

**SWIMMING POOL
SOLAR HEATING SYSTEMS
INSTALLATION MANUAL FOR
CONSOLIDATED MANUFACTURING INTERNATIONAL'S
THERMOCRAFT SOLAR COLLECTORS**

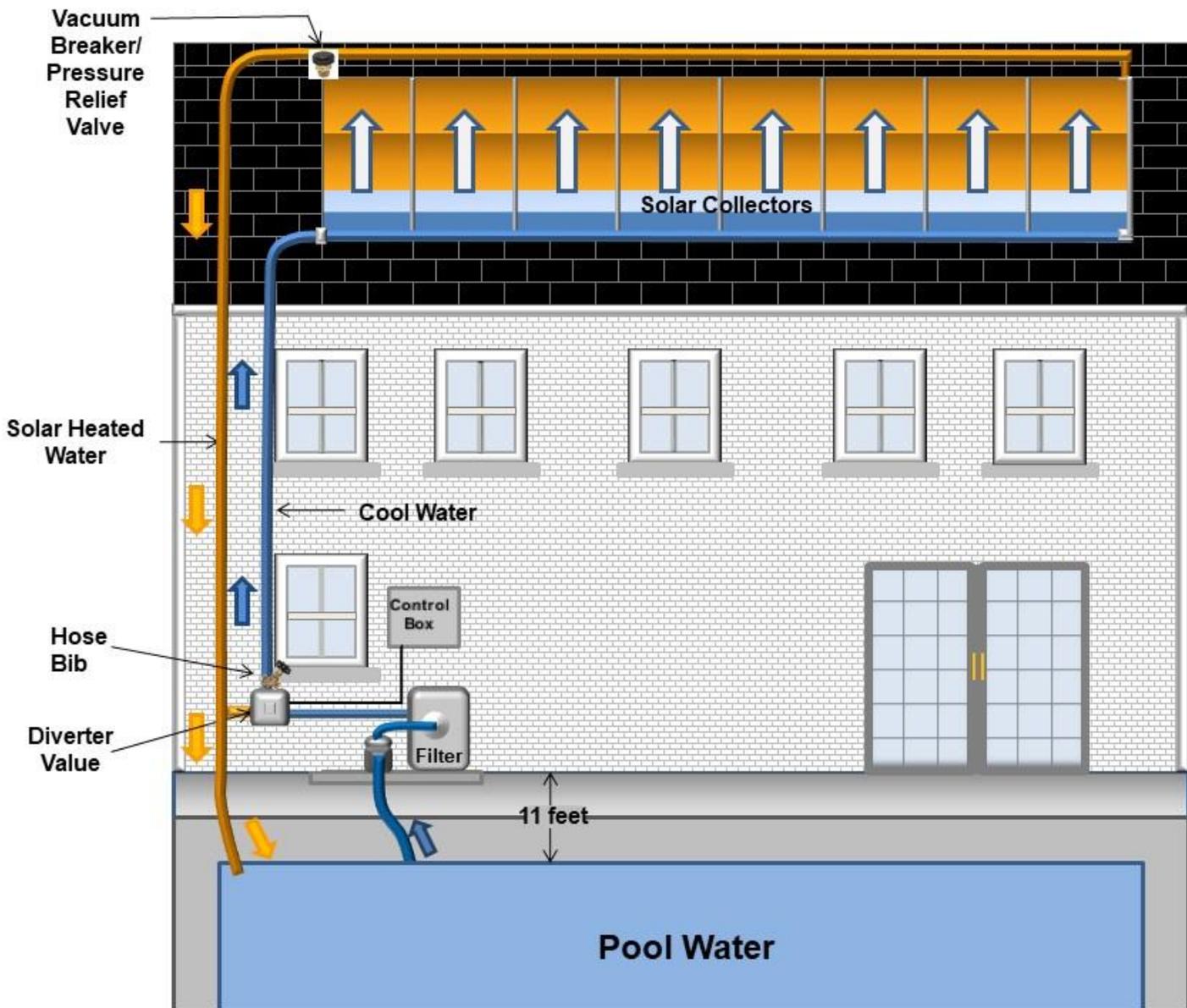
VERSION 19.3

MODEL NUMBERS:

SP8
SP10
SP12

This manual provides a detailed step-by-step procedure for the installation of a Consolidated Manufacturing International's solar pool heating system. If the directions are followed correctly and only recommended Consolidated Manufacturing International's hardware and components are used, the installed system should provide years of trouble free service, savings, and enjoyment.

