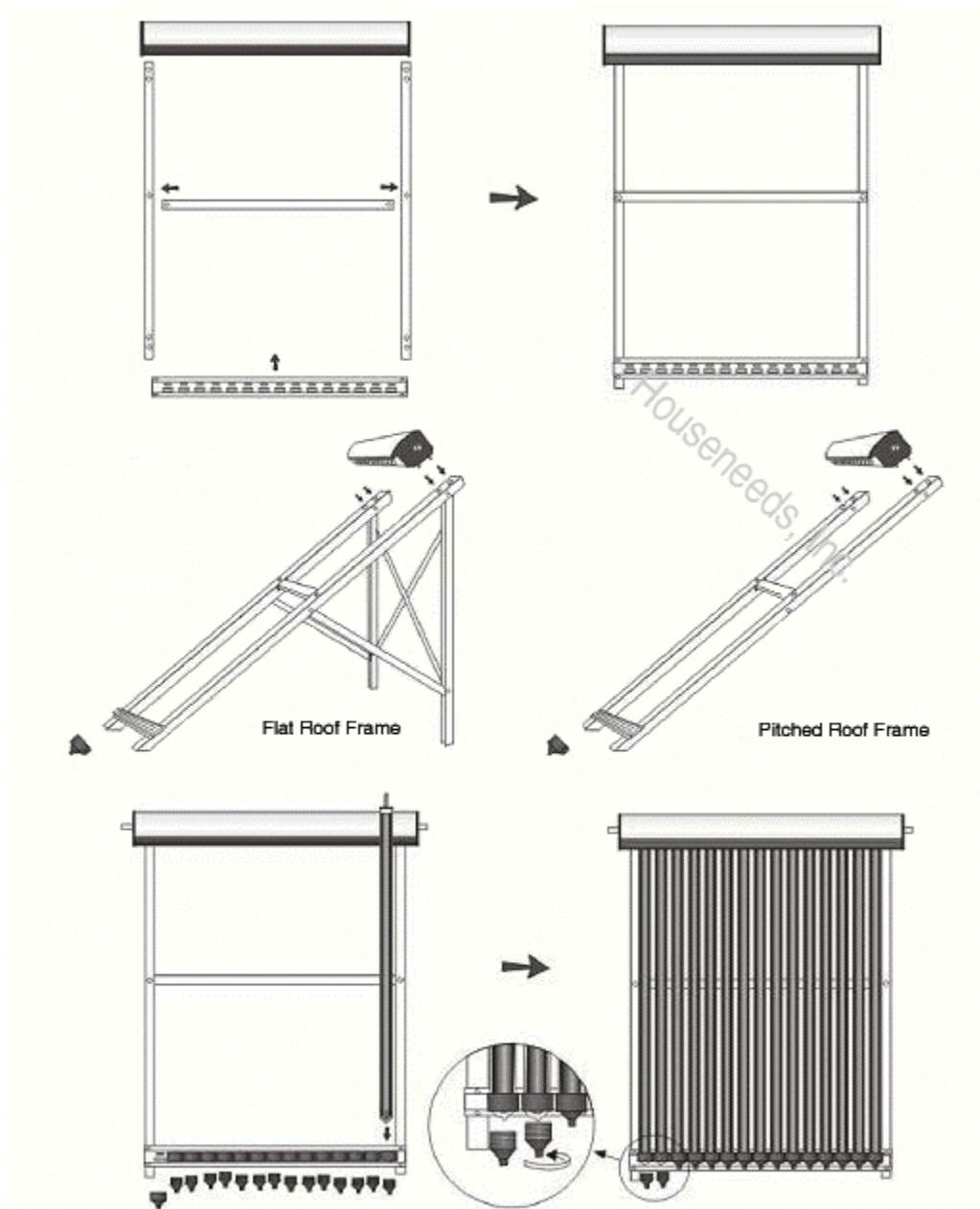
Stagnation refers to the condition that occurs when the pump stops running due to pump failure, power interruption or as a result of a high tank temperature protection feature built into the controller, which turns the pump off. If a PTRV (pressure temperature relief valve) is installed on the collector inlet or outlet, the collector will continue to increase in temperature until the limit of the PTRV 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 and eventually some steam may feed back into the storage tank via the return line. The PTRV on the tank will open to release pressure or heat as required. Under such conditions the manifold will normally reach a maximum temperature of around 160 C or 320 F. Generally the heat returning from the collector in the form of steam is not enough to affect a continued increase in tank temperature. Under normal conditions, stagnation should rarely occur as a result of pump stoppage from a power outage since power outage causing storms rarely occur during hot clear sunny weather. High temperature protection should only occur during periods when hot water or heat in the solar system is not used for several days. During a period when hot water or heat is not being drawn from the system (such as when the house is left unoccupied for several days), it is advisable to cover the collector panel or design the system with a heat dissipation device (heat dump zone) thus preventing the system from over heating. Stagnation of the solar collector will not damage the solar collector however the insulation used on the piping close to the manifold is not able to withstand temperature of 200C or 395F.

