

# SOLAR WORLD, INC. INSTALLATION MANUAL

Read this manual before beginning installation of solar system



## INSIDE THIS MANUAL

**Section 1** illustrates the kits and components used for installation of the solar collectors, and shows component locations in the system.

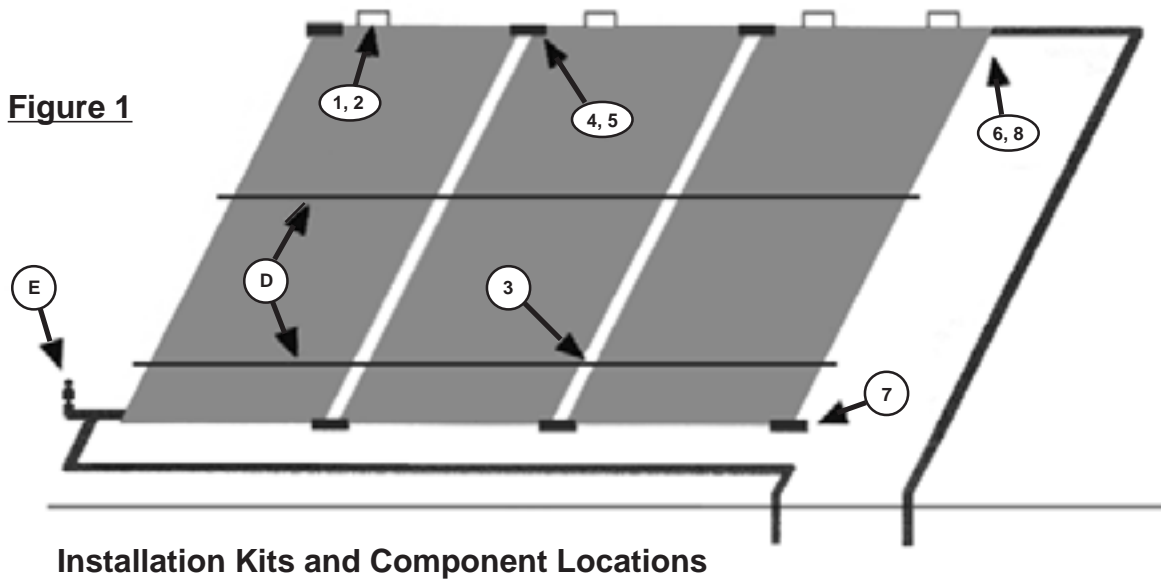
**Section 2** shows the steps to properly install the solar collectors.

**Section 3** describes the system piping and control components.

**Section 4** covers start-up and maintenance.



## Section 1 Installation Kits & Components



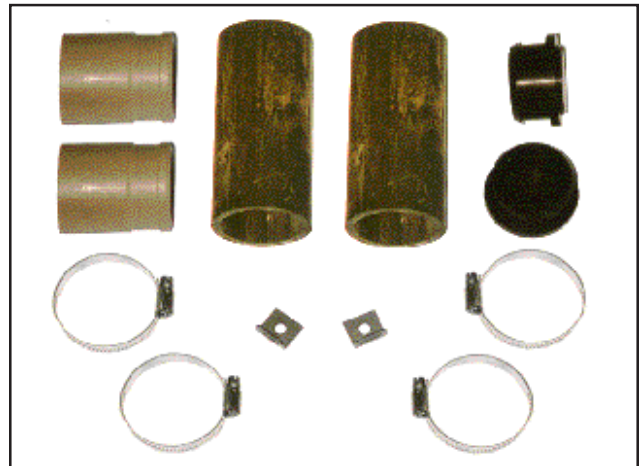
This section describes three Solar World installation kits and the individual components used in the solar system. The kits and components are itemized below. Installed component locations are exemplified within the labeled, circled areas in Figure 1, above. Components listed in "F" and "G" are shown in Figure 3 (see Page 5).

### A. Collector Kit (Part No. 1090)

Contains all parts needed to fasten down one solar collector and connect it to the next one in a row. One collector kit per collector required.

### B. System Kit (Part No. 1091)

Contains parts needed to fasten down collectors, and to connect piping to a system. Use one system kit for each row of collectors in the installation.