- **CAUTION:** SOLAR COLLECTORS ARE OFTEN INSTALLED ON THE ROOFS OF BUILDINGS. UNLESS YOU ARE VERY FAMILIAR WITH WORKING ON ROOFS AND HAVE THE PROPER LADDERS AND SAFTETY EQUIPMENT FOR SUCH WORK, YOU SHOULD HIRE SOMEONE WITH THE NECESSARY EXPERIENCE TO DO THE INSTALLATION. FAIURE TO OBSERVE SAFE PRCATICES ON A ROOF OR OTHER ELEVATED STRUCTURE MAY RESULT IN FALLING, LEADING TO SERIOUS INJURY TO YOU.



MOUNTING THE SOLAR COLLECTORS

Thermocraft Solar Panels are sold separately, but all of the installation hardware has been placed in ONE box labeled System Kit. These system kits contain all hardware to mount the panels to the roof and connect with your plumbing. There are 4 sizes of System Kits depending on the number of panels utilized, 6, 8, 10, & 12. The part #s are SPSK6, SPSK8, SPSK10, SPSK12.

When mounting the collectors, First ENSURE the surface is structurally sound enough to support the system fully loaded with water! Next, always make provisions for inlet connections at the bottom header and outlet connections at the top. The outlet headers should be pitched a vertical distance of at least 8" (20cm) above the inlet headers to assure proper drainage and uniform flow. Plan the collector location to allow at least one foot on all sides of the row collectors for mounting brackets and piping. The outlet pipe for each row of collectors must be connected diagonally opposite the inlet pipe.

1) Determine the position of the last outlet header bracket for the row of collectors. Mark this point on the roof. The collector outlet headers will be located approximately 1" (25mm) below this mark.

2) Using this point, snap a chalk line to the opposite end of the row. Slope this line down the roof toward the inlet approximately 1" (25mm) for each 6 collectors in the row. Using a drill bit sized for the lag screw (For 1/4" (6mm) diameter screws) for the type of anchor intended to secure Header Clamp onto the roof, drill a hole for the first outlet header bracket on the first roof mark. Measure up 3-1/2" on center from the first pilot hole and drill pilot hole for the second screw. Repeat this process all along the chalk line for the total number of collectors to be installed.

3) Inject a generous amount of high-quality sealant into each hole and onto the surrounding roof surface. Bolt all the outlet header hold-down brackets (Header Clamps) to the roof.

4) Bring the first collector to the roof and remove the blue caps that protect the attachment ear and house the round CPVC Ear Inserts (the Ear Inserts will provide additional structural support when tightening hose clamp around coupling over the ear portion of the panel. **THIS STEP IS IMPORTANT**, do not leave the Ear Inserts out, they look like 2" long pieces of 1-1/2" gray PVC pipe. Slip the proper Flexible Couplings over both ends of the inlet and outlet headers on the last return collector. Push Flexible Coupling UP TO the hose locating shoulder, but NOT OVER it. Locate a hose clamp approximately 3/8" (10mm) from the end of the hose in order to center it on the header groove. This clamp must face up so as to be accessible for tightening and will not rub against the mounting surface. Make sure you securely tighten each clamp with a nut driver. If a nut driver is not available, a "hex" wrench or screwdriver will suffice. **THE HOSE CLAMPS MUST BE LOCATED OVER THE GROOVES IN THE HEADER.**

5) Place Panel onto bottom portion of Header Clamp that has been mounted to the roof. Place top portion of the Header Clamp onto bottom portion by sliding the "T" portion of the top piece into the "groove" portion of the bottom piece. After the top piece has been slid in where both sides align with bottom piece, insert a small self-tapping screw into the hole of the top piece, which will secure them together mechanically and ensures the two pieces stay together and withstands any vibration or wind movement. The screw can be backed out and the two pieces slid apart, if the panel has to be removed later. These #4 x 1/2" screws are provided in this kit.