### 5. Structure of the Heat Pip with Glass Tube

The heat pipe series solar collectors are always connected into an existing heating supply system. The selective coating on the inner cover of the evacuated tubes converts solar energy into heat energy and transfers heat to the heat pipes via aluminum fins. The liquid in the heat pipe changes into vapor, which rises to the condenser. The heat then passes through the heat exchanger and the vapor becomes liquid returning to the base of the heat pipe. The heat conducts to the heat transfer liquid (anti-freeze 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.

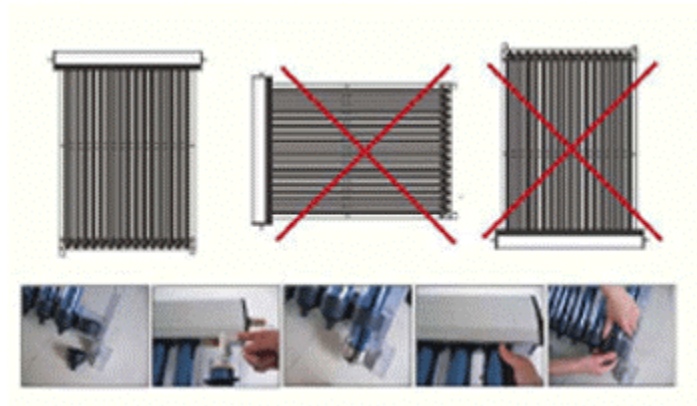
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## 6. Frame Installation



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## 7. Installation of the Collector



### 7.1 Collector Direction

The collector should face the equator, which in the Northern hemisphere is true South. Facing the collector in the correct direction and at the correct angle is important to insure optimal heat output. A deviation of up to 10 degrees from true South is acceptable.

### 7.2 Collector Angle

It is common for collectors to be installed at an angle that corresponds to the latitude at the location. Installing at an angle of less than 20 degrees is not recommended as the heat pipes perform best in the range of 20 to 70 degrees. Adhering to a guideline angle of +/- 10 degrees from latitude at the location will not significantly reduce solar output. An angle lower than latitude at the location will enhance summer output while an angle greater than latitude will increase winter output.

### 7.3 Location

The collector should be positioned as close as possible to the solar storage tank to minimize long pipe runs.

**Step 1: first install the nylon cap on the bottom track then screw off the jacket from the nylon cap.**

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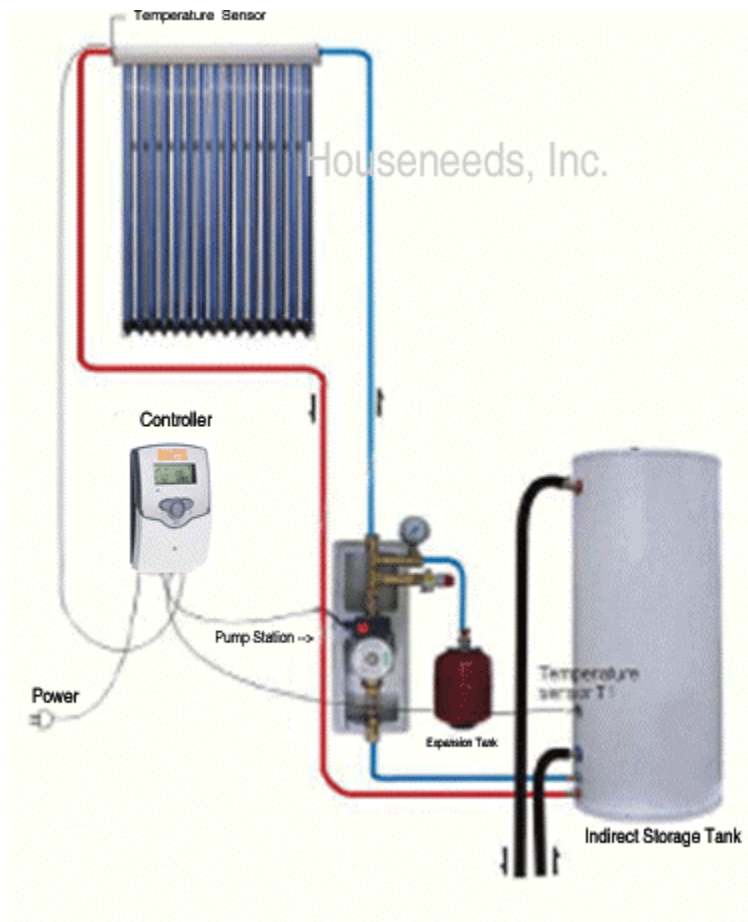
**Step 2: put the anti-dust ring on the vacuum tube (mild dish washing soap or water will be helpful) then paint the heat transfer paste on the heat pipe condenser.**