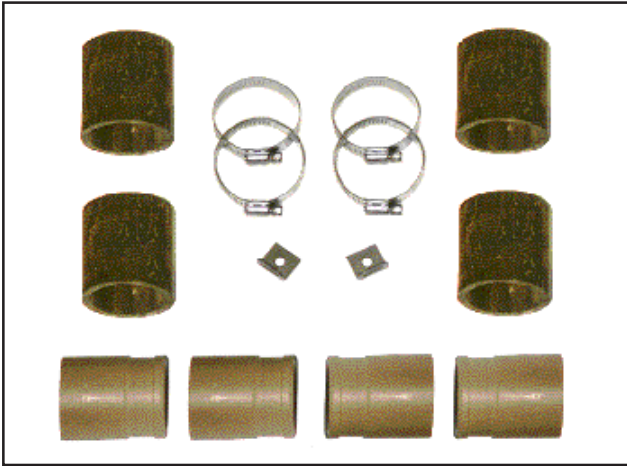


Part No.	Description	Qty.	Figure 1 No.
4031	Universal Mount	2	1
8019	Stainless Steel Washer	1	2
8016	Strap Bracket	2	3
8017-2	Coupling Hose, Short	2	4
1012	Coupling Clamp	4	5

Part No.	Description	Qty.	Figure 1 No.
8016	Strap Bracket	2	3
1012	Coupling Clamp	4	5
8017-6	Coupling Hose, Long	2	6
4032	End Cap	2	7
4033	Adapter, Pipe to Collector	2	8

**C. Split Row Kit (Part No. 1093)**

Use this kit whenever it is necessary to split a row of collectors to clear obstructions, or to install part of a row on another roof.



<u>Part No.</u>	<u>Description</u>	<u>Qty.</u>
8016	Strap Bracket	2
8017-3	Coupling Hose, Medium	4
1012	Coupling Clamp	4
4033	Adapter, Pipe to Collector	4

**D. Hold-Down Strap**

A 100' roll will hold down up to twelve collectors. Note: local building codes for wind load may require additional strapping.

**E. Vacuum Relief Valve**

One per system is required whenever collector inlet (bottom) headers are higher than three feet above the pool surface. Several locations for installation of this valve are acceptable. See Section 2, Step 10, on Page 5.

**F. Check Valve**

One check valve should be installed per system. A second valve must also be installed whenever collector inlet (bottom) headers are more than three feet above the pool. See Section 3, Figure 3, on page 5 for locations.

**G. Control System**

Every Solar World pool heater needs a control system to by-pass the solar collectors when the pool is at the desired temperature, or during inclement weather. In most climates an automatic control system should be used. It consists of an electronic control panel, two sensors and a motor-driven valve or pump. In warm climates, or when the system is regularly attended, a manual control valve may be used.

**Section 2**

**Installation of Guardian or SwimMaster Plus Solar Collectors**

**Step 1:** Plan the location of the collectors on the mounting surface. The outlet (top) headers must be at least 4 inches higher than the inlet (bottom) headers and the row of collectors must slope at least 1/4 inch per collector toward the supply pipe as shown in Figure 2. This will permit drainage which prevents freeze damage. Table 1 shows the amount of space required for an uninterrupted row of collectors.

Add 8 to 12 inches at each end of the row for piping. Add 2 inches above the outlet header for the Universal Mounts.

Note from Figure 2 that the pipe carrying the water back to the pool, the return pipe, is connected to the collectors diagonally opposite the supply pipe to the collectors.

**Step 2:** Starting at the return (back to pool) end of the outlet headers, snap a horizontal chalk line 1 1/2" up the roof above the intended top of the outlet headers. The chalk line must slope down the roof toward the supply side 1/4" per collector. For example, six collectors in the row means a total slope of 1 1/2" inches.