6) Repeat this process (Steps 4 &5) until all panels are connected side by side with Flexible Couplings and affixed to the roof with two header clamps for each panel.

7) After all of the panels are assembled and affixed to the roof, installation of the Wind Straps is next. Locate the upper hold-down strap screw holes by measuring from the top outlet header bracket chalk line, snap another chalk line parallel to this line (60" below for 12' panels, 48" below for 10' panels, 36" below for 8' panels). The lower hold-down strap line dimension is the same for all collector sizes, which is 16" up from the outside of the bottom header and can be measured after the collectors are installed. Wait to install the hold-down straps until after the collectors are installed so as not to damage the collectors when you are bringing them to the roof for installation.

7-Option) If installing the panels on a flat tile roof, there is the option of drilling through the Wind Tie Down Bar and securing directly to the roof. These Wind Tie Down Bars have a 'cut to size' wind strap already applied in the factory. This is a fast and convenient way to secure the panels to the roof for wind resistance, in lieu of running the additional wind strap across the entire system.

8) (If not utilizing the individual Wind Tie Down Bar on each panel) Proceed to the lower chalk line previously snapped on the roof for the hold-down strap brackets. Drill a pilot hole 2" (5cm) to the side of the first panel and between each of the panels until you reach the last panel. Drill the last pilot hole the same 2" (5cm) to the side of the last panel. Apply sealant at each of these locations.

Measure the overall distance from the outside pilot hole to the outside pilot hole (for example, a 10 panel system will measure about 45' overall). This will be the approximate length to cut the Poly Tie Down (wind) strap. Cut the poly strap a little longer so there is a couple of inches past the anchor on each end of the strap, for added security.

At the first pilot hole 2" away for the first collector, obtain an anchor of your choice (depending on roof substrate), and on that anchor place a Round Metal Poly Strap Tie Down Plate (basically a washer). Place the end of the poly strap 2" from the pilot hole, then install the anchor and Round Metal Poly Strap Tie Down Plate into the pilot hole. Continue laying the Wind strap across all panels and securing them into the pilot hole with an anchor and Round Metal Poly Strap Tie Down Plate between each panel and on each end. It is okay to step on the collectors as long as you do NOT step on them over a valley of the roof tiles.

9) Assemble the vacuum breaker/pressure relief valve in the adapter provided by screwing it in and utilizing plumbers tape, etc., as is done with any plumbing fitting. Utilizing PVC glue, install the adapter/valve into the 90 Deg. Elbow. Utilizing PVC glue, install one of the 3 SA20 2" Solar Adapter into the other side of the 90 Degree Elbow. Install this entire assembly into a Flexible Coupling, securing with a Band Clamp, into the outlet header of the row. If there are multiple rows, there needs to be one vacuum breaker assembly installed in the outlet header of each row. This will be located at the opposite end of the row that is connected to the collector outlet pipe. The Vacuum Relief Valve shall comply with ANSI Z21.22

10) Install an end cap in the inlet header of each row, opposite the end that is connected to the collector inlet pipe.

11) INSPECT THE INSTALLATION AND CHECK ALL CLAMPS FOR PROPER POSITION AND TIGHTNESS.

Installation Over Roof Vent Pipes

Collector panels can be installed over or around different diameter roof vent pipes or other obstruction up to 2" (63mm) in diameter. After snapping the top chalk lines but before marking and pre-drilling for your outlet header brackets, locate the seam in the collector nearest to where the vent pipe is to come through. Separate by pulling the two collector extrusions apart. Lay the collector over the

vent pipe, keeping the vent pipe at least 12" (30.5cm) away from a header. It will be easier to complete an installation by mounting this collector first and then working away from it.

With a roof vent pipe of 3" (8cm) in diameter, the collectors can be positioned on either side of the vent. The extension kit can be employed to couple the collectors together for vent pipes or other obstacles.

System Piping

The most common piping configurations use a pressure filter. The pump draws the water from the skimmer and/or a main drain, forcing it through the filter and sends it back to the pool through the return lines.

If a fuel-fired heater is installed, it is located between the filter and the return line to the pool. The pipes to and from the solar collectors are connected to the return line to the pool before the water enters the fuel-fired heater, if one is used.