**Step 3: insert the vacuum tube into the nylon cap. Be careful to keep the end of the vacuum tube off the ground so the tube will not be broken.**

**Step 4: hold the vacuum tube tightly then insert it into the appropriate opening on the manifold. A slight twisting rotation will help insert the tube and seat it properly.**

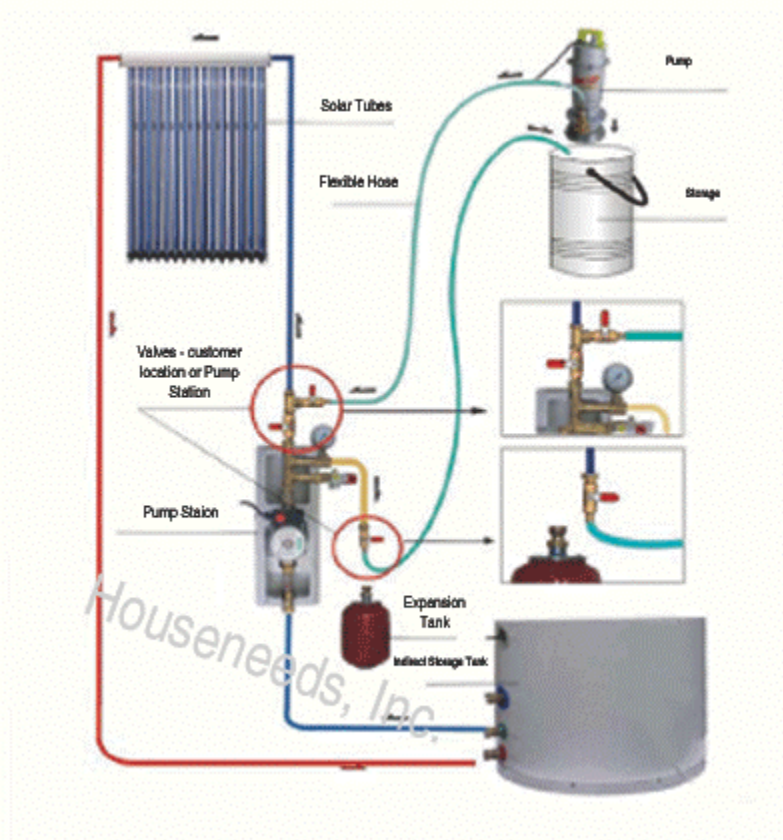
**Step 5: screw the jacket on the nylon cap**

## 8. Installation Example



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## 9. Filling Solar System with liquid (Glycol/Water)



## 10. Filling the pipeline with Liquid



### 10.1 Air Purge

Once the supply and return piping is connected to the plumbing system, the collector loop should be purged of air. If a direct mains pressure system is being used, opening the hot water taps in the house and operating the pump at full speed should eliminate all air from the system. For non-main pressure installations, the

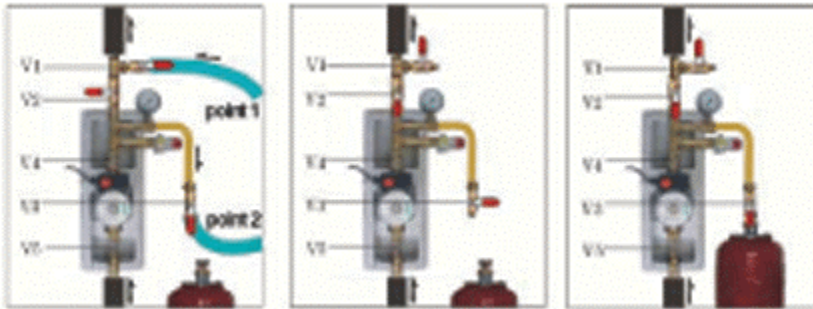
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pump should be run at the highest speed settings forcing air out of the manifold and back into the tank. If air is not fully eliminated from the collector manifold it may be necessary to loosen the connection to the header outlet allowing air to be released. An auto-air vent may be used to vent air from the collector manifold.