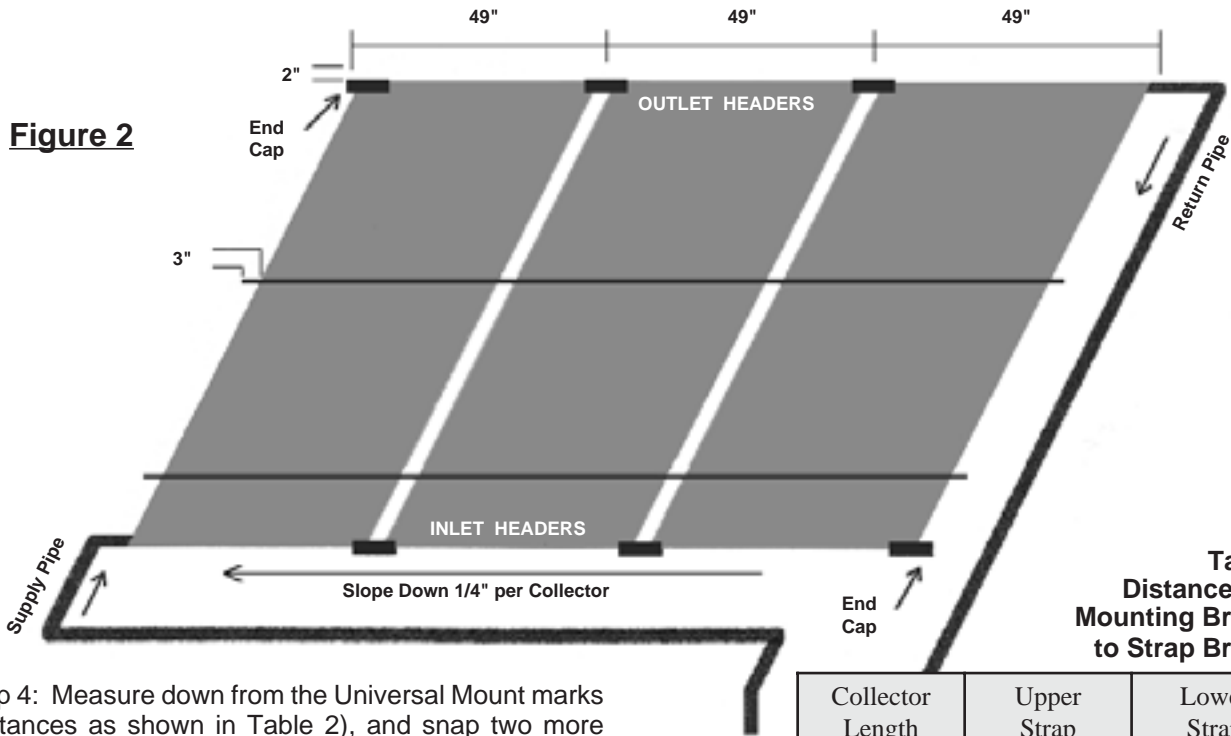
**Step 3:** Identify and make a chalk mark at the top corner (the intended beginning) of your collector array (the first

collector in your system is the one connecting to the supply piping). Next, make a chalk mark roughly 12" first, and then every 24" horizontally across your array area, 2" above the intended line of your upper headers (two marks for every collector to be installed). Locate roof trusses for these marks if possible.

<i>Number of Collectors</i>	<i>Width of Array</i>
5	20' 5"
6	24' 6"
7	28' 7"
8	32' 8"
9	36' 9"
10	40' 10"
11	44' 11"
12	49'

**Table 1**

## Assembly Diagram (Showing Three Collectors)



**Figure 2**

**Table 2  
Distance from  
Mounting Bracket  
to Strap Bracket**

Collector Length	Upper Strap	Lower Strap
8'	3' 8"	7' 2"
10'	4' 8"	9' 2"
12'	5' 8"	11' 2"

**Step 4:** Measure down from the Universal Mount marks (distances as shown in Table 2), and snap two more horizontal chalk lines to mark your strap locations. The Strap Bracket holes will be located and drilled after the collectors are in place.

**Step 5:** Bring two collectors up on the roof. Connect the headers together with Short Hoses. Between the two outlet headers, where they are connected by a hose, should be two Coupling Clamps. Tighten a Coupling Clamp at each end of the hose, just behind the barb at the end of the collector fitting. **DO NOT OVER-TIGHTEN** (hose rubber should only bulge slightly into the holes in the band of the clamp).

Brace the two collectors at the intended beginning of your array. Then, align the base of the first Universal Mount



with the first chalk line mark. Fill the pilot hole with a high quality, polyurethane sealer. Place a steel washer into the circular area in the Mount's base, and slide a mounting screw through the Mount's hole, and anchor it into the roof. Cover each screw's head with ample sealant. Fasten the next three Universal Mounts to the roof along the chalk marks. Lay the top headers from the two collectors into the Mount's base.