Piping to and from the collectors should be the same type of plastic piping and fittings approved for use with swimming pool filters and pumps. It is recommended to always use Schedule 40 PVC pipe and fittings. Although PVC pipe is generally white, black is also available but may be difficult to find locally. If for aesthetics black pipe is desired it can always be painted black. Use a PVC cutter or a PVC wide-blade saw (not a hacksaw) for cutting pipe. It is important to use both a quality cleaner/primer and solvent in gluing a PVC joint. Finally, use a cloth while either gluing or painting to keep the job a clean one. Piping should also be supported at intervals of 5' (1.5m) for horizontal pipe and 8' (2.5m) for vertical pipe. Use either galvanized or plastic pipe clamps. Thermocraft outlet header bracket assemblies (Part #SPHC), which are made of PolyPropylene, are also excellent pipe hangers.

The following is a list of Pipes and Valves that are acceptable:

For PVC Pipe– Must adhere to specifications ASTM D1785 and D2665

For CPVC – Must adhere to specifications ASTM F441

For PVC fittings – Must adhere to specifications ASTM D2464, D2466, D2467

For CPVC fittings – Must adhere to specifications ASTM F437, F438, F439

For PVC & CPVC valves – Must adhere to specifications ASTM F1970

NOTE: When any Check Valves are installed, they **MUST** be **CLEARLY** labeled with the direction of the flow.

Manual Systems

Some systems can employ a manual control valve to control the flow of water thru the solar collectors, although this may reduce the overall heating capacity of the system. The manual control valve usually consists of a non-positively sealed 3-way valve. Water continually flows through the solar collectors when the filter pump is on but can be diverted manually by the pool owner if the pool becomes too warm or during extended cloudy weather. During a threat of freezing conditions it can also be diverted, by first shutting off the pool pump, allowing the collectors to drain, diverting the 3-way manual valve to the "bypass collector" position and shutting the isolation valves on the collector feed and return lines. A lower end cap in the collectors or any of the connecting hoses can be removed to make sure there is no standing water in the collectors. The filter pump can then be restarted to allow for normal pool filtration.

AUTOMATIC CONTROL SYSTEMS

The performance of a solar pool heating system can be improved with the use of an electronic control and motorized 3-way valve. CMI does not manufacture or supply an automatic controller, but any type of automatic controller should work as long as it interfaces properly with the actuated valves and plumbing. The control activates the motorized valve and either sends water thru the collectors for heating (or nocturnal cooling) or automatically bypasses the collectors when the pool is warm enough or insufficient sunlight is available. **Refer to the manufacturer's instructions included with the automatic control you use.**

NOTE: The controller shall comply with NFPA 70 or CSA C22.1 and be listed and labeled to UL 60730-1, UL 873 or CSA E60730-1 as applicable.

Other Equipment

Some pools employ an automatic pool cleaner. This should be plumbed before the control valve to assure positive flow to the cleaner at all times. If the pool uses an automatic chlorinator, this should be plumbed after the outlet tee on the return to the pool.

Flow Rates

In order to receive optimum results from Thermocraft Solar Panels, the following flow rates are recommended: 12' panels – 5 GPM; 10' panels – 4 GPM; 8' panels – 3.25 GPM

When the system is running, all the collectors should feel uniformly cool to the touch, and there should be no residual air left in the pool return lines. If either of these two conditions persists, chances are that the flow rates thru the collectors are inadequate or the system is not properly balanced. A flow meter can be installed in the collector feed line to check on the flow rate. If the flow rates are within the limits as recommended, then the system may not be properly balanced, especially with systems requiring multiple banks of collectors.

If the flow rate is below the minimum recommended, then the pool pump horse power or pipe size should be increased, or a booster pump installed in some cases. If the flow rate is excessive (more than 10 GPM), or if the system pressure is greater than 30 psi, a bypass line should be installed between the collector feed and return lines above the 3-way valve to prevent problems with the collectors and connection hoses.

If there is residual air in the pool return lines and the collectors DO feel cool to the touch, refer to the section concerning the vacuum relief valve test.