### 10.2 Plumbing Check

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

### 10.3 In Proper Order:

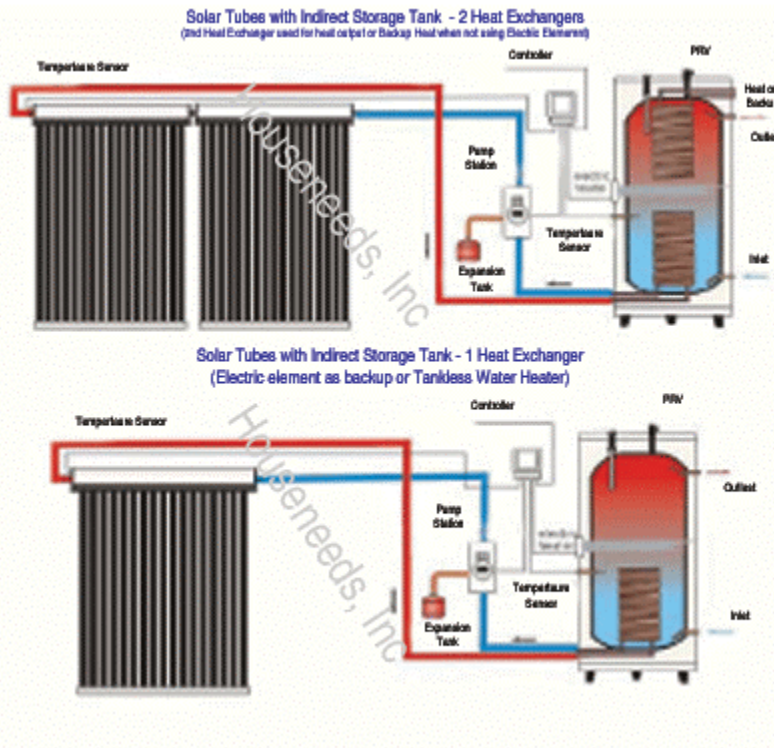


**Step 1: open valve V1, V3, and V4. Close V2. Start the pump from the liquid medium from point 1 and out point 2. Let the circulation last for 2 minutes until all the air is exhausted from the pipeline.**

**Step 2: close V3, then close V1 and take off the pump from the liquid medium fill container.**

**Step 3: connect the expansion tank at V3. Open V3 and V2. Open V4 and leave it in that position from now on. Start the pump station, observing the balancing valve V5 and see if there is any air inside the pipeline. If there is air left in the pipeline, reconnect the pump and liquid medium as before and run until all the air is eliminated from the system.**

## 11. Maintenance



### 11.1 Cleaning

Regular rain should keep the evacuated tubes clean but if particularly dirty, they may be washed off with a soft cloth and warm soapy water or glass cleaner. If the tubes are not easily accessible, a high-pressure hose may be used.

### 11.2 Leaves

During autumn, leaves may accumulate between or beneath the tubes. These should be removed to insure maximum heat transfer.

### 11.3 Broken Tube

If a tube breaks, it should be replaced as soon as possible. The system will still operate but heat transfer will be compromised.

### 11.4 Insulation

The pipes running to and from the collector should be insulated. Insulation should be checked annually for damage and UV stabilized covering should be installed to protect the insulation.

## 12 Precautions

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### **12.1 Solar for Central Heating-Preventing Overheating**

**If a system has been designed to provide a contribution to space heating, it will often generate more heat in the summer than can be used in the domestic hot water supply system alone. In such cases, it is advisable for the home to have a heat dump zone directed to a spa, pool or other heat-dissipating outlet to get rid of excess heat.**

### **12.2 Metallic components**

**Wear gloves when handling the metal system components to protect against injuries from sharp edges. All efforts have been made to make components safe to handle, but care should be exercised.**

### **12.3 Evacuated Tubes**

**Tubes are made of glass and though strong, they can break so again, exercise caution.**

### **12.4 High Temperature**

**With the heat pipe installed in the evacuated tube and in good sunlight, the heat pipe condenser can reach temperatures in excess of 200C or 392F. At this temperature touching the heat pipe will result in serious burns.**