**Step 6:** Install the remaining collectors in the array. Each of these collectors will have two Universal Mounts. Apply polyurethane sealer to all anchor points, as in Step 5. Slide the tops of the Universal Mounts into place on their bases until each snaps, fastening the collectors firmly in place.

**Step 7:** Drill a pilot hole (3/16" for 1/4" lag bolt) on each end of the strap chalk lines, a minimum of 3" from the edge of the absorber plate (four places). Drill pilot holes on each chalk line, between the edges of the absorber plate at each collector. These holes should be about 1/4" off of center, so that the leg of the Strap Bracket will be in the center of the space. Install the Strap Brackets with polyurethane sealer. The Strap Brackets at both ends of the row must be installed with the bracket's flat side towards the collector (screw head outside). Note: be sure all of your anchors satisfy your prevailing local code requirements.

**Step 8:** Slip the Hold-Down Strap (polyester) through the Strap Brackets, tie it to one end bracket, stretch it tight, cut it off and tie it to the bracket at the opposite end. Polypropylene strap is slipped through the bracket and doubled back on itself. Slip a Strap Clamp over the doubled section and tighten the screw until the strap bulges into the hole. Do not puncture strap with screw.

**Step 9:** Connect the end caps to the collectors in the locations shown on Figure 2, using Short Hoses and Coupling Clamps. Connect the collectors to the supply and return piping with Long Hoses and Coupling Clamps using Pipe to Collector Adapters. Universal PVC/CPVC/ABS adhesive must be used at these cemented joints.

**Step 10:** The appropriate location for the vacuum relief valve in the system may be dictated by the particulars of the system. Typically best locations are: out of a tee at the supply connection of the pipe and collectors (see "E" in Figure 1); out of a fitting, in place of any of the end caps; and out of a tee in the supply or return line, just below the roof level.

**Step 11:** If the plumbing in your system will not allow the collectors to properly drain (eg: piping over the peak of the roof), a manual drain line must be installed from the lowest point in the system on the roof. Manually draining the system during freezing weather should protect the collectors from freezing.

Notes: 1) Local building codes may enforce additional requirements for the installation of your solar system. 2) All points where the system is anchored to the roof should be properly flashed, especially for asbestos shingle roofs. Check your local building codes for the approved method of flashing roof penetrations.

### Section 3 System Piping

#### Solar to Filter System Piping:

To achieve optimum performance levels from the system, meet the recommended water flow rates in Table 3.

Solar systems with less than 300 square feet of collector and located less than 20 feet from the pool may be connected with 1 1/2" schedule 40 pipe. All other systems should be plumbed with 2" or larger, schedule 40 pipe. Plan the piping to minimize the number of fittings. It is important that pressure losses are kept low so that the maximum amount of water flows through the collectors.

Collector Size	4 x 8	4 x 10	4 x 12
Recommended Flow Rate per Collector (gpm)	3.2	4.0	5.0
Minimum Flow Rate per Collector (gpm)	2.0	2.5	3.0
Maximum Number of Collectors per Row	18	15	12

Table 3

Referring to Figures 2 and 3, note that the supply to the solar collectors is always at the inlet headers, and the return is diagonally opposite, at the outlet headers. The three-way control valve, whether it is manual or motor driven, is installed in the inlet line to the collectors.