Optional Isolation Valves

Isolation valves may be installed in the collector piping so that the pool may be operated while the collectors are being serviced or during freezing weather. Install a manually operated ball valve in the collector inlet line and a check valve on the collector return line. Make sure that the arrow on the check valve is pointing away from the collectors, and that the ball valve and check valve are located close to the control valve and outlet "T", respectively. Three way Valves shall be full port and CLEARLY labeled with the direction of the flow. For further precautions in warm climates where pools are operated year round and periodic freezes can occur, a bypass line (small diameter tubing) can be located above the ball and check valves so as to prevent any accidental trapping of water in the collectors by the pool owner. To make sure no water left in the collectors for servicing or during freezes, remember that the pool pump should be shut off, allowing the collectors to drain naturally, before the optional isolation valves are use.

The following is a list of Pipes and Valves that are acceptable:

For PVC Pipe– Must adhere to specifications ASTM D1785 and D2665

For CPVC – Must adhere to specifications ASTM F441

For PVC fittings – Must adhere to specifications ASTM D2464, D2466, D2467

For CPVC fittings – Must adhere to specifications ASTM F437, F438, F439

For PVC & CPVC valves – Must adhere to specifications ASTM F1970

NOTE: When any Check Valves are installed, they MUST be CLEARLY labeled with the direction of the flow.

Special System Layouts

Use a divided system when installing more than the recommended maximum number of collectors per row, when avoiding roof obstruction, or where limited space dictates. This provides uniform distribution of water through all the collectors. If water distribution through the collector is non-uniform, the heating capacity of the system will be reduced.

WHEN INSTALLING A DIVIDED SYSTEM, THE OUTLET HEADERS FROM EACH OF THE LOWER (OR CLOSEST) ROWS OF COLLECTORS MUST BE CONNECTED TO THE HIGHEST (OR FURTHEST) POINT IN THE SYSTEM.

A divided system requires an **Add-A-Row Kit** (Part #SPARK) for each row of collectors.

Booster Pump System

In some cases, the pool filter pump may not be able to circulate water at a high enough slow rate to allow for proper collector operation. If so, it may be necessary to replace the filter pump with a large one or add a booster pump. If the pump size is increased, it may also be necessary to upgrade the filter with one with greater flow ratings.

Supplemental Gas, Oil-Fired, Or Electric Heaters

It is desirable to pipe the stand-by heater in a bypass loop. Fuel-fired heaters often create a large pressure drop. By placing a heater in a by-pass loop, pump size, and electrical energy requirements may be reduced.

SYSTEM START-UP AND TEST

System Start-up and Checkout for Automatic Systems

To check out the system for proper operation turn on the filter system. Set the temperature control to its highest level. Switch the control to the “flow through collector” mode. The “flow through collector” light should come on. The 3-way valve will then be sending water thru the collectors, and air will be purged out of the collectors into the pool return line for several minutes, and should then clear. The collectors should feel uniformly cool to the touch. Switch the control to the “bypass collector” mode. The corresponding light will go on and the 3-way valve will be sending water directly back to the pool, bypassing the solar collectors. After about 5-10 minutes, feel the solar collectors again. They should have begun to warm up. Now switch back to the automatic mode. If the sun is still shining on the solar collectors, the “flow thru collector” light should go on again. Adjust the temperature control lower.

When you reach the actual temperature of the pool water, the light will turn off. The flow bypass collector light will go on again. Move the temperature control to maximum and leave there. The “flow through collector” light will go back on. For more detailed information on the system startup, trouble shooting and valve/control installation, follow the manufacturer’s instructions included with the automatic control system.

Manual Control of System

To test collector operation, follow either the flow-rate or temperature-rise procedure. Divert water through the collectors. Turn on the pump and either observe flow rate or temperature rise. The flow rate or temperature rise would be the same as that specified in the “System Start-Up and Test” section. If it is not, then check for the indicated probable causes and make necessary corrections.

Flow Rate Test Method

The preferred system test method is flow rate. This is also the easiest and quickest method. To check flow rate, install a flow meter in the inlet line to the collectors (follow installations instructions provided with the flow meter).

Temperature Rise Test Method

An alternate test method is temperature rise. To prepare the system of testing, obtain two accurate thermometers. One of these thermometers is installed in the outlet line from the collectors. The other is used to check the temperature of the pool water, to compare it with that of the water leaving the solar collectors. Before installing the thermometer in the outlet line, immerse both thermometers in the pool water for several minutes to compare the temperature readings. If they are not identical, make a notation of the difference and add or subtract (as appropriate) this difference to or from the reading taken while you are testing. This is necessary in order to provide an accurate indication of the temperature rise of the water passing through the solar collectors.