If the collectors' inlet headers are installed more than three feet

#### Residential Solar System Piping

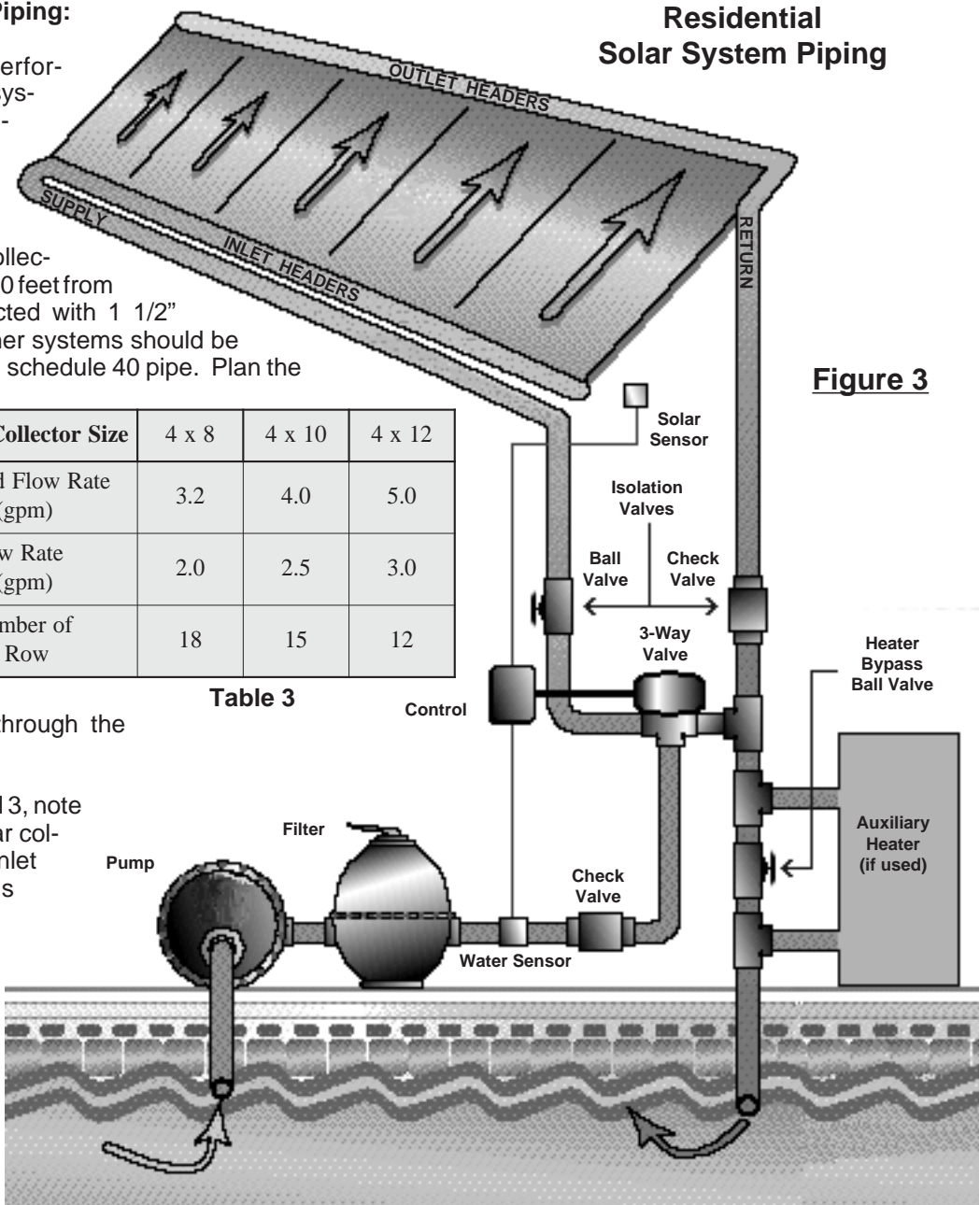


Figure 3

higher than the pool, a check valve should be installed between the pool filter and the control valve. This valve prevents back-washing filter debris to the pool. The pool water sensor for an automatic control must be installed before the control valve, so that it senses the actual pool water temperature. The solar sensor is mounted on the same surface as the solar collectors but not touching them. It is important that the sensor sees the same sun, all day, as the collectors. Installation instructions packed with the automatic control system should be followed.

Solar system isolation valves should be installed to allow the collectors to be serviced without requiring that the pool circulation stay turned off. If the 3-way control valve has a non-positive seal, a ball valve should be installed between the 3-way valve and the collectors. If the 3-way has a positive seal, it will act as the isolation valve on the supply side. Install a 1/2 lb. spring check valve between the return from the solar collectors and the bypass tee in the return line. Do not use two ball valves for system isolation.

If a high pressure pool cleaner pump is used, its supply should be connected between the filter and the control valve. If a gas or electric heater or heat pump is used, it must be installed between the solar system return tee and the return line to the pool. Heaters and heat pumps often create an excessive pressure loss, so it is good practice to provide a bypass as shown. The bypass valve may be opened whenever the solar system alone is heating the pool (Note: some heaters require water flow at all times).

On the roof (or other mounting surface) horizontal pipes should be supported every 4 feet and vertical pipes every 8 feet. A support should be placed as close to the collector supply and return as is practical. Hi-Tec Stainless Steel Hold Down Clamps, Part Number 2022, are useful for this purpose.

### Special System Layout Piping:

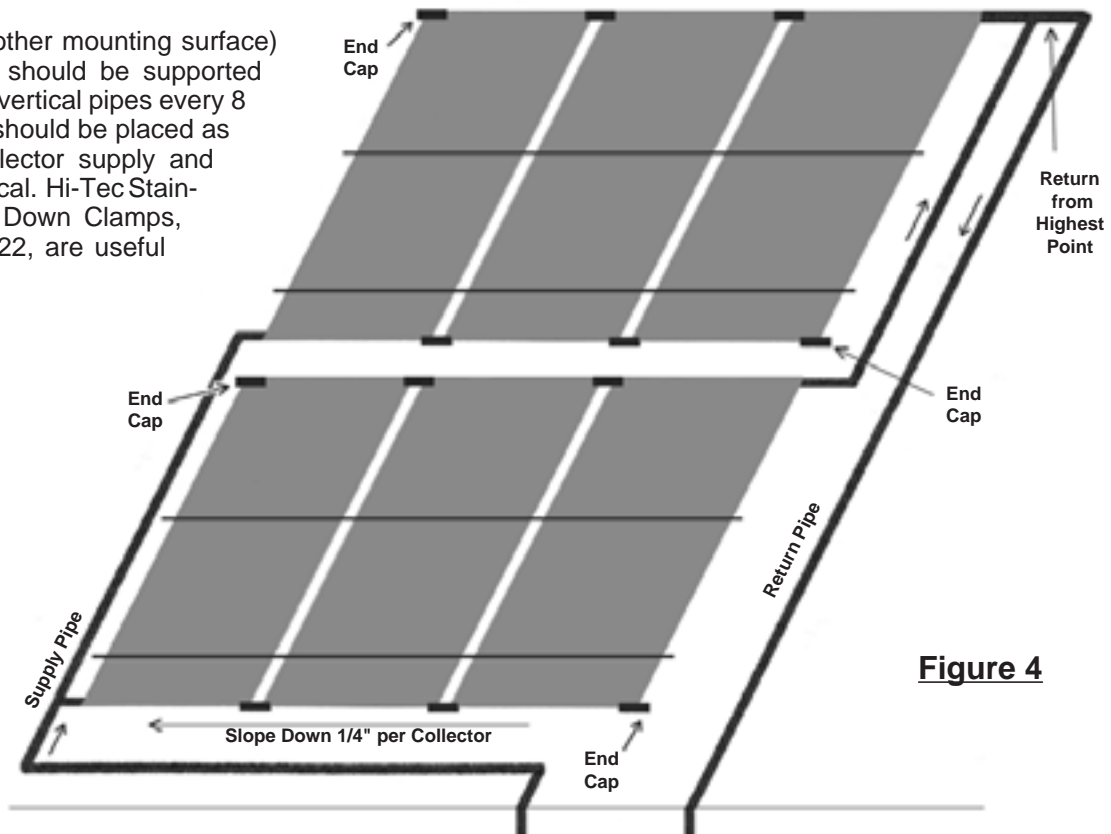
The shape of the available space or roof obstructions often dictate dividing a system into multiple rows or splitting rows.

Figure 4 below shows a system divided into two rows. You will need a System Kit, Part Number 1091, for each added row. Note that the return from the lower row is connected to the return at the highest point in the system. Slope the rows toward the supply for drainage.

Figure 5 on page 7 shows a more complex, multi-level system with split rows. Roof vents can often be straddled by using a pair of long hoses in place of short ones. The normal space between the absorber plates on adjacent collectors is 2.9 inches. That space can be increased to 7.9 inches by replacing short hoses with long ones, giving room to pass any standard vent stack. For larger obstructions, such as chimneys, attic vents or windows, you will have to split the row with the Split Row Kit, Part Number 1093.

In Figure 5, the third row is on another roof, higher than the first two rows. Note that the returns for the first two rows meet the return from the third row at the highest point in the system. Again, slope all rows toward the supplies, so they can drain.