Turn the pump on and move the flow switch to the “COLL” position. Observe valve action, noting that it should divert water through the collectors. After the flow through the collectors has continued for least fifteen minutes, compare the pool water temperature with the temperature of the water flowing through the outlet line. On an average sunny day, with the air temperature approximately 70F, the water leaving the collectors should be 1 to 7F (1 to 4C) higher than that in the pool. If the water rise is GREATER than this, insufficient water is flowing through the collectors. This may be caused by a clogged filter, undersized piping, too many elbows in the piping or an inadequate pump. It is important that the temperature rise through the collectors be kept as low as possible in order to deliver the maximum amount of heat to the pool.

NOTE: All thermometers used shall provide readings in increments of a maximum of 1 F or (0.56C).

Vacuum Relief Valve Test

When the solar system is first turned on, air in the collectors will be expelled into the pool and bubbles will appear. The appearance of bubble in the pool should stop after a few minutes. If, after a few minutes, bubbles continue to be discharged at the return to the pool, remove the vacuum relief valve (s) and replace it with an end cap. Relocate a vacuum relief valve to a position in the inlet piping which is at a height of approximately three-fourths of the elevation of the collectors above the pool.

(A quicker alternate method is to first try to reverse the end cap and the vacuum relief valve on the collector array to see if this stops the bubbles in the return lines. Sometimes the end cap is about $\frac{3}{4}$ of the elevation of the collectors and this is a lot quicker than cutting in a tee in the supply pipe).

System Fluid and Ambient Condition Design Specifications

Maximum operating temperature: 93 °C 200 °F

Maximum operating pressure: 69 kPag 10 psig

Maximum pressure (Test Pressure): 103 kPag 15 psig

MAINTENANCE

Winterizing Procedures

The solar collectors should be drained before temperatures drop to or below freezing! The pool piping should be winterized as per your normal practice. In southern parts of the country pool owners operate their pools throughout the winter although freezing conditions may occur. The accepted procedure for avoiding freezing of the pool piping and filtration system has been to continuously circulate the water. When solar heaters are used on a pool under these conditions, anti-freeze precautions should be taken. Thermocraft solar collectors are not normally affected by light freezing. However, in order to protect appurtenant components such as end caps and pipe fittings and the collectors against unusual or severe freezing conditions, one of the following two procedures should be followed when freezing weather is imminent. Laminated Freeze protection instructions should be zip tied to the plumbing in the control/equipment area.

1. Turn circulating system off by closing the 3-way valve so that the pool water from the pump is diverted from going to the solar collectors. Open the Hose Bib located directly above the 3-way valve and allow solar collectors and piping to drain. Switch the solar control to the bypass position. The pool filtering system may then be turned back on. When freezing conditions have passed, open isolation valves and switch the solar control to "AUTO".
2. Switch the solar control to the "COLL" position so that water circulates through the collector. When freezing conditions have passed, switch the solar control to "AUTO". THIS METHOD IS NOT RECOMMENDED WHERE TEMPERATURE LEVELS MAY DROP SEVERLY.

Annual Service

Collector Clamps:

In particularly hot climates, such as Arizona and Southern Florida, the clamps which are used to connect the solar collectors may become loose. If you notice leaks around the house couplings, use a nut driver to tighten clamps. Do not tighten to the extent that the clamp gears strip. This should not be necessary more than a time or two because of the internal CPVC ring that prevents this.

COLLECTOR REPAIR

This method allows for an easy and permanent on site repair of a collector by isolating the leaking riser tube. Locate the tube to be isolated. Using a sharp utility knife, very carefully cut away approximately 1' of the tube at both headers. Put a dab of silicone type caulk on the screw first, then drive a #10-#12 sheet metal screw with very small head, either stainless steel or brass, into the hole in the header. The screw must be between 1/2" and 3/4" long. DO NOT OVERTIGHTEN! If the screw strips out, or if the repair leaks, use a larger screw. This repair method will not void the collector warranty.