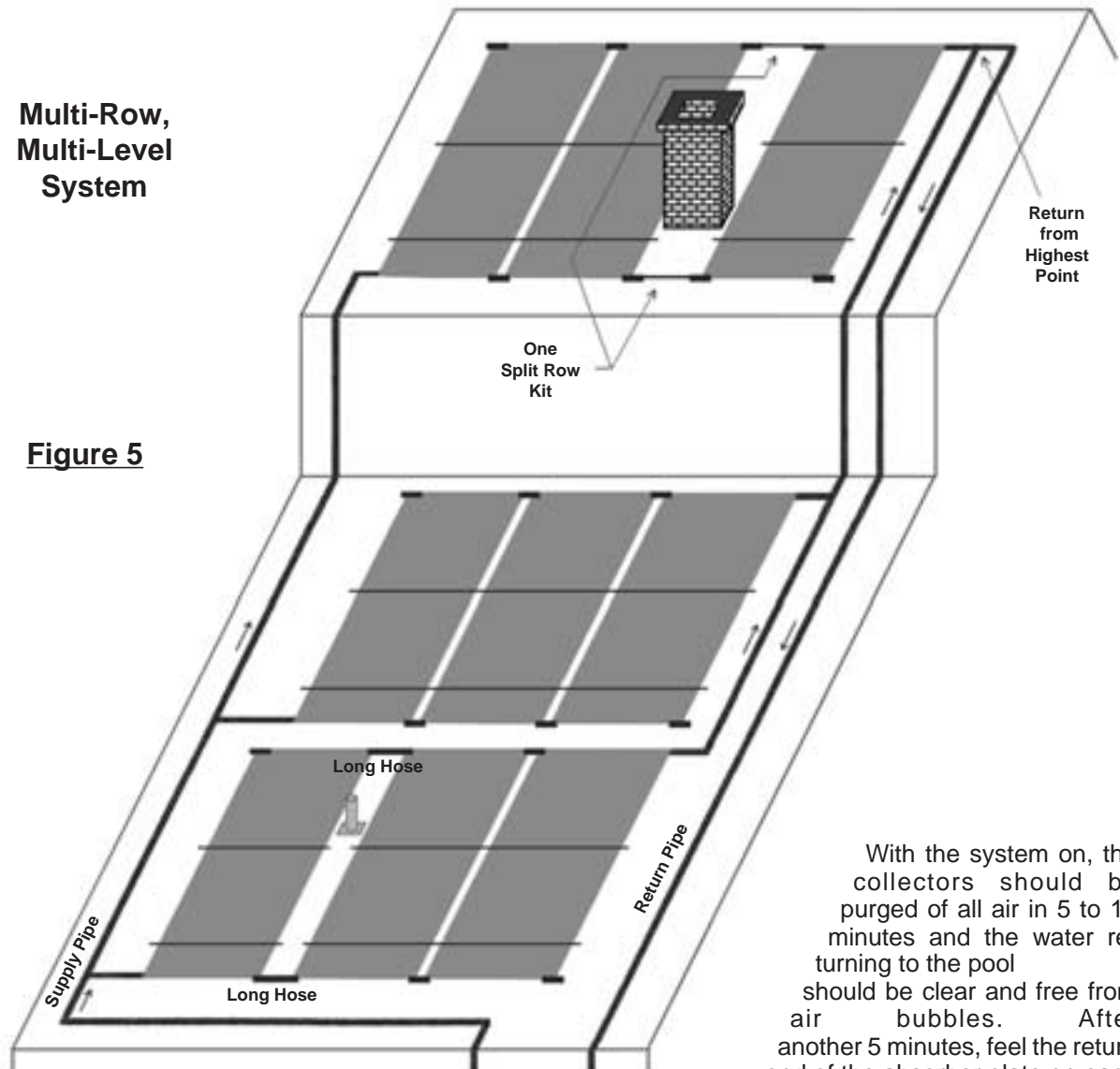
### Two-Row System



**Figure 4**

## Multi-Row, Multi-Level System

**Figure 5**



With the system on, the collectors should be purged of all air in 5 to 10 minutes and the water returning to the pool should be clear and free from air bubbles. After another 5 minutes, feel the return end of the absorber plate on each collector. They should be uniformly

cool to the touch. If they are, you have uniform flow to all collectors. If they are not, flow must be increased to the minimum specified levels in order to get rated performance for the system. If on the multiple-row system, one bank feels warmer than the other, the flow must be corrected. Install a ball valve in either the supply or return line to the row that feels cooler. You can then throttle this valve until the temperatures of the collectors on each bank are approximately equal.

Next, switch the control to "OFF". The valve/pump should stop. Switch the control to "AUTO". Set the temperature control to the maximum position, or at least 10 degrees higher than the pool water temperature. The "Heating" light should come on which allows the pump to pool water through the solar system. If the light does not come on, disconnect the pool water temperature sensor wires and temporarily "short" the solar sensor terminals. If the "Heating" light now comes on, you probably have a bad wiring connection to the solar sensor.

## Section 4 Start-Up and Maintenance

### Start-Up and Test:

Before starting the pump, we recommend that you install a flow meter in a location to accurately show the flow rate through the solar system. The preferred location is before the solar collectors, after at least 3 feet of straight pipe. You can then determine if the flow rate meets the levels shown in Table 3.

This section describes the steps for starting an automatic system. Switch the control to "ON". The "Power", "Heating" and "Cooling" lights should go on and divert water flow through the solar collectors. If it does not, check the electrical supply and wiring to the controller and pump.

Set the temperature control to the minimum position or at least 10 degrees below the pool water temperature, The "Heating" light should go out and the pump should stop. If it does not, disconnect the solar sensor wires and temporarily "short" the pool water temperature sensor terminals. If the light now goes out, you probably have a bad connection in the pool water sensor wiring. For further trouble shooting information, see the manual packed with the control.

Once everything is working, set the control for the maximum desired water temperature with the control on "Auto" and the installation is complete.

#### Operation/Maintenance:

##### Emergency Procedure

1. Turn controller (A) to "OFF".
2. Open at least one drain port (valve #4, 5, 6, 7).
3. Close valves # 1 and #2.

##### Pool Backwash

To isolate solar system for backwash to prevent DE media from entering solar collector array

1. Turn collector controller (A) from "AUTO" to "OFF".
2. Close valve #1 (optional)
3. Backwash pool.
4. Open valve #1.
5. Return controller (A) to "AUTO".
6. Make sure pump (B) is primed.

For pools that close during winter months, if the solar system is piped so that it will naturally drain from gravity, turn off your circulating system at least 30 minutes before any freezing temperatures. When all water has drained from the collectors, normal pool winterization procedures may be followed. Any piping that will not drain from gravity must be manually drained, or blown out, to prevent freeze damage.

Winterize Pool - Drain collector array when nighttime temperatures drop to 35° for winter as follows:

1. Turn controller (A) to "OFF".
2. Open valves #4, 5, 6, 7 (3/4" ball valve at bottom of array).
3. Break (loosen and drain) rubber couplings at points C and D.
4. Close valves #1 and #2. Items 2, 3 and 4 should assure complete drainage of collector array.
5. Reverse procedure at Spring start-up by tightening couplings at C and D, closing valves 4, 5, 6, 7, turning control (A) to "AUTO" making sure pump is primed.

#### Collector Repair:

If a collector tube becomes damaged and leaks, it may be easily repaired with Repair Kit, Part #1095. Cut the damaged tube where it connects to the inlet header (a standard razor knife should perform this cut adequately), separating the tube from the header. Then free the cut end of the tube by cutting the center of the web, parallel with the tube on each side, downward a few inches away from the header. Now, you have two options:

1. Insert a repair screw snugly into the molded hole in the header, screwing it until it finishes flush with the header. Then, slip the cut end of the tube over the protruding end of the screw. Repeat this process for the same tube at the other header to prevent water from entering the tube from either end. This method can also repair a header leak.

2. Insert a rubber repair plug into the leaking tube. Open the top half of the damaged tube with the speedball knife included in Kit #2RPRK. Starting 3" - 4" from the header, slice the tube back towards header 1 1/2" - 2", hold the sliced 1/2 tube up with your finger like an orange peel, insert the rubber plug with the insert tool towards the header after lubricating outside of plug and inside of tube to be repaired, remove insert tool leaving plug --- letting the plug completely eliminate water in now "dead" tube. Repeat this process for the same tube at the other end of the header to prevent water from entering the tube at either end.